



# TURBO HYDRA-MATIC 250

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### GENERAL DESCRIPTION

The Turbo Hydra-Matic 250 transmission (Fig. 7-1) is a fully automatic unit consisting primarily of a 3-element hydraulic torque converter and two planetary gear sets. Three multiple-disc clutches, one roller clutch, and an adjustable intermediate band provide friction elements required to obtain desired function of two planetary gear sets.

The 3-element torque converter consists of a pump, turbine and a stator assembly. Stator is mounted on a one way roller clutch which will allow stator to turn clockwise, but not counterclockwise. References to clockwise and counterclockwise are determined by looking toward the rear of the car.

The torque converter is of welded construction and is serviced as a complete assembly. The unit is filled with

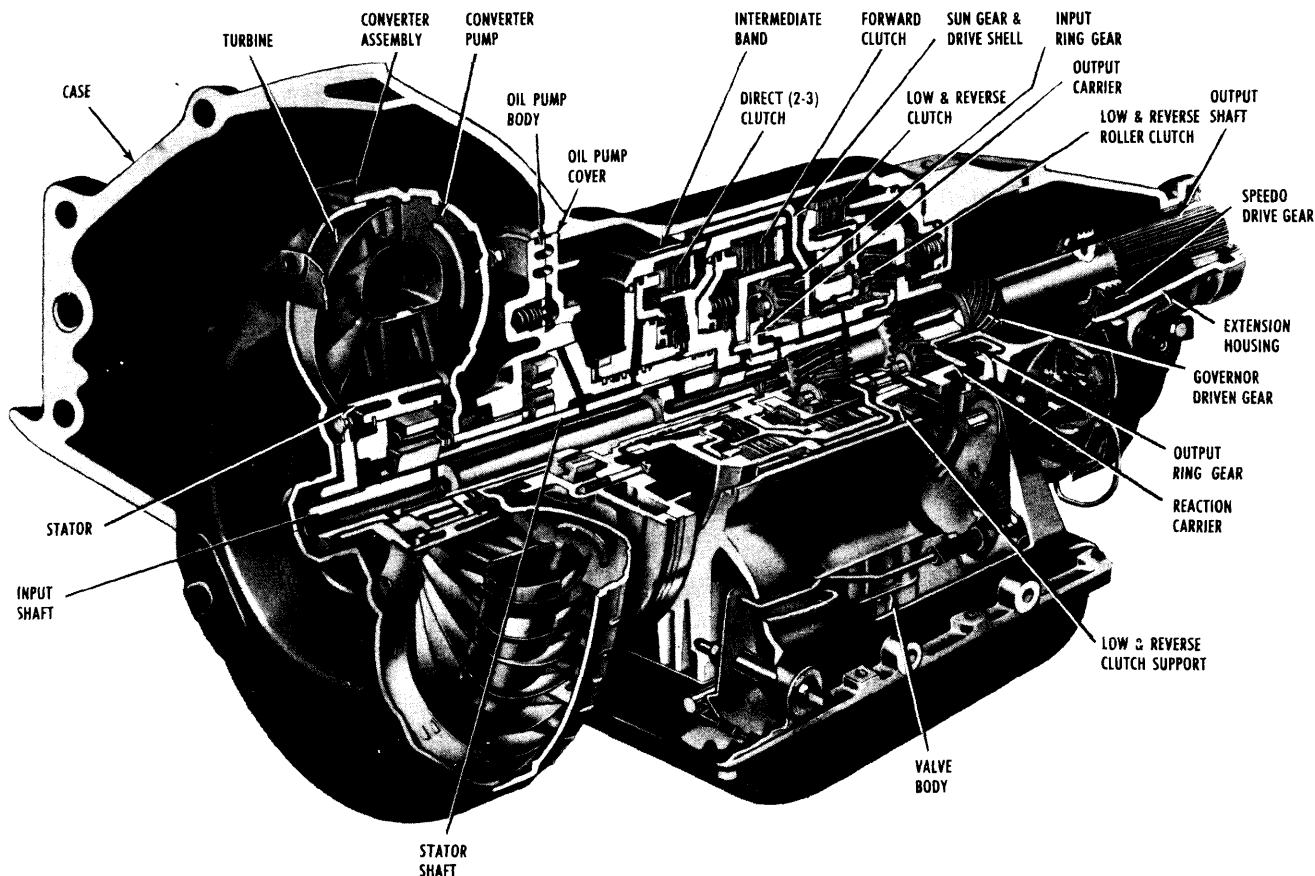


Fig. 7-1—Turbo Hydra-Matic 250

hydraulic fluid and is attached to the engine crankshaft by a flywheel, thus always rotates at engine speed. The converter pump is an integral part of converter housing; therefore, the pump blades, rotating at engine speed, set fluid within the converter into motion and direct it to the turbine, causing the turbine to rotate.

As fluid passes throughout the turbine it is traveling in such a direction that if it were not redirected by stator it would hit the rear of the converter pump blades and slow its pumping action. So at low turbine speeds, fluid is redirected by the stator to the converter pump in such a manner that it actually assists the converter pump to deliver power, or multiply engine torque.

As turbine speed increases, the direction of fluid leaving the turbine changes and flows against the rear side of the stator vanes in a clockwise direction. Since the stator is now slowing the smooth flow of fluid, its roller clutch releases and it revolves freely on its shaft. Once the stator becomes inactive, there is no further multiplication of engine torque within the converter.

At this point, the converter is merely acting as a fluid coupling as both the converter pump and the turbine are being driven at approximately the same speed.

A hydraulic system pressurized by a gear type pump provides working pressure required to operate friction elements and automatic controls.

External control connections to the transmission are:

Manual Linkage - to select desired operating range.

Engine Vacuum - to operate the vacuum modulator.

Cable Control - to operate the detent valve.

A vacuum modulator is used to automatically sense any change in torque input to the transmission. The vacuum modulator transmits this signal to the pressure regulator, which controls line pressure, so that all torque requirements of the transmission are met and the correct shift points are obtained at all throttle openings.

The detent valve is activated by a cable that is connected to accelerator lever assembly. When throttle is half open, the valve is actuated causing a detent downshift at speeds below approximately 40 mph. When the throttle is fully open the detent valve is actuated causing transmission to down shift from 3-1 at speeds below approximately 35 mph and 3-2 below approximately 65 mph.

## DIAGNOSIS

### SEQUENCE FOR DIAGNOSIS

1. Check and correct fluid level.
2. Check detent downshift cable adjustment.
3. Check and correct vacuum line and fittings.
4. Check and correct shift cable adjustment.
5. Road test car.
  - a. Install oil pressure gauge.
  - b. Road test using all selective ranges, noting when discrepancies in operation or oil pressure occur.
  - c. Attempt to isolate the unit or circuit involved in the malfunction.
  - d. If engine performances indicates an engine tune-up is required, this should be performed before testing is completed or transmission correction attempted. Poor engine performance can result in rough shifting or other malfunctions.

### FLUID CHECKING PROCEDURES

Refer to Maintenance and Adjustment section for fluid checking procedures.

## FLUID LEAK DIAGNOSIS

### Determining Source of Fluid Leak

Before attempting to correct a fluid leak, the actual source of leak must be determined. In many cases, source of leak can be deceiving due to "wind flow" around engine and transmission.

The suspected area should be wiped clean of all fluid before inspecting for source of leak.

The use of a "Black Light" to locate point at which fluid is leaking is helpful. Comparing fluid from leak to that on engine or transmission dipstick, when viewed by black light, will determine source of leak - engine or transmission.

Fluid leaks around engine and transmission are generally carried toward rear of car by air stream. For example, a transmission oil filler tube to case leak will sometimes appear as a leak at rear of transmission. In determining source of a leak, proceed as follows:

1. Degrease underside of transmission.
2. Road test to get transmission at operating temperature.
3. Inspect for leak with engine running.
4. With engine off, check for fluid leaks due to raised fluid level caused by drain back.

### Possible Points of Fluid Leak

1. Transmission Oil Pan Leak
  - a. Attaching bolts not correctly torqued.
  - b. Improperly installed or damaged pan gasket.
  - c. Oil pan gasket mounting face not flat.
2. Extension Housing
  - a. Attaching bolts not correctly torqued.
  - b. Rear seal assembly damaged or improperly installed.
  - c. Square seal, extension to case, damaged or improperly installed.
  - d. Porous casting, see subparagraph c.
3. Case Leak
  - a. Filler pipe "O" ring seal damaged or missing, misposition of filler pipe bracket to engine.
  - b. Modulator assembly "O" ring seal damaged or improperly installed.
  - c. Detent cable connector "O" ring seal damaged or improperly installed.
  - d. Governor cover not tight, gasket damaged or leak between case face and gasket.
  - e. Speedometer gear "O" ring damaged.
  - f. Manual shaft seal damaged or improperly installed.
  - g. Line pressure tap plug loose.
  - h. Vent pipe (refer to item 5).
  - i. Porous casting.
4. Leak at Front of Transmission
  - a. Front pump seal leaks: seal lip cut - check governor hub, etc.; bushing moved and damaged - fluid return hole plugged; or no fluid return hole.
  - b. Front pump attaching bolts loose or bolt washer type seals damaged or missing.
  - c. Front pump housing "O" ring damaged or cut.
  - d. Converter leak in weld area.
  - e. Porous casting (pump).
5. Fluid Comes Out Vent Pipe
  - a. Transmission over-filled.
  - b. Coolant or water in fluid.
  - c. Foreign material between pump and case or between pump cover and body.
  - d. Case - porous near converter bosses. Front pump cover or housing oil channels shy or stock near breather.

- e. Pump to case gasket mispositioned.

### FLUID PRESSURE CHECK

While car is stationary, drive wheels blocked with parking brake on, engine speed set to 1200 RPM, transmission oil pressure gauge attached to line pressure tap (Fig. 7-2) and vacuum modulator tube disconnected, transmission line pressure should read 120 in Drive, 120 in L1 or L2 and 245 in Reverse.

While car is stationary, drive wheels blocked with parking brake on, engine speed set to maintain 16" of vacuum, transmission oil pressure gauge attached, and vacuum modulator tube connected, the transmission line should check with 55.0 psi in Drive, Neutral and Park, 81.9 psi in L1 or L2 and 88.4 psi in Reverse.

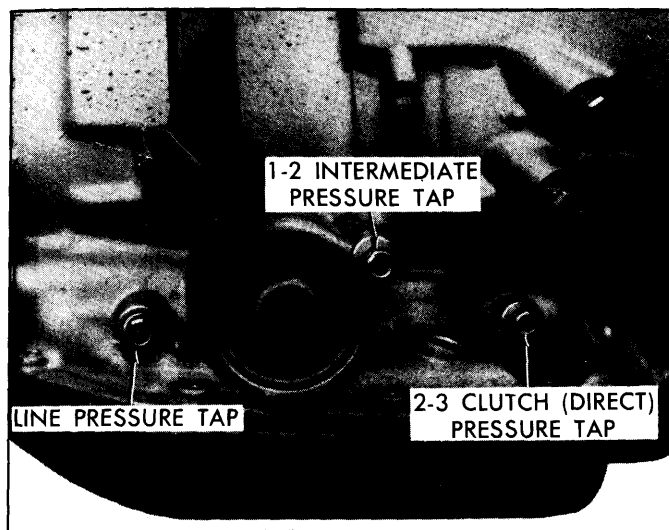


Fig. 7-2—Pressure Tap Locations

### CASE POROSITY REPAIR

External fluid leaks caused by case porosity can be successfully repaired with the transmission in the car by using the following recommended procedures:

1. Road test and bring the transmission to operating temperature, approximately 180°F. (82°C.).
2. Raise car on a hoist or jack stand, engine running, and locate source of fluid leak. Check for fluid leaks in Low, Drive and Reverse.
3. Shut engine off and thoroughly clean area to be repaired with a suitable cleaning solvent and a brush, air dry.

(NOTE: A clean, dry soldering acid brush can be used to clean the area and also to apply the epoxy cement.)

4. Using instructions of the manufacturer, mix a sufficient amount of epoxy to make the repair. Make certain the area to be repaired is fully covered.
5. Allow cement to cure for 3 hours before starting engine.
6. Road test and check for leaks.

### VACUUM MODULATOR DIAGNOSIS

A defective vacuum modulator can cause one or more of the following complaints.

1. Harsh upshifts and downshifts.
2. Delayed upshifts.
3. Soft upshifts and downshifts.
4. Slips in low, drive and reverse.
5. Transmission overheating.
6. Engine buring transmission fluid.

If any one of the above complaints are encountered, the modulator must be checked.

### Vacuum Diaphragm Leak Check

Insert a pipe cleaner into vacuum connector pipe as far as possible and check for the presence of transmission fluid. If fluid is found, replace modulator.

Gasoline or water vapor may settle in vacuum side of the modulator. If this is found without presence of transmission fluid, the modulator is serviceable and should not be changed.

### Atmospheric Leak Check

Apply a liberal coating of soap bubble solution to crimped upper to lower housing seam. Using a short piece of rubber tubing, apply air pressure to vacuum pipe by blowing into tube and observe for leak bubbles. If bubbles appear, replace modulator.

(NOTE: Do not use any method other than human lung power for applying air pressure as pressures over 6 psi may damage modulator.)

### Spring Comparison Check (Fig. 7-3)

Using Tool J-24466, compare load of a known good modulator with assembly in question.

1. Install modulator that is known to be acceptable on either end of the gauge.
2. Install modulator in question on opposite end of gauge.
3. Holding modulators in a horizontal position, bring them together under pressure until either modulator sleeve end just touches the line in the center of the tool. The gap between opposite modulator sleeve end and gauge line should then be 1/16" or less. If distance is greater than this amount, the modulator in question should be replaced.

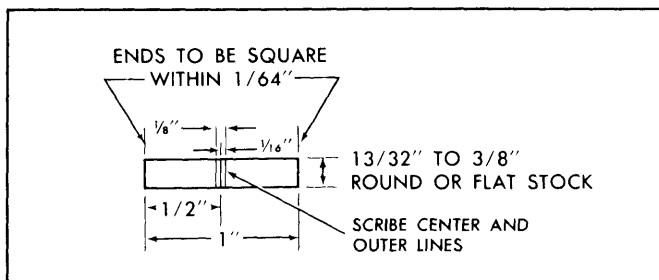


Fig. 7-3—Modulator Comparison Gauge

### Sleeve Alignment Check

Roll main body of modulator on a flat surface and observe, the sleeve for concentricity to cam. If sleeve is concentric and plunger is free, modulator is acceptable.

Once modulator assembly passes all of the above tests, it is an acceptable part and should be reused.

### TRANSMISSION CLUTCH PLATES DIAGNOSIS

1. Lined Drive Plates — dry plates with compressed air and inspect lined surface for: pitting and flaking, wear,



glazing, cracking, charring and/or chips or metal particles imbedded in lining.

If a lined drive plate exhibits any of the above conditions, replacement is required. Do not diagnose drive plates by color.

2. Steel Driven Plates — wipe plates dry and check for heat discoloration. If surface is smooth and an even color smear is indicated, plate should be reused. If severe heat spot discoloration or surface scuffing is indicated, plate must be replaced.

3. Clutch Release Springs — evidence of extreme heat or burning in area of clutch may have caused springs to take a heat set and would justify replacement of springs.

#### CAUSES OF BURNED CLUTCH PLATES OR BAND

1. Forward Clutch
  - a. Check ball in clutch housing damaged, stuck or missing.
  - b. Clutch piston cracked, seals damaged or missing.
  - c. Low line pressure.
  - d. Pump cover oil seal rings missing, broken or undersize; ring groove oversize.
  - e. Case valve body face not flat or porosity between channels.
2. Intermediate Band
  - a. Intermediate servo piston seals damaged or missing.
  - b. Low line pressure.
  - c. Case valve body face not flat or porosity between channels.
3. Direct Clutch
  - a. Restricted orifice in vacuum line to modulator (poor vacuum response).
  - b. Check ball in direct clutch piston damaged, stuck or missing.
  - c. Defective modulator spring.
  - d. Clutch piston seals damaged or missing.
  - e. Case valve body face not flat or porosity between channels.
  - f. Clutch installed backwards.

(NOTE: Burned clutch plates can be caused by incorrect usage of clutch plates. Also engine coolant in transmission fluid can cause severe damage, such as large pieces of composition clutch plate material peeling off.)

#### GOVERNOR PRESSURE CHECK

1. Install pressure gauge, at line pressure tap location. (Fig. 7-2)
2. Disconnect vacuum line to modulator.
3. With car on hoist (rear wheels, off ground), foot off brake, in Drive, check line pressure at 1000 RPM.
4. Slowly increase engine RPM to 3000 and determine if a line pressure drop occurs (at 7 psi or more).
5. If no pressure drop occurs:
  - a. Inspect governor for stuck valve, free weights or restricted orifice in governor valve.
  - b. Governor Feed System, check screen in control valve assembly, check for restrictions in feed line, or scored governor bore.

#### MANUAL LINKAGE

Manual linkage adjustment and associated neutral start switch are important from a safety standpoint. The neutral start switch should be adjusted so that engine will start in Park and Neutral positions only.

With selector lever in Park position, parking pawl should freely engage and prevent car from rolling. The

pointer on indicator quadrant should line up properly with range indicators in all ranges.

#### ROAD TEST

##### Drive Range

Position selector lever in DRIVE RANGE and accelerate car from 0 mph. A 1-2 and 2-3 shift should occur at all throttle openings. (Shift points will vary with throttle opening.) As car decreases in speed to 0 mph, the 3-2 and 2-1 shifts should occur.

##### Low L2 Range

Position selector lever in L2 RANGE and accelerate car from 0 mph. A 1-2 shift should occur at all throttle openings. (No. 2-3 shift can be obtained in this range.) The 1-2 shift point will vary with throttle opening. As car decreases in speed to 0 mph, a 2-1 shift should occur.

The 1-2 shift in INTERMEDIATE RANGE is somewhat firmer than in DRIVE RANGE. This is normal.

##### Low L1 Range

Position selector lever in L1 RANGE and accelerate car from 0 mph. No upshift should occur in this range.

##### 2nd Gear Overrun Braking: (L2)

Position selector lever in DRIVE RANGE, and with car speed at approximately 35 mph, move selector lever to L2 RANGE. Transmission should downshift to 2nd. An increase in engine RPM and an engine braking effect should be noticed. Line pressure should change from approximately 55 psi to approximately 125 psi in 2nd.

##### 1st Gear Overrun Braking: (L1)

Position selector lever in L2 RANGE at approximately 30 to 50 mph, with throttle closed, move selector lever to L1. A 2-1 downshift should occur in speed range of approximately 45 to 30 mph, depending on axle ratio and valve body calibration. The 2-1 downshift at closed throttle will be accompanied by increased engine RPM and an engine braking effect should be noticed. Line pressure should be approximately 80 psi. Stop car.

##### Reverse Range: (R)

Position selector lever in REVERSE position and check for reverse operation.

#### TROUBLE DIAGNOSIS

Refer to Diagnosis Chart (Fig. 7-4) to determine a possible cause of a transmission problem.

Additional diagnosis of a malfunction is as follows:

##### No Drive in Drive Range

Install pressure gauge.

1. Low Fluid Level - correct level and check for external leaks or defective vacuum modulator (leaking diaphragm will evacuate fluid from unit).

2. Manual Linkage - misadjusted, correct alignment to manual lever shift quadrant is essential.

3. Low Fluid Pressure - refer to LOW LINE PRESSURE below.

4. Forward Clutch:

a. Forward clutch does not apply - piston cracked; (see Burned Clutch Plates below).

b. Pump feed circuit-to-forward clutch oil seal rings missing or broken on pump cover; leak in feed circuits; pump-to-case gasket mispositioned or damaged; clutch drum ball check stuck or missing.

# Turbo Hydra-Matic 250 Diagnosis Chart

PROBLEM		CAR ROAD TEST		Diagnostic Chart																															
LEGEND																																			
POSSIBLE CAUSE																																			
		ALL RANGES-SLIPS	DRIVE-SLIPS-NO 1ST GEAR	LINE PRESSURE-ALL LOW	LINE PRESSURE-ALL HIGH	1-2 INTERM. PRES. HIGH	2-3 INTERM. PRES. HIGH	2-3 DIRECT CL. PRES. LOW	NO 1-2 U.S. PRES. HIGH	1-2 U.S. PRES. LOW	1-2 U.S. EARLY/LATE	SLIPS-1-2 UPSHIFT @ W.O.T. ONLY	ROUGH-1-2 UPSHIFT	NO 2-3 UPSHIFT	2-3 U.S.-EARLY/LATE	ROUGH-2-3 UPSHIFT	NO WOT. 1-2 UPSHIFT	NO -PART TH. DOWN SHIFT	2-3 UPSHIFT TH. DOWN SHIFT	HARSH-DOWN SHIFT	L1 RANGE-DOWN SHIFT	L2 RANGE-DOWN SHIFT	NEUTRAL-NO ENG. BRAKING	REVERSE-NO ENG. BRAKING	SLIPS IN REVERSE	PARK-NO REVERSE	NOISY-NO PARK	1-2 2-3 RANGES	REV & D. L1 & L2 NOISY	SPEWS FLUID OUT BREATHER	HUNTS BETWEEN 2 & 3 AND 3 & 2				
	LOW FLUID LEVEL/WATER IN FLUID	X	X	X		X	X			X			X										X		X	X		X							
	VACUUM LEAK			X	X	X	X	X	X	X	X	X	X	X				X																	
	MODULATOR &/OR VALVE	X	X	*	X	X					X	X	X	X									X												
	STRAINER &/OR GASKET	X	X	X		X	X																X		X				X						
	GOVERNOR-VALVE/SCREEN		X	X				X	X			X																							
	VALVE BODY-GASKET/PLATE	X	X	X		X	X	X	X	X		X	X	X									X		X										
	PRES. REG. &/OR BOOST VALVE	X	X	X	X	X	X	X	X		X	X		X	X					X	X		X	X											
	BALL (#1) SHY	X	X	*		X			X	X		X	X						O				X	X											
	1-2 SHIFT VALVE					X		X	X	X	X									X			X												
	2-3 SHIFT VALVE						X					X	X	X	X		X																		
	MANUAL LOW CONT'L. VALVE											X	X	X	X						X														
	DETENT VALVE & LINKAGE				X				X			X					X	X	X											S					
	DETENT REG. VALVE																X																		
	2-3 ACCUMULATOR					X				X				X																					
	MANUAL VALVE/LINKAGE	X	X	X																X	X		X	X											
	POROSITY/CROSS LEAK	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X	X		X	X											
	PUMP-GEARS	X	X	X		X	X				X		X													X									
	CLUTCH SEAL RINGS	X	X	X		X	X	X			X	X	X							X	X		X	X											
	POROUS/CROSS LEAK	X	X	X		X	X	X		X	X	X	X		X								X	X						X					
	GASKET SCREEN-PRESSURE	X	X	X																			X	X		X									
	CASE-POROUS/X LEAK	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X			X	X												
	1-2 ACCUMULATOR	X	X	X		X		X		X	X											X	X												
	INTERMED. SERVO		X	X		X				X																									
	FORWARD CLUTCH ASS'Y		X																	X	X	X	L												
	DIRECT CLUTCH ASS'Y						X					X	X										X	X			X								
	INTERMED. BAND ASS'Y					X		X		X																	X								
	L & REV. CL. ASS'Y																			X			X	X											
	L. & R. ROLLER CL. ASS'Y		X																																
	PARK PAWL/LINKAGE																							X											
	CONVERTER ASS'Y																								X			X							
	GEAR SET & BEARINGS																									X	X								

Fig. 7-4-THM 250 Diagnosis Chart

5. Low and Reverse Roller Clutch Assembly - broken spring, damaged cage or installed backwards.

#### High or Low Fluid Pressure

(Refer to Fluid Pressure Checks)

#### High Line Pressure

1. Vacuum Leak:
  - a. Vacuum line disconnected.
  - b. Leak in line from engine to modulator.
  - c. Improper engine vacuum.
  - d. Leak in vacuum-operated accessory (hoses, vacuum advance, etc.).
2. Modulator:
  - a. Stuck modulator valve.
  - b. Water in modulator.
  - c. Damaged, not operating properly.
3. Detent System - detent valve or cable stuck in detent position.
4. Valve Body:
  - a. Pressure regulator and/or boost valve stuck.
  - b. Boost valve sleeve broken or defective.
  - c. Incorrect pressure regulator valve spring.

#### Low Line Pressure

1. Low Transmission fluid level.
2. Defective vacuum modulator assembly.
3. Strainer Assembly:
  - a. Blocked or restricted.
  - b. Gasket omitted or damaged.
4. Oil Pump:
  - a. Gear clearance, damaged, worn, gear installed backwards.
  - b. Pump-to-case gasket mispositioned.
  - c. Defective pump body and/or cover.
5. Valve Body:
  - a. Pressure regulator or boost valve stuck.
  - b. Pressure regulator valve spring, too weak.
6. Internal Circuit Leaks:
  - a. Forward clutch leak (pressure low in Drive range, pressure normal in Neutral and Reverse). Check pump oil seal rings and forward clutch seals.
  - b. Direct clutch leak (pressure low in Reverse, pressure normal in other ranges). Check direct clutch outer seal and 1-2 accumulator piston and ring for damage or missing.
7. Case Assembly - check ball missing from cored passages in case face.

#### 1-2 Shift Full Throttle Only

1. Detent Valve - sticking or linkage misadjusted.
2. Vacuum Leak - vacuum line or fittings leaking.
3. Control Valve Assembly:
  - a. Valve body gaskets - leaking, damaged or incorrectly installed.
  - b. Detent valve train stuck.
  - c. 1-2 valve stuck closed (in downshifted position).
4. Case Assembly - refer to case porosity repair.

#### First Speed Only No 1-2 Shift

1. Detent (downshift) cable - binding.
2. Governor Assembly:
  - a. Governor valve sticking.
  - b. Driven gear loose, damaged or worn (check for pin in case and length of pin showing; also, check output shaft drive gear for nicks or rough finish if driven gear shows damage).

3. Control Valve Assembly:
  - a. Valve body gaskets - leaking, damaged or incorrectly installed.
  - b. Governor feed channels blocked.
  - c. 1-2 shift valve train stuck closed (in downshifted position).
4. Intermediate Band:
  - a. Servo piston seals - missing, improperly installed or broken.
  - b. Band improperly adjusted - screw loose.
  - c. Servo apply rod broken.
5. Case:
  - a. Porosity between channels.
  - b. Governor feed channel blocked; governor bore scored or worn, allowing cross pressure leak.

#### First and Second Speeds Only No 12-3 Shift

1. Control Valve Assembly:
  - a. Valve body gaskets - leaking, damaged or incorrectly installed.
  - b. 2-3 shift valve train stuck closed (in downshifted position).
2. Direct Clutch:
  - a. Pump hub - direct clutch oil seal rings - broken or missing.
  - b. Clutch piston seals - missing, improperly assembled or cut.
  - c. Clutch plates burned (see Burned Clutch Plates below).

#### No First Speed Starts in Second Speed

(Locks up to L1 Range)

Intermediate Band - band adjustment too tight, or 1-2 shift valve stuck in upshift position.

#### Drive in Neutral

1. Manual Linkage - misadjusted, (correct alignment in manual lever shaft quadrant is essential).
2. Internal Linkage - manual valve disconnected or end broken.
3. Oil Pump - line pressure leaking into forward clutch apply passage.
4. Forward Clutch - incorrect clutch plate usage or burned clutches (see Burned Clutch Plates below).

#### No Motion in Reverse or Slips in Reverse

(Install pressure gauge)

1. Low Fluid Level - add fluid.
2. Manual Linkage - misadjusted (correct alignment in manual lever shift quadrant is essential).
3. Low Oil Pressure - refer to Low Line Pressure above.
4. Control Valve Assembly:
  - a. Valve body gaskets - leaking, damaged or incorrectly installed.
  - b. 2-3 shift valve train stuck open (in upshifted position).
5. Intermediate Servo - piston or pin stuck so intermediate band is applied.
6. Low and Reverse Clutch - piston outer seal damaged or missing.
7. Direct Clutch:
  - a. Outer seal damaged or missing.
  - b. Clutch plates burned (see Burned Clutch Plates below).
8. Forward Clutch - clutch does not release (will cause Drive in Neutral).

**Slips in All Ranges or Slips on Start**

(Install pressure gauge)

1. Low Fluid Level - add fluid.
2. Low Fluid Pressure - refer to Low Line Pressure above.
3. Forward Clutch:
  - a. Clutch plates burned (see Burned Clutch Plates below).
  - b. Pump cover oil seal rings broken or worn.
4. Case - cross leaks or porosity.

**Slipping 1-2 Shift**

(Install pressure gauge)

1. Low Fluid Level - add fluid.
2. Low Fluid Pressure - refer to Low Line Pressure above.
3. 1-2 Accumulator - oil ring damaged, missing or case bore damaged.
4. Pump-to-Case Gasket - mispositioned or damaged.
5. Intermediate Band:
  - a. Piston seals damaged or missing.
  - b. Intermediate Band burned (see Burned Intermediate Band above).
6. Case - porosity between channels.
7. Improper Intermediate Band adjustment.

**Slipping 2-3 Shift**

(Install pressure gauge)

1. Low Fluid Level - add fluid.
2. Low Oil Pressure - refer to Low Line Pressure above.
3. Direct Clutch:
  - a. Piston seals leaks, damaged or missing.
  - b. Clutch plates burned (see Burned Clutch Plates below).
  - c. Inspect for proper number and type of clutch plates.
4. Case - refer to case porosity repair.

**Rough 1-2 Shift**

(Install pressure gauge)

1. High Fluid Pressure - refer to High Line Pressure above.
2. 1-2 Accumulator:
  - a. Oil rings damaged.
  - b. Piston stuck.
  - c. Broken or improper spring.
  - d. Bore damaged.
3. Case:
  - a. Check for correct number and location of check balls.
  - b. Porosity between channels.
4. Intermediate Band:
  - a. Improper adjustment.
  - b. Improper or broken servo spring.

**Rough 2-3 Shift**

(Install pressure gauge)

1. High Fluid Pressure - refer to High Line Pressure above.
2. 2-3 Accumulator:
  - a. Oil ring damaged.
  - b. Piston stuck.
  - c. Broken or missing spring.
  - d. Piston bore damaged.

**No Engine Braking in L2**

(Install pressure gauge)

1. Low Fluid Pressure - pressure regulator and/or boost valve stuck.
2. Intermediate Servo:
  - a. Servo oil rings or bores leaking or damaged.
  - b. Servo piston stuck or cocked.
3. Intermediate Band - intermediate band broken or burned (look for cause), not engaged on servo pin or improper adjustment.

**No Engine Braking in L1**

(Install pressure gauge)

1. Low Fluid Pressure - pressure regulator and/or boost valves stuck.
2. Manual Low Control Valve Assembly - stuck.
3. Low and Reverse Clutch - piston inner seal damaged or missing.

**No Part Throttle Downshift**

(Install pressure gauge)

1. Fluid pressure - vacuum modulator assembly, modulator valve or pressure regulator valve train (other malfunctions may also be noticed).
2. Detent Valve and Linkage - sticks, disconnected or broken.
3. 2-3 shift valve - stuck.

**No Detent (Wide Open Throttle) Downshift**

Detent cable or retainer not adjusted properly.

1. Detent cable disconnected at transmission or throttle linkage.
2. Valve Body:
  - a. Detent valve sticks.
  - b. Detent regulator valve sticks.
  - c. Incorrect spacer plate or gasket.

**High or Low Shift Points**

(Install pressure gauge)

1. Fluid Pressure:
  - a. Engine Vacuum - check at transmission end of modulator pipe.
  - b. Check vacuum line connections at engine and transmission.
  - c. Vacuum modulator assembly and valve and pressure regulator valve train.
2. Governor:
  - a. Valve sticking.
  - b. Feed holes restricted or leaking.
3. Detent Valve and Linkage - stuck open (will cause high shift points).
4. Control Valve Assembly:
  - a. 1-2 shift valve train sticking.
  - b. 2-3 shift valve train sticking.
5. Case - refer to case porosity repair.

**Will Not Hold in Park**

1. Manual Linkage - misadjusted (correct alignment in manual lever shift quadrant is essential).
  - a. Inner lever and actuating rod assembly - defective or improperly installed.
  - b. Parking pawl - broken or inoperative.
  - c. Parking lock bracket loose, burred or rough edges or incorrectly installed.
  - d. Parking pawl disengaging spring missing, broken or incorrectly hooked.

**Transmission Noisy**

**CAUTION:** Before checking transmission, make certain that noise is not coming from water pump, generator, power steering, etc. These parts can be isolated by removing proper belt and running engine not more than two minutes at one time.

**Park, Neutral and All Driving Ranges**

1. Pump Cavitation:
  - a. Low Fluid level.
  - b. Plugged or restricted strainer.
  - c. Strainer-to-valve body gasket damaged.
  - d. Porosity in valve body intake area.
  - e. Water in fluid.
  - f. Porosity or voids at transmission case (pump face) intake port.
  - g. Pump-to-case gasket off location.
2. Pump Assembly:
  - a. Gears damaged.
  - b. Driving gear assembled backwards.
  - c. Crescent interference.
  - d. Oil seal rings damaged or worn.
3. Converter:
  - a. Loose flexplate-to-converter bolts.
  - b. Converter damage.
  - c. Coolant or water in fluid (causes whine).

**First, Second and/or Reverse Gear****Planetary Gear Set:**

1. Gears or thrust bearings damaged.
2. Input or output ring gear damaged.

**During Acceleration Any Gear**

1. Transmission grounded to underbody.
2. Motor or transmission mounts loose or broken.

**Squeal at Low Car Speed**

Speedometer driven gear shaft seal - required lubrication or replacement.

To determine proper level, proceed as follows:

1. Apply parking brake and block car wheels.
2. With the selector lever in the PARK position, start engine. **DO NOT RACE ENGINE.** Move selector lever through each range.
3. Immediately check fluid with the selector lever in PARK, engine running at SLOW IDLE and the car on a LEVEL surface. The fluid level on the dip stick should be at the "FULL HOT" mark.
4. If additional fluid is required, add sufficient fluid to bring it to the "FULL HOT" mark on the dipstick.

**CHECKING AND ADDING FLUID (Transmission at Room Temperature 65[ to 85[ F.) (Fig. 7-5)**

Automatic transmissions are frequently overfilled because the fluid level is checked when the fluid is cold and the dipstick indicates fluid should be added. However, the low reading is normal since the level will rise as the fluid temperature increases. A level change of over 3/4" will occur as fluid temperature rises from 60° to 180° F. (16° to 82° C.).

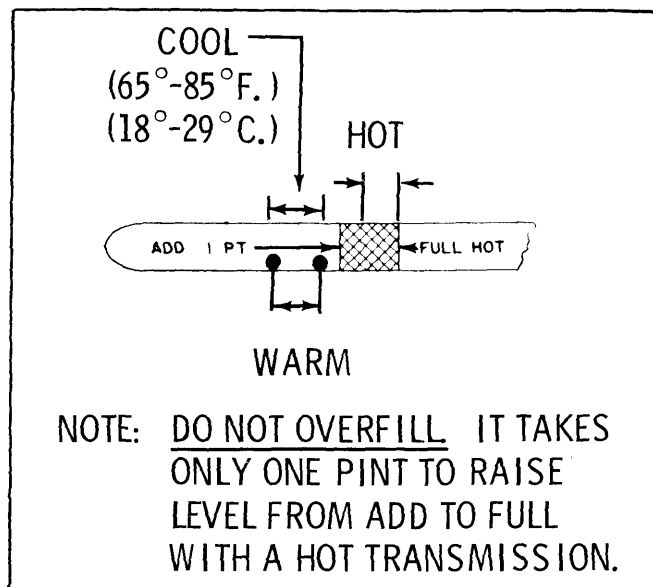


Fig. 7-5—Transmission Oil Level Check

**MAINTENANCE AND ADJUSTMENTS****TRANSMISSION FLUID****FLUID LEVEL AND CAPACITY**

Fluid level indicator is located in filler tube at right rear of the engine. To bring fluid level from ADD mark to FULL mark requires one pint of fluid.

**MAINTENANCE SCHEDULE**

The fluid level should be checked at each oil change (see below). When adding or changing fluid, use DEXRON®-II or equivalent automatic transmission fluid. Under normal driving conditions, change transmission fluid every 60,000 miles.

**CHECKING AND ADDING FLUID (Transmission at Operating Temperature) (Fig. 7-5)**

The automatic transmission is designed to operate at the "FULL HOT" mark on the dip stick at normal operating temperature (190° to 200° F.) and should be checked under these conditions. The normal operating temperature is obtained only after at least 15 miles of highway type driving or the equivalent of city driving.

Overfilling can cause foaming and loss of fluid through the vent. Slippage and transmission failure can result.

Fluid level too low can cause slipping, particularly when the transmission is cold or the car is on a hill.

Check the transmission fluid level with the engine running, the shift lever in Park, and the car level.

(NOTE: If the car has recently been operated for an extended period at high speed or in city traffic in hot weather or the car is being used to pull a trailer, an accurate fluid level cannot be determined until the fluid has cooled down—usually about 30 minutes after the car has been parked.)

Remove the dipstick and touch the transmission end of the dipstick cautiously to find out if the fluid is cool, warm or hot.

Wipe it clean and re-insert until cap seats. Remove dipstick and note reading.

1. If the fluid feels cool, about room temperature 65° to 85° or (18° to 29° C.), the level should be between the two dimples below the "ADD" mark.

2. If it feels warm the level should be close to the "ADD" mark (either above or below).

3. If it feels hot (cannot be held comfortably) the level should be between the "ADD" and "FULL" marks.

#### FLUID DRAIN INTERVALS

The transmission operating temperature resulting from the type of driving conditions under which the car is used is the main consideration in establishing the proper frequency of transmission fluid changes.

Change the transmission fluid and filter every 15,000 miles if the car is usually driven under one or more of the following conditions which are considered severe transmission service.

1. In heavy city traffic.
2. Where the outside temperature regularly reaches 90° F. (32° C.).
3. In very hilly or mountainous areas.
4. Frequent trailer pulling.
5. Commercial use, such as taxi, police car, or delivery service.

If you do not use your car under any of these conditions, change the fluid and filter every 60,000 miles.

(NOTE: DO NOT OVERFILL. It takes only one pint to raise level from "ADD" to "FULL" with a hot transmission.)

#### CHECKING AND ADDING FLUID (After Transmission Service)

If work has been performed on the transmission, add the following quantity of fluid, then check fluid as outlined above.

#### TURBO HYDRA-MATIC (250)

Pan Removal . . . . .	4 quarts
Converter Change . . . . .	6 quarts
Overhaul . . . . .	10 quarts

1. Raise car and support transmission with suitable jack at the transmission vibration damper.
2. Remove transmission crossmember support.
3. With fluid container placed under transmission oil pan, remove oil pan attaching bolts from front and side of pan.
4. Loosen rear pan attaching bolts approximately four (4) turns.
5. Carefully pry transmission oil pan loose with screwdriver, allowing fluid to drain.
6. Remove remaining screws and remove oil pan and gasket. Discard gasket.
7. Drain fluid from oil pan. Clean pan with solvent and dry thoroughly with clean compressed air.
8. Remove two (2) strainer-to-valve body screws, strainer and gasket. Discard gasket.
9. Thoroughly clean strainer assembly in solvent and dry thoroughly with clean compressed air.
10. Install new strainer-to-valve body gasket, strainer and two (2) screws.
11. Install a new gasket on the oil pan and install the oil pan. Tighten the thirteen (13) attaching bolt and washer assemblies to 12 ft. lbs.
12. Lower the car, then add approximately 5 pints of DEXRON<sup>®</sup>-II automatic transmission fluid or its equivalent through the filler tube.

13. With the selector lever in PARK position, apply the parking brake, start engine and let idle (carburetor off fast idle step). DO NOT RACE ENGINE.

14. Move the selector lever through each range and, with the selector lever in PARK range, check the fluid level.

15. Add additional fluid to bring level to 1/4" below ADD mark on the dipstick.

#### ADDING FLUID TO FILL DRY TRANSMISSION AND CONVERTER ASSEMBLY

In cases to transmission overhaul, when a complete fill is required, including converter (approximately 10 quarts), proceed as follows:

1. Add 4 quarts of transmission fluid through filler tube.
2. With manual control lever in park (P) position, start engine and place on cold idle cam. DO NOT RACE ENGINE. Move manual control level through each range.
3. Immediately check fluid level with selector lever in park (P), engine running and the car on a LEVEL surface, then add additional fluid so the level will be between the two dimples below the "ADD" mark. (Fig. 7-5)

#### INTERMEDIATE BAND ADJUSTMENT

Intermediate band adjustment should be performed every 30,000 miles or sooner, as necessary if operating performance indicates intermediate band slippage.

1. Position selector lever in neutral (N) and raise car.
2. Using special Tool J-24367 in position over adjusting screw and locknut on right side of transmission, loosen locknut 1/4 turn and hold tool in this position.
3. With a torque wrench attached on special tool, tighten adjusting screw to 30 in. lbs. and backoff 3 complete turns. Use mark on special tool as indicator.
4. With torque wrench held in position on special tool, tighten locknut.

#### CHECKING TRANSMISSION MOUNT

Raise car on a hoist. Push up and pull down on transmission tailshaft while observing transmission mount. If rubber separates from metal plate of mount or if tailshaft moves up but not down (mount bottomed out) replace mount. If there is relative movement between a metal plate of mount and its attaching point, tighten screws or nuts attaching mount to transmission or crossmember.

#### SHIFT CABLE LINKAGE ADJUSTMENT (Fig. 7-6)

1. Position transmission control cable through transmission control bracket and attach to shifter assembly.
2. Position lever pin through transmission lever and loosely install washer and nut.
3. Place transmission control shifter in "NEUTRAL" position.
4. Place transmission lever in "NEUTRAL" position.

(NOTE: Obtain "NEUTRAL" position by moving the transmission lever counterclockwise to L1 detent position, then clockwise through four (4) detent positions to "NEUTRAL".)

5. Tighten transmission lever nut to 20 ft. lbs.
6. Readjust neutral start switch if necessary to provide the correct relationship to the transmission detent positions. (See Section 12)

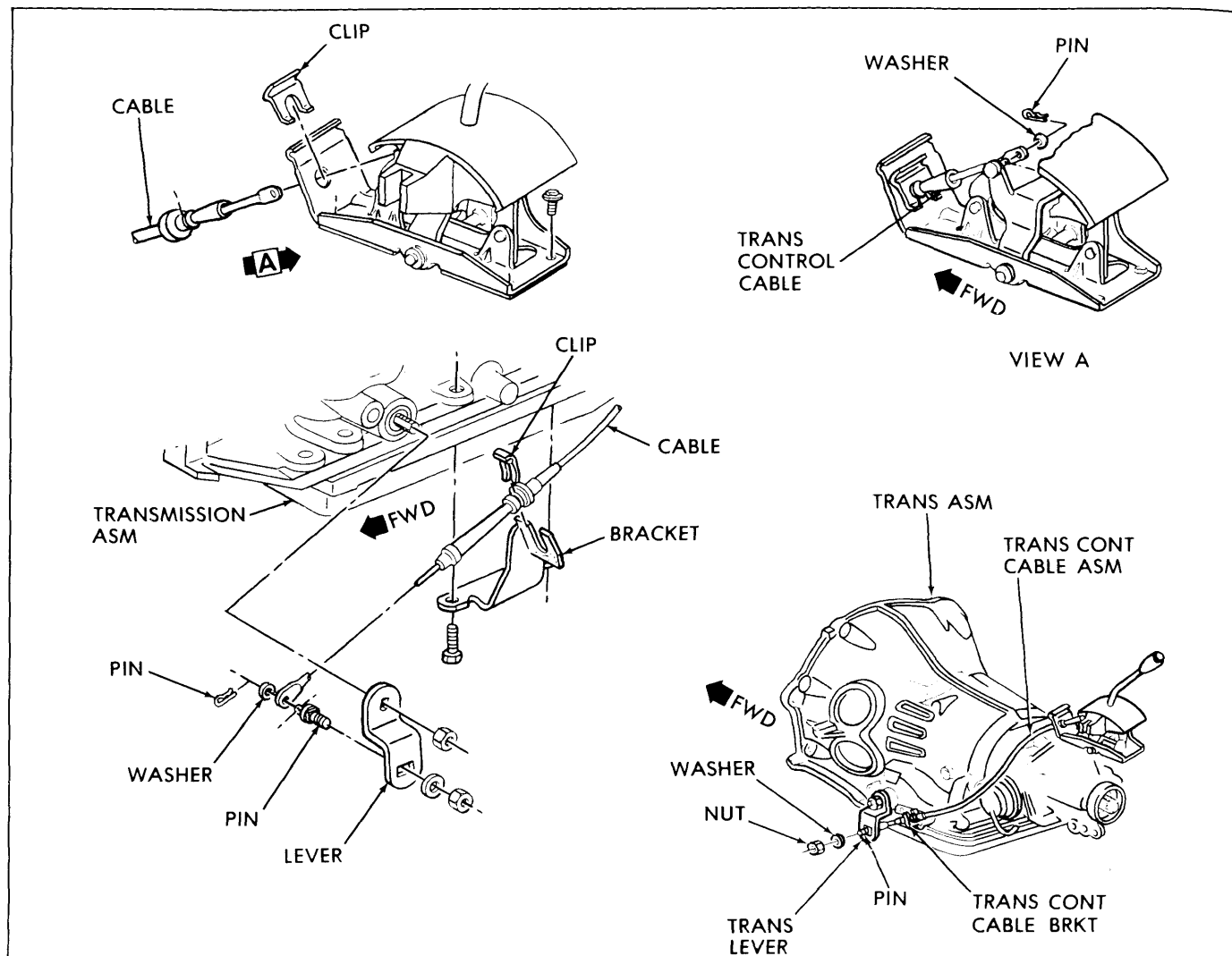


Fig. 7-6—Shift Cable Linkage Adjustment

**CAUTION:** Any inaccuracies in the above adjustments may result in premature failure of transmission due to operation without controls in full detent. Such operation results in reduced pressure and in turn partial engagement of affected clutches. Partial engagement of clutches with sufficient pressure to cause apparent normal operation of car will result in failure of clutches or other internal parts after only a few miles of operation.

#### NEUTRAL START SWITCH

The adjustment of neutral start switch is described in Section 12, Electrical.

#### SERVICE OPERATIONS

#### SHIFT CONTROL LEVER ASSEMBLY (Figs. 7-6, 7-7, 7-8)

##### Removal

1. Raise car on hoist and disconnect shift cable from actuating lever.

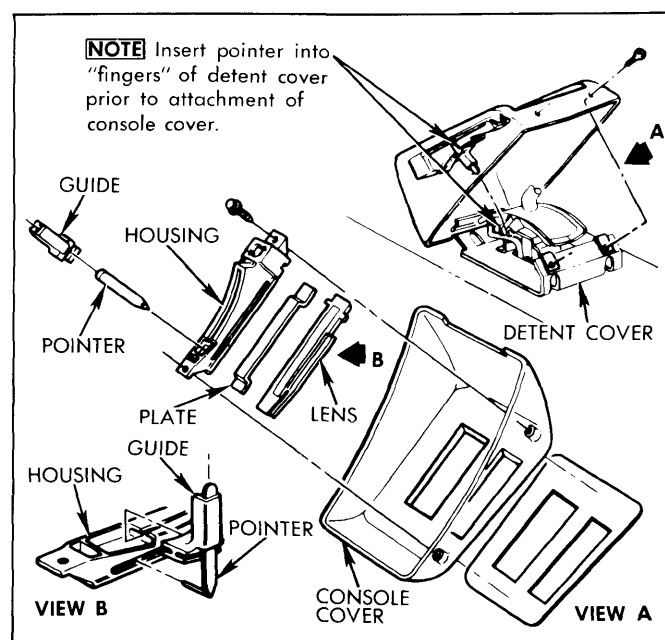


Fig. 7-7—Console Cover

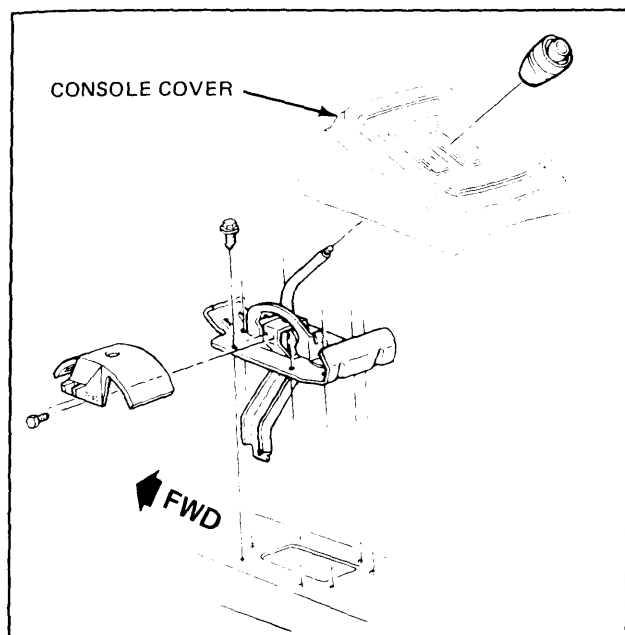


Fig. 7-8—Shift Control Lever

2. Lower car and remove two cover mounting screws and remove cover.

3. Disconnect electrical connector from neutral start switch, then remove switch.

4. Remove six shift control assembly-to-floor mounting screws and remove shift control assembly.

#### Installation

Reverse removal procedure Steps 1 thru 4. Thoroughly coat detent inner shaft and guide slot with lub-lithium soap or equivalent. When installing console cover, insert pointer into "finger" of detent cover prior to attachment of cover. Insert neutral start switch actuating tang in neutral start switch lever.

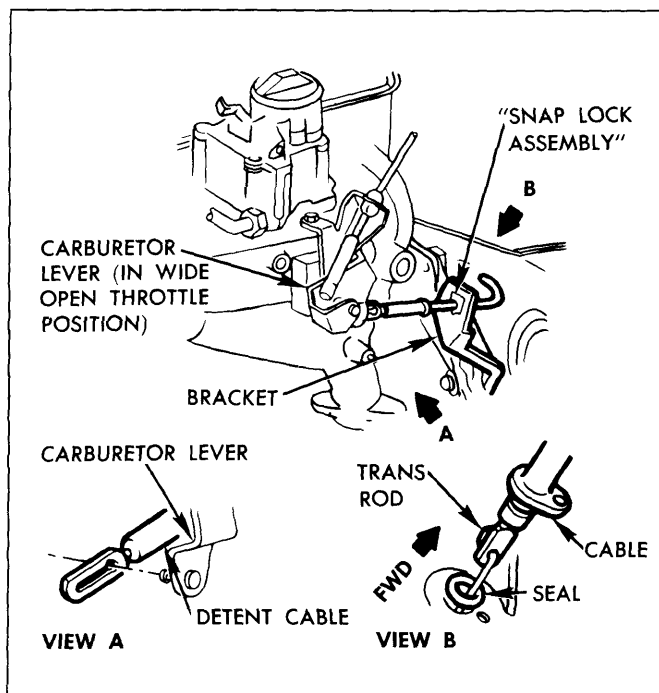


Fig. 7-9—Detent Downshift Cable

### VACUUM MODULATOR AND MODULATOR VALVE ASSEMBLY

#### Removal

1. Disconnect vacuum hose from vacuum modulator stem and remove vacuum modulator attaching screw and retainer.

2. Remove modulator assembly and its O-ring seal from case.

3. Remove modulator valve from case.

4. Installation of modulator and modulator valve is the reverse of REMOVAL. Install a new O-ring seal and adjust fluid level.

### DRIVE RANGE DETENT DOWNSHIFT CABLE (Fig. 7-9)

#### Removal

1. Remove air cleaner.

2. Push up on bottom of snap-lock and release lock and detent cable.

3. Compress locking tabs and disconnect snap-lock assembly from bracket.

4. Disconnect cable from carburetor lever.

5. Remove clamp around filler tube, remove screw and washer securing cable to transmission and disconnect detent cable.

#### Installation

1. Install new seal on detent cable. Lubricant seal with transmission fluid.

2. Connect transmission end of detent cable and secure to transmission case with bolt and washer tightened to 75 in. lbs.

3. Route cable in front of filler tube and install clamp around filler tube, modulator pipe and detent cable. Locate clamp approximately 2" above filler tube bracket.

4. Pass cable through bracket and engage locking tube of snap-lock on bracket.

5. Connect cable to carburetor lever.

6. Install air cleaner.

#### Adjustment

With snap-lock disengaged, position carburetor to wide open throttle (WOT) position and push snap-lock downward until top is flush with rest of cable.

### GOVERNOR

#### Removal

1. Raise car and disconnect speedometer cable at transmission.

2. Remove governor cover retainer and governor cover.

(NOTE: Be careful not to damage cover and "O" ring seal.)

3. Remove governor. Inspect weights and valve for freeness.

#### Installation

1. Install governor.

2. Install governor cover using a brass drift around outside flange of cover.

(NOTE: Do not distort cover on installation. Be sure "O" ring seal is not cut or damaged.)

3. Install retainer.

4. Connect speedometer cable, lower car and check



transmission fluid level.

### **SPEEDOMETER DRIVEN GEAR**

#### **Removal**

1. Disconnect speedometer cable.
2. Remove retainer bolt, retainer, speedometer driven gear and "O" ring seal.
3. Installation of speedometer driven gear is the reverse of REMOVAL. Install new "O" ring seal (if required) and adjust fluid level.

### **SPEEDOMETER DRIVE GEAR**

#### **Removal**

1. Raise car and support transmission with suitable transmission jack.
2. Remove drive shaft.
3. Disconnect speedometer cable.
4. Disconnect transmission rear mount from frame crossmember.
5. Remove two bolts at each end of frame crossmember and remove crossmember.
6. Remove extension housing.
7. Install tools, J-21427-01 and J-8105 on output shaft and remove speedometer drive gear. Remove retaining clip.

#### **Installation**

1. Place speedometer drive gear retaining clip into hole in output shaft.
2. Align slot in speedometer drive gear with retaining clip and install.
3. Install extension housing and tighten attaching bolts to 25 ft. lbs.
4. Connect speedometer cable.
5. Install crossmember to frame and transmission.
6. Install drive shaft.
7. Remove transmission jack and lower car.

### **EXTENSION HOUSING OIL SEAL**

#### **Removal**

1. Remove drive shaft.
2. Pry out lip oil seal with screwdriver or small chisel.

#### **Installation**

1. Coat outer edge of the new lip oil seal with a nonhardening sealer and drive it into place with Installer J-21426.
2. Install drive shaft and adjust fluid level.

### **1-2 ACCUMULATOR**

#### **Removal**

1. Remove two transmission oil pan bolts below the 1-2 accumulator cover. Install J-23069 in place of bolts removed.
2. Press in on cover and remove retaining ring.
3. Remove cover "O" ring seal, spring and 1-2 accumulator.

#### **Installation**

1. Install 1-2 accumulator piston.

(NOTE: Rotating piston slightly when installing will help to get rings started in bore.)

2. Position spring, "O" ring seal and cover in place.

3. Press in on cover with J-23069 and install retaining ring.
4. Remove tool and install oil pan bolts.

### **VALVE BODY ASSEMBLY**

#### **Removal**

1. Referring to draining procedures, drain transmission fluid from oil pan.
2. Remove oil pan and strainer. Discard gaskets.
3. Remove detent spring and roller assembly from valve body and remove valve body-to-case bolts.
4. Remove valve body assembly while disconnecting manual control valve link from range selector inner lever and removing detent control valve link from the detent actuating lever.
5. Remove manual valve and link assembly from valve body assembly.
6. Installation of valve body assembly is the reverse of REMOVAL. Install new gaskets to strainer and oil pan and adjust fluid level.

### **MANUAL SHAFT, RANGE SELECTOR INNER LEVER AND PARKING LINKAGE ASSEMBLIES**

#### **Removal**

1. Referring to draining procedures, drain transmission fluid from oil pan.
2. Remove oil pan, strainer and valve body assembly. Discard gaskets.
3. Remove manual shaft-to-case retainer and unthread jam nut holding range selector inner lever to manual shaft.
4. Remove jam nut and removal manual shaft from range selector inner lever and case.

(NOTE: Do not remove manual shaft lip oil seal unless replacement is required.)

5. Remove parking pawl actuating rod and range selector inner lever from case.
6. Remove bolts and parking lock bracket.
7. Remove parking pawl disengaging spring and, if necessary to replace park pawl or shaft, clean up bore in case and remove parking pawl shaft retaining plug, park pawl shaft and pawl.
8. Installation of parking linkage, selector lever and manual shaft is the reverse of REMOVAL. Install new plug (if required), new lip oil seal (if required) and new gaskets. Adjust fluid level.

### **TRANSMISSION REPLACEMENT**

1. Before raising car, disconnect the negative battery cable, detent downshift cable at carburetor and release parking brake.
2. Raise car on hoist.
3. Remove drive shaft.
4. Disconnect speedometer cable, detent downshift cable and modulator vacuum line at transmission.
5. Disconnect shift control linkage.
6. Support transmission with suitable transmission jack.
7. Disconnect transmission rear mount from frame crossmember.
8. Remove two bolts at each end of frame crossmember. Remove crossmember.
9. Remove converter under pan.
10. Remove converter to flywheel bolts.
11. Lower transmission until jack is barely supporting it.

12. Remove transmission to engine mounting bolts and remove oil filler tube at transmission.

13. Raise transmission to its normal position, support engine with jack and slide transmission rearward from the engine and then lower from car.

**CAUTION:** Use suitable converter holding tool when lowering transmission or keep rear of transmission lower than front so as not to drop the converter.

The installation of transmission is the reverse of removal with the following added step. Before installing flex plate to converter bolts, make certain that the attaching lugs on converter are flush with flex plate and converter rotates freely by hand in this position. Then hand start all three bolts and tighten finger tight before torquing to specification. This will insure proper converter alignment.

(NOTE: After installation of transmission, lower and remove car from hoist. Check linkage for proper adjustment.)

#### TRANSMISSION DISASSEMBLY AND REASSEMBLY

##### Disassembly

1. Install Holding Fixture J-8763-01 on transmission and place into Holding Tool Base J-3289-14 with converter facing up. (Fig. 7-10)

(NOTE: Cleanliness is an important factor in the overhaul of transmission. Before attempting any disassembly operation, exterior of case should be thoroughly cleaned and prevent the possibility of dirt entering the transmission. During disassembly, all parts should be thoroughly cleaned in cleaning fluid and then air dried. Wiping cloths or rags should not be used to dry parts.)

**CAUTION:** Do not use solvents which could damage rubber seals or clutch facings.

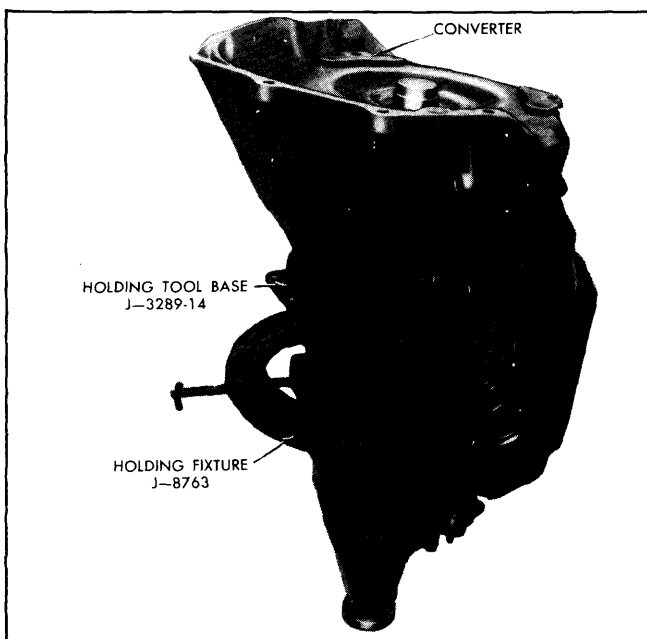


Fig. 7-10—Transmission in Holding Fixture

2. With the transmission in holding fixture remove torque converter assembly.

3. Remove vacuum modulator assembly attaching bolt and retainer.

4. Remove vacuum modulator assembly, "O" ring seal, and modulator valve from case. (Fig. 7-11) Discard "O" ring.

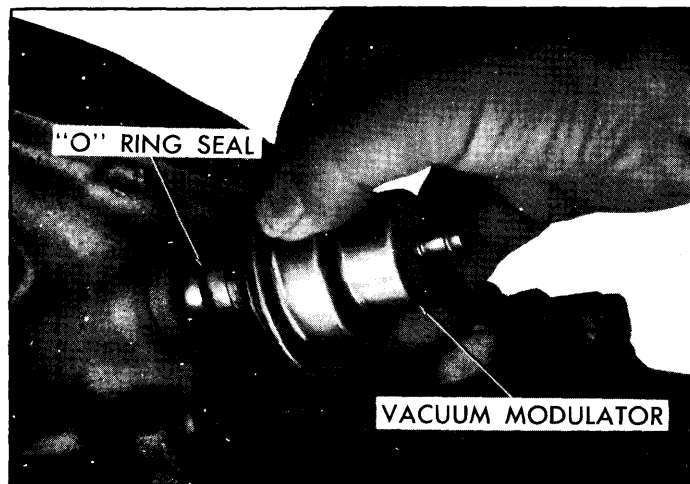


Fig. 7-11—Remove Vacuum Modulator Assembly

##### Removal of Extension, Speedometer Driven Gear, Governor, Oil Pan and Screen

1. Remove four housing to case attaching bolts.

2. Remove extension housing from case and remove square cut "O" ring seal from extension housing.

3. Remove extension housing lip seal using screwdriver. (Fig. 7-12)

4. If extension housing bushing is to be replaced, refer to the THM 250 Bushing Service at end of this section.

5. Install speedometer drive gear remover Tool J-21427-01 and J-9539 bolts with J-8105 or suitable puller on output shaft and remove speedometer drive gear. Remove retaining clip.

6. Remove governor cover retainer with a screwdriver.

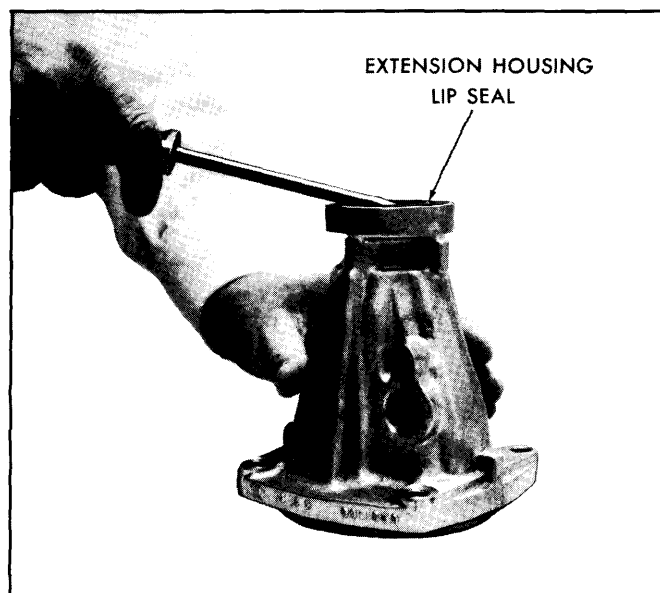


Fig. 7-12—Removing Extension Housing Lip Seal

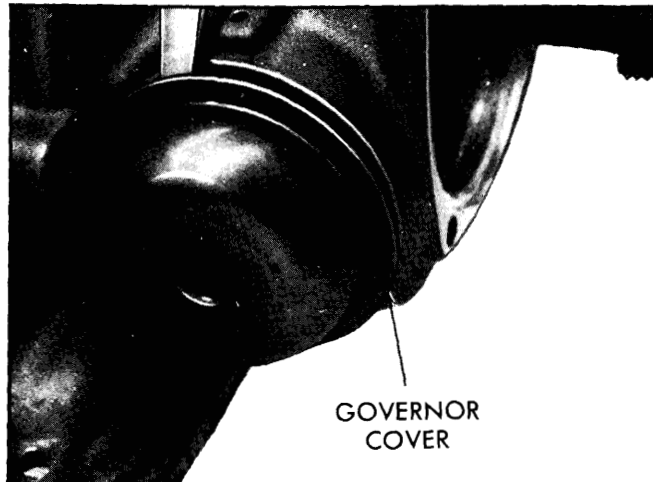


Fig. 7-13—Removing Governor Cover

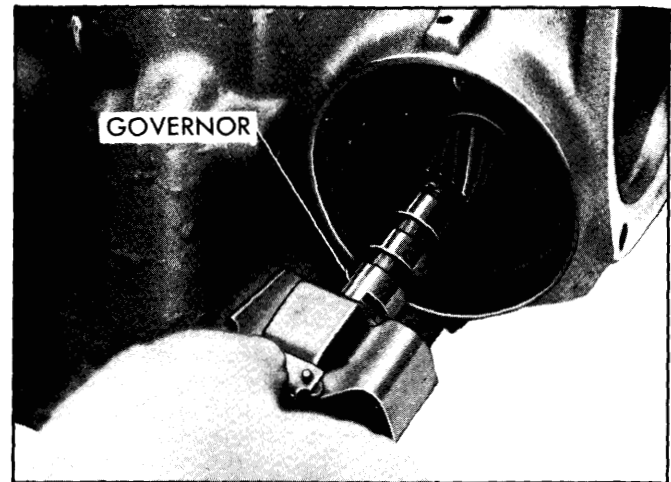


Fig. 7-15—Removing Governor from Case

7. Using a screwdriver and hammer, gently tap along governor cover lip (Fig. 7-13), remove governor cover and "O" ring seal. (Fig. 7-14) Discard Seal.

**CAUTION:** Do not attempt to pry screwdriver between case and governor cover as this could cause damage to case.

8. Withdraw governor assembly from case (Fig. 7-15) and check governor bore and governor sleeve for scoring.



Fig. 7-14—Governor Cover and "O" Ring Seal

9. Remove oil pan attaching screws (Fig. 7-16), oil pan, and gasket. Discard gasket.

10. Remove oil pump suction screen (strainer) to valve body attaching screws. (Fig. 7-17)

11. Remove oil pump screen (strainer) and gasket from valve body.

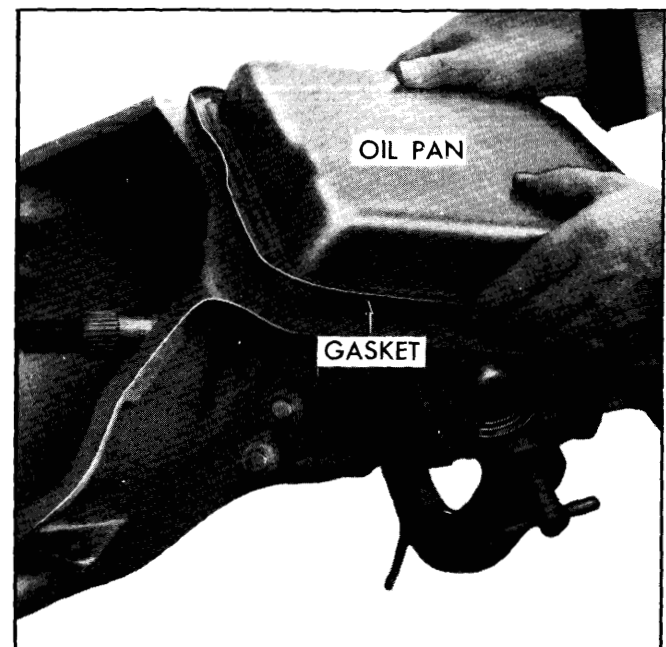


Fig. 7-16—Removing Transmission Oil Pan

#### Removal of Valve Body and Linkage

1. Remove detent roller and spring assembly from valve body. Remove valve body to case attaching bolts. (Fig. 7-18)

2. Remove actuator pin from detent actuator valve lever and remove control wire. (Fig. 7-19)

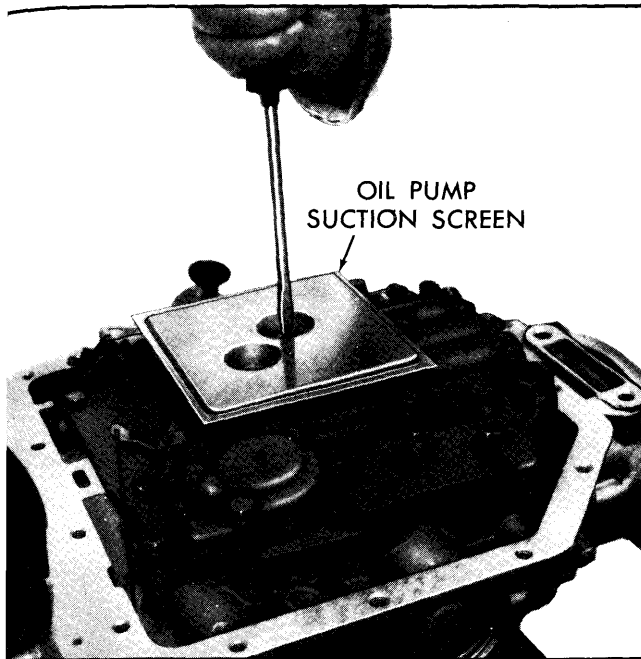


Fig. 7-17—Removing Oil Pump Suction Screen (Strainer) from Valve Body

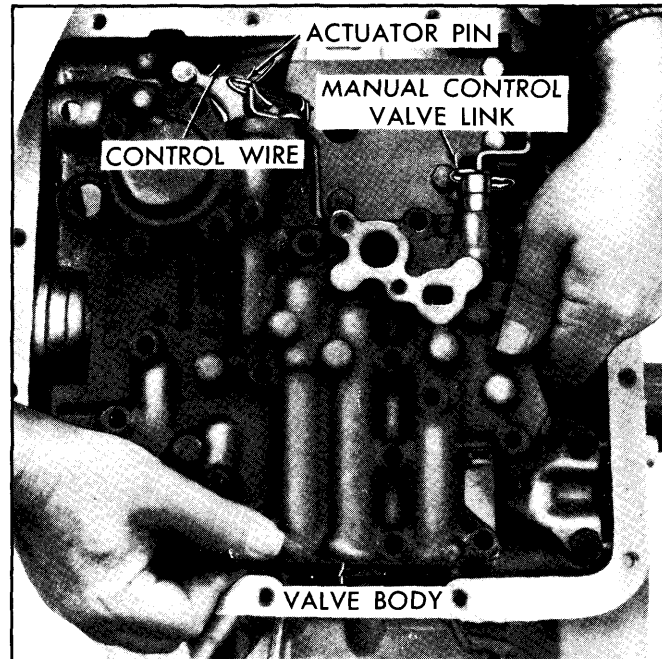


Fig. 7-19—Removing Manual Control Valve Link, Valve Body and Detent Actuating Lever

3. Remove manual control valve link from range selector inner lever and remove valve body. (Fig. 7-19)
4. Remove intermediate servo return spring. (Fig. 7-20)

5. Remove transfer support plate bolts. Remove transfer support plate. (Fig. 7-20)
6. Remove upper valve gasket, valve body transfer plate and lower valve gasket. (Fig. 7-21)

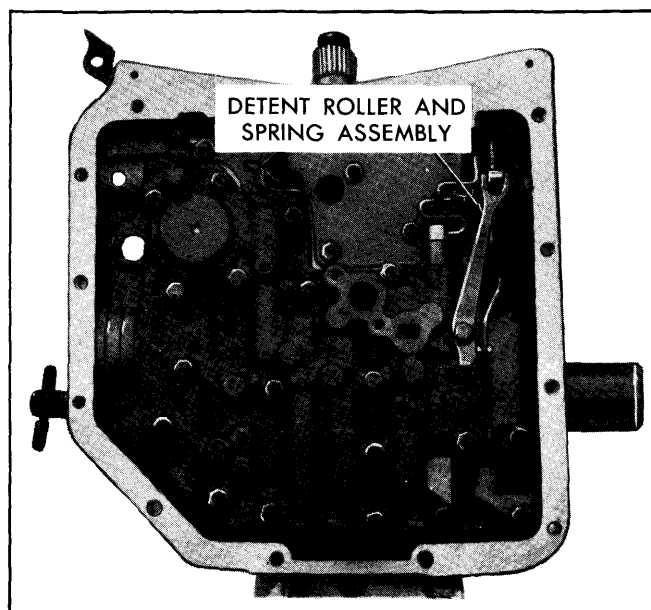


Fig. 7-18—Detent Spring and Roller Assembly

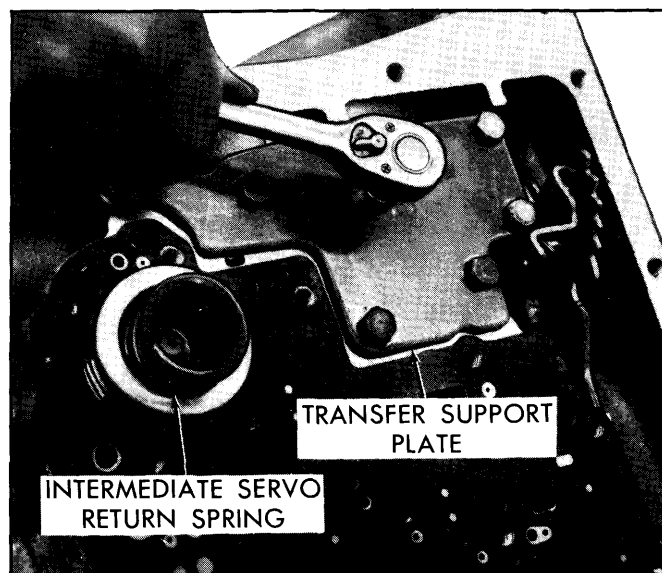


Fig. 7-20—Removing Transfer Support Plate and Intermediate Servo Return Spring

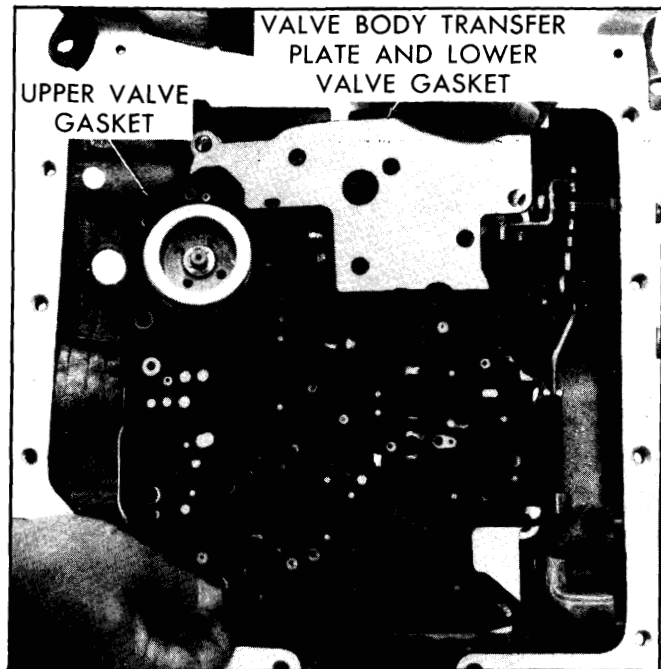


Fig. 7-21—Removing Valve Body Transfer Plate and Gasket

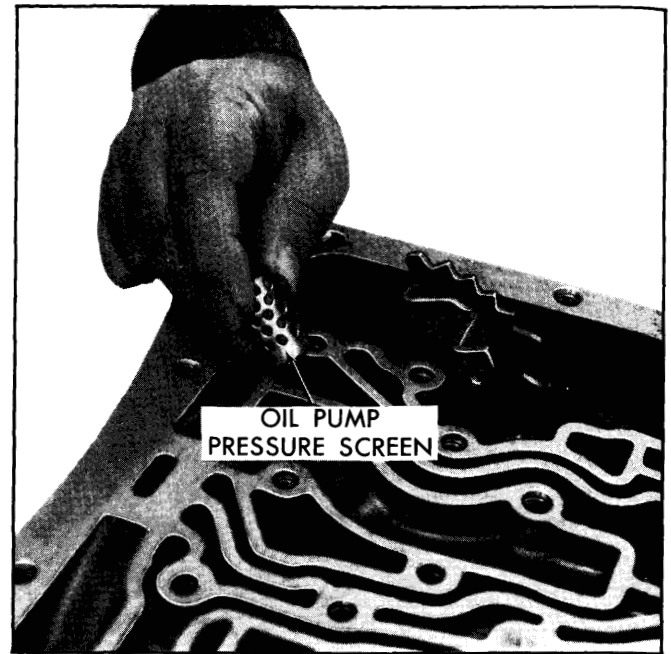


Fig. 7-23—Removing Oil Pump Pressure Screen

7. Remove (4) check balls from correct passages in case face. (Fig. 7-22)
8. Remove oil pump pressure screen from oil pump

pressure hole in case. (Fig. 7-23)

9. Remove governor feed screen from governor feed hole (drive oil) in case. (Fig. 7-24)

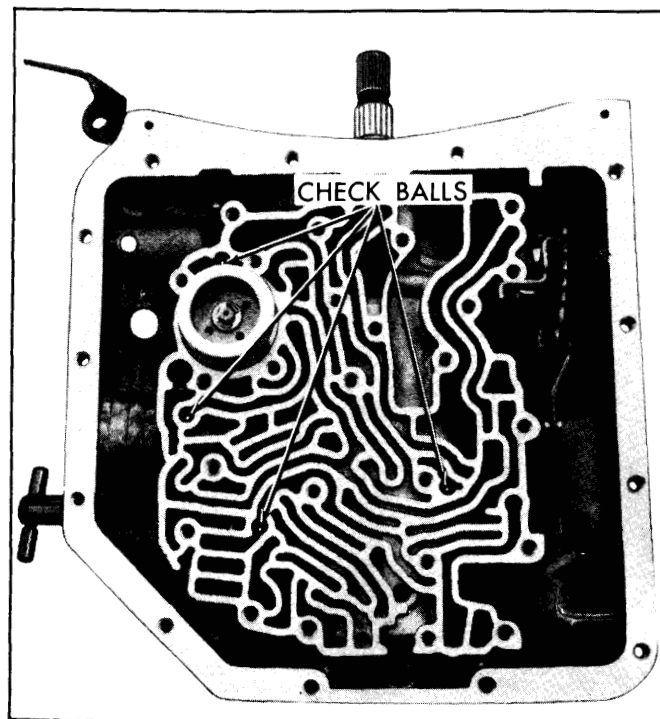


Fig. 7-22—Check Ball Four (4) Locations



Fig. 7-24—Removing Governor Feed Screen

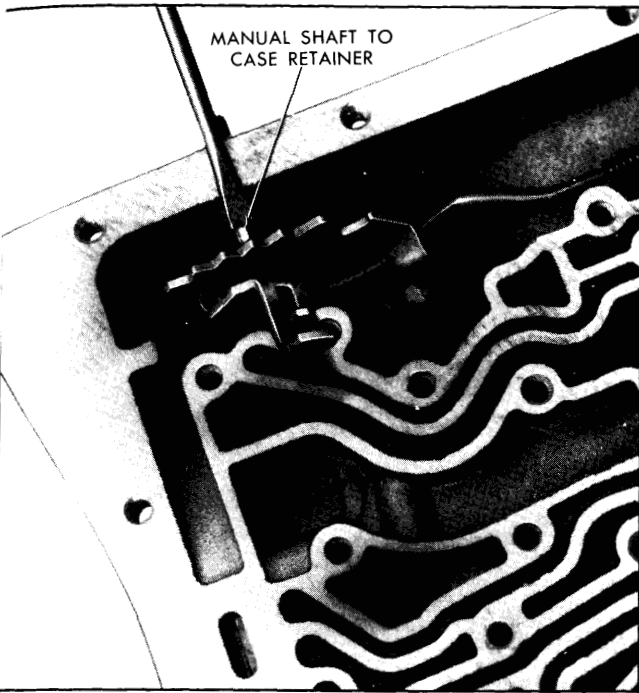


Fig. 7-25—Removing Manual Shaft to Case Retainer

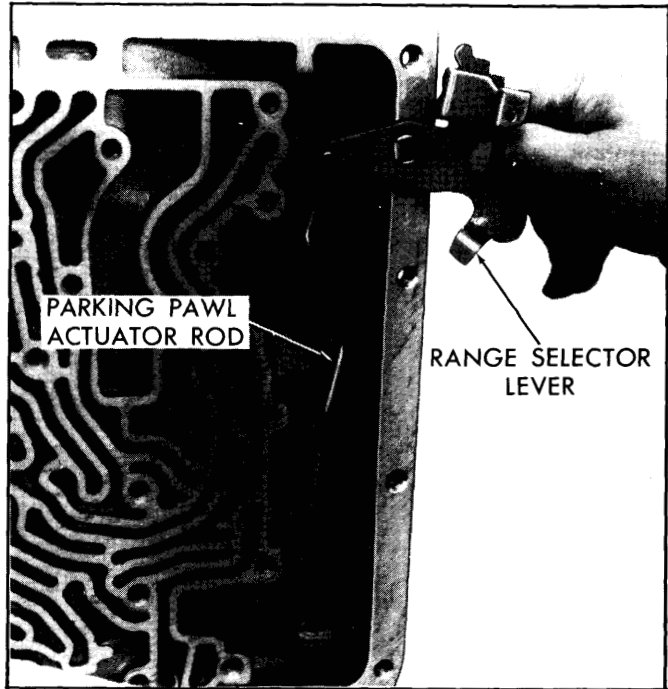


Fig. 7-27—Removing Range Selector Lever and Parking Pawl Actuator Rod from Case

10. Remove manual shaft to case retainer with screwdriver. (Fig. 7-25)

11. Loosen nut holding range selector inner lever to manual shaft. (Fig. 7-26) Pull on manual shaft and remove nut. Remove manual shaft and nut.

12. Remove range selector lever parking pawl actuator rod from case. Disassemble inner lever from parking pawl actuator rod. (Fig. 7-27)

13. Remove manual shaft to case lip seal (Fig. 7-28) if replacement is required.

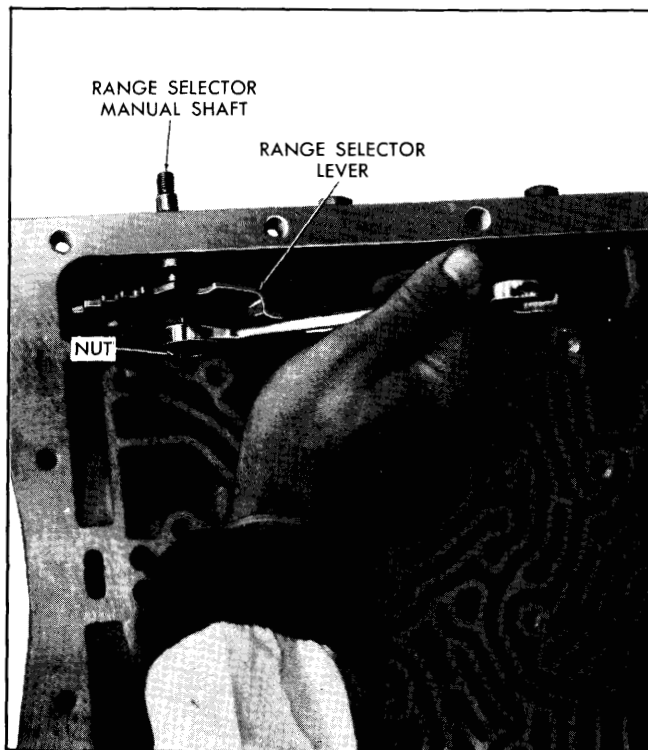


Fig. 7-26—Loosening Nut Holding Range Selector Lever to Manual Shaft

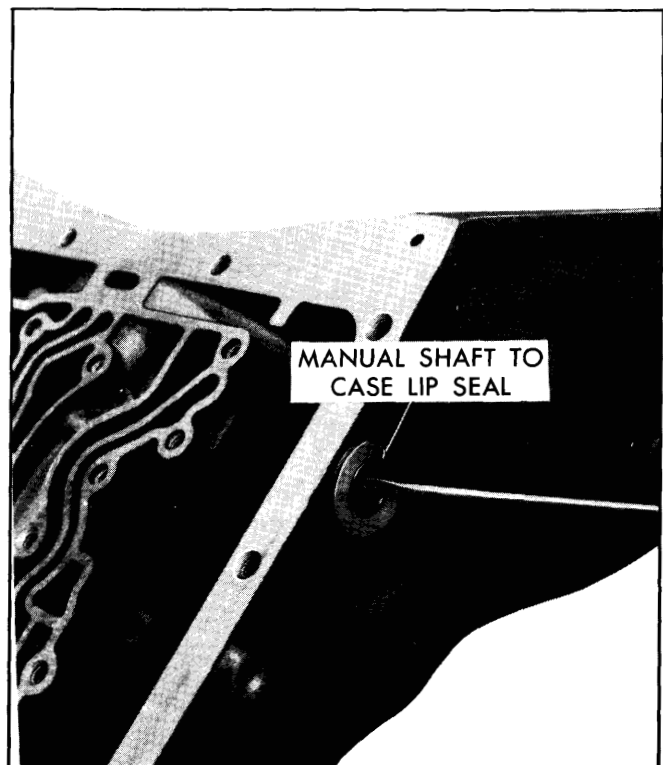


Fig. 7-28—Removing Manual Shaft to Case Lip Seal



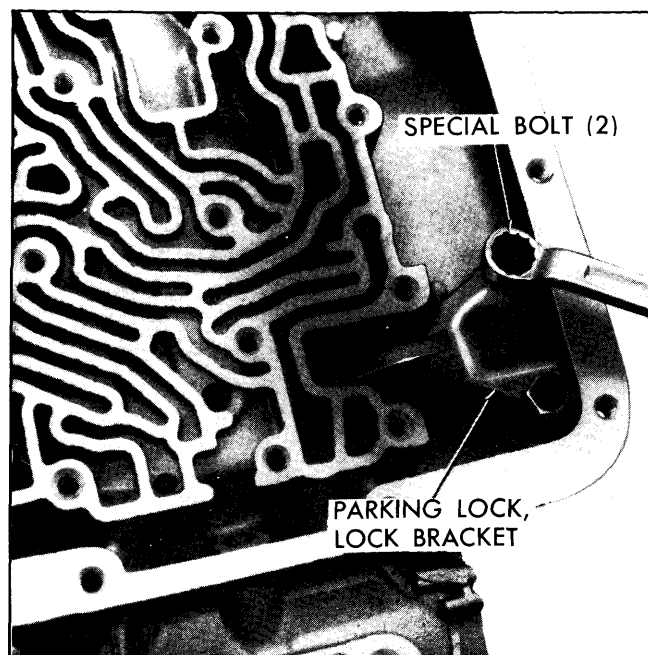


Fig. 7-29—Removing Park Lock, Lock Bracket



Fig. 7-31—Parking Pawl Shaft Retaining Plug, Parking Pawl Shaft and Parking Pawl

14. Remove attaching special bolts and parking lock, lock bracket. (Fig. 7-29)

15. Remove parking pawl disengaging spring. (Fig. 7-30)

16. Remove parking pawl shaft retaining plug, parking pawl shaft, and parking pawl (Fig. 7-31) if replacement is required.

(NOTE: The parking pawl shafts retaining clip may be removed by using a bolt extractor.)

#### Removal of Oil Pump and Internal Case Components

1. Remove (8) pump attaching bolts with washer type seals. (Fig. 7-32)

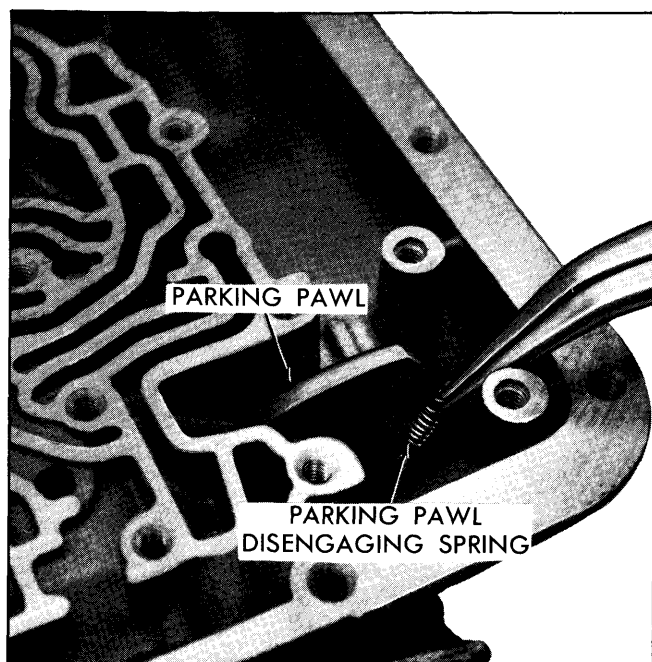


Fig. 7-30—Removing Parking Pawl Disengaging Spring

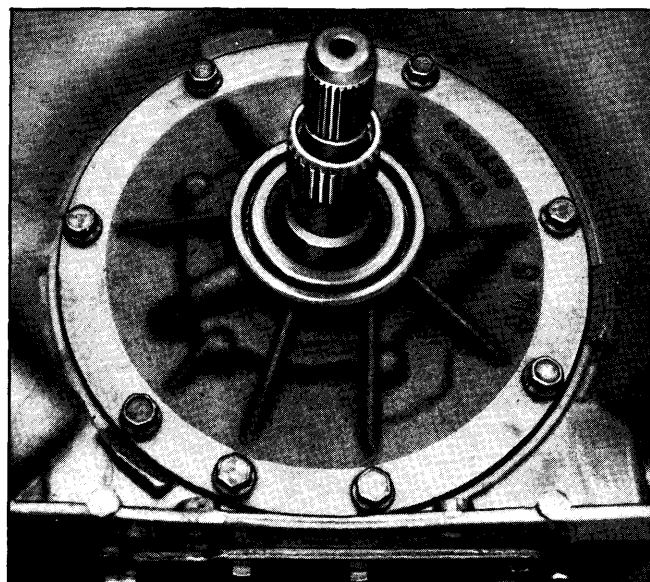


Fig. 7-32—Pump Attaching Bolts



Fig. 7-33—Removing Pump from Case

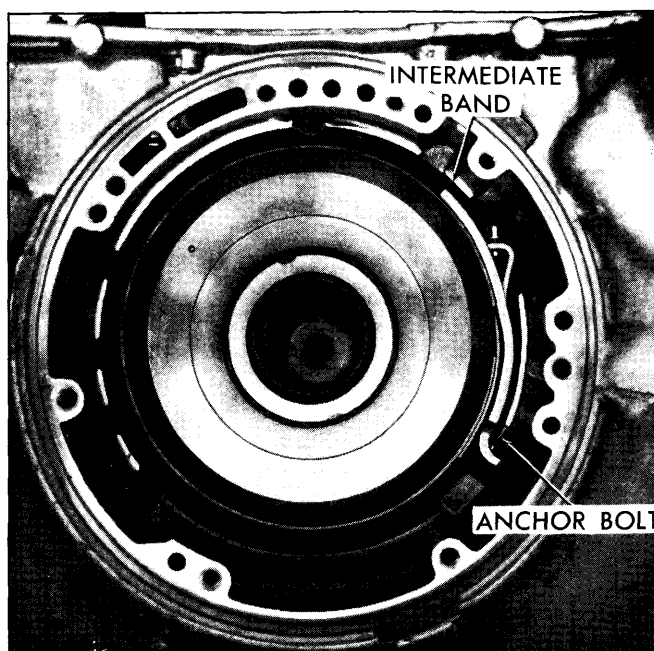


Fig. 7-35—Intermediate Band

2. Install (2) threaded slide hammers J-7004 into threaded holes in pump body and remove pump assembly from case. (Fig. 7-33) Discard pump gasket. Refer to "Pump Disassembly" for disassembly and reassembly of the oil pump.

3. Loosen nut and intermediate band anchor bolt. (Fig. 7-34)

4. Remove intermediate band. (Fig. 7-35)

5. Remove intermediate servo (Fig. 7-36) and disassembly as shown in Fig. 7-37.

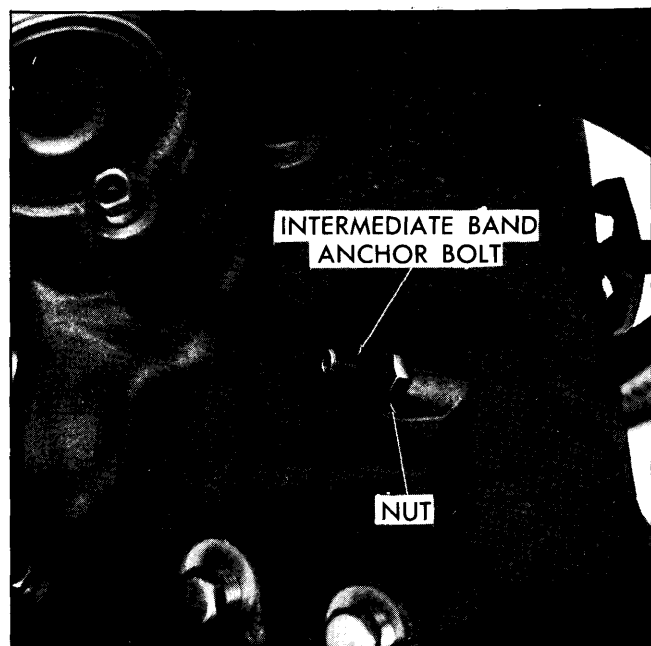


Fig. 7-34—Intermediate Band Anchor Bolt

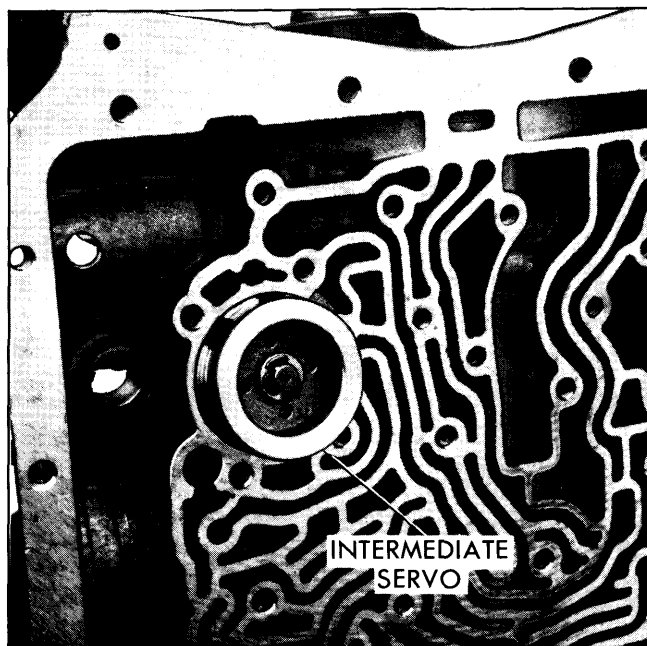


Fig. 7-36—Removing Intermediate Servo



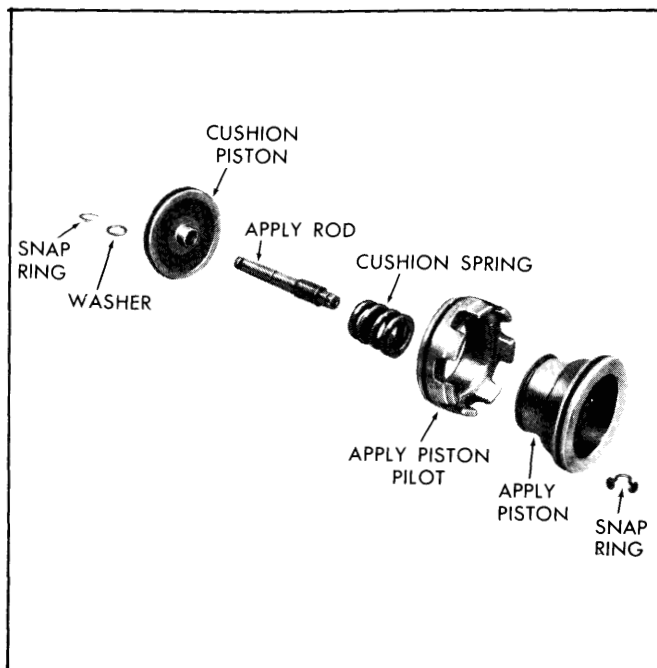


Fig. 7-37—Intermediate Servo

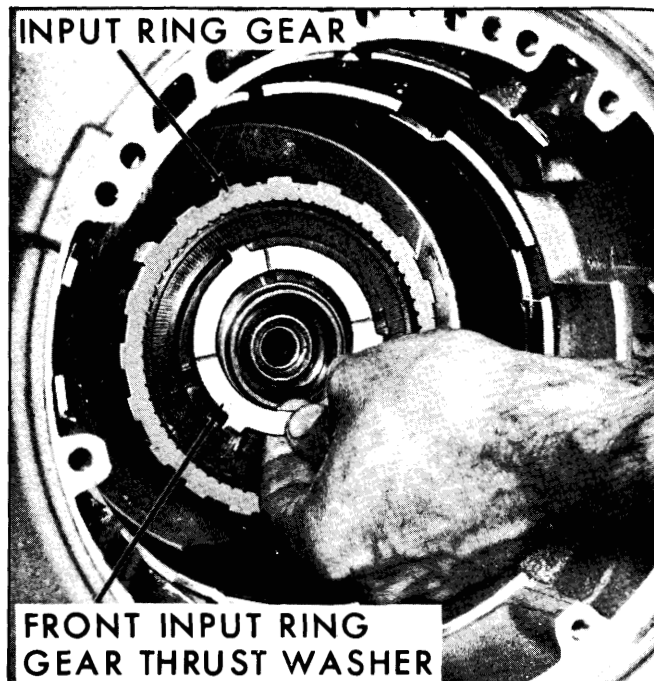


Fig. 7-39—Removing Input Ring Gear Front Thrust

6. Remove direct and forward clutch assemblies from case. (Fig. 7-38) Refer to disassembly and reassembly of the direct and forward clutches.

7. Remove input ring gear from thrust washer. (Fig. 7-39)

(NOTE: Washer has 3 tangs.)

8. Remove output carrier to output shaft snap ring. (Fig. 7-40)

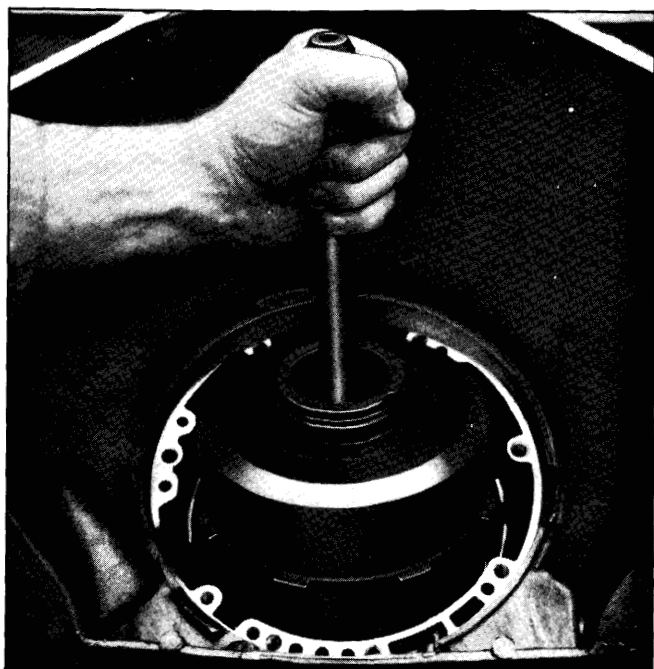


Fig. 7-38—Removing Direct and Forward Clutch Assemblies

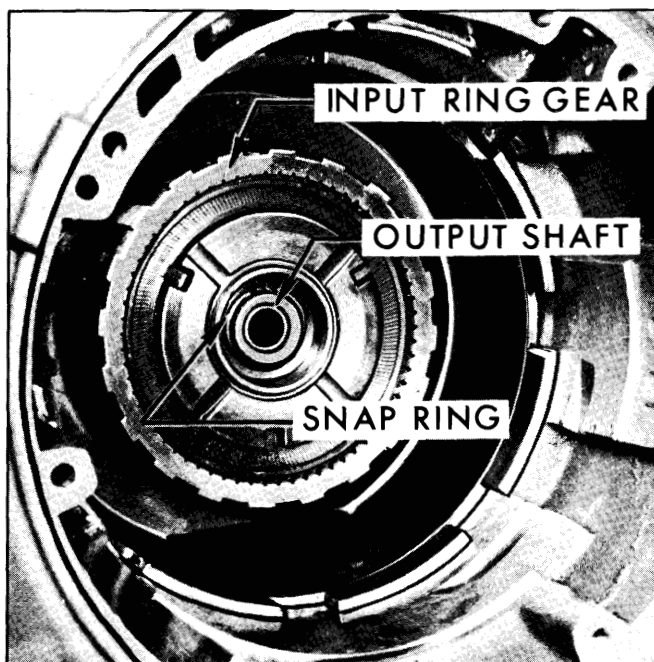


Fig. 7-40—Removing Output Carrier to Output Snap Ring

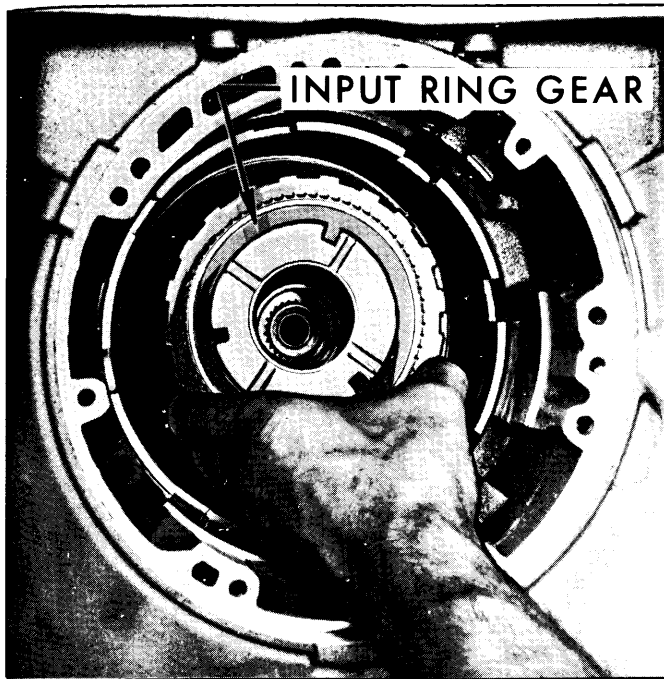


Fig. 7-41—Removing Input Ring Gear

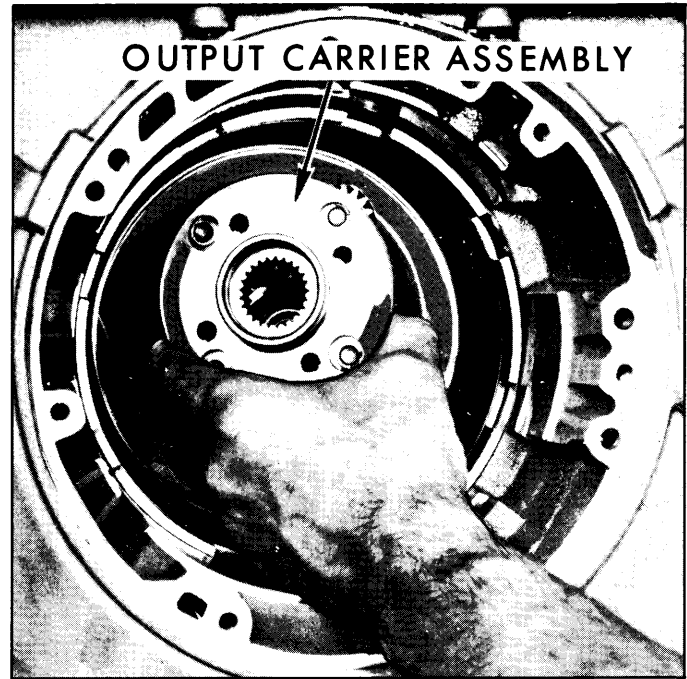


Fig. 7-43—Removing Output Carrier Assembly

9. Remove input ring gear. (Fig. 7-41)
10. Remove input ring gear rear (output carrier) thrust washer. (Fig. 7-42)

11. Remove output carrier assembly. (Fig. 7-43)
12. Remove sun gear drive shell assembly. (Fig. 7-44)

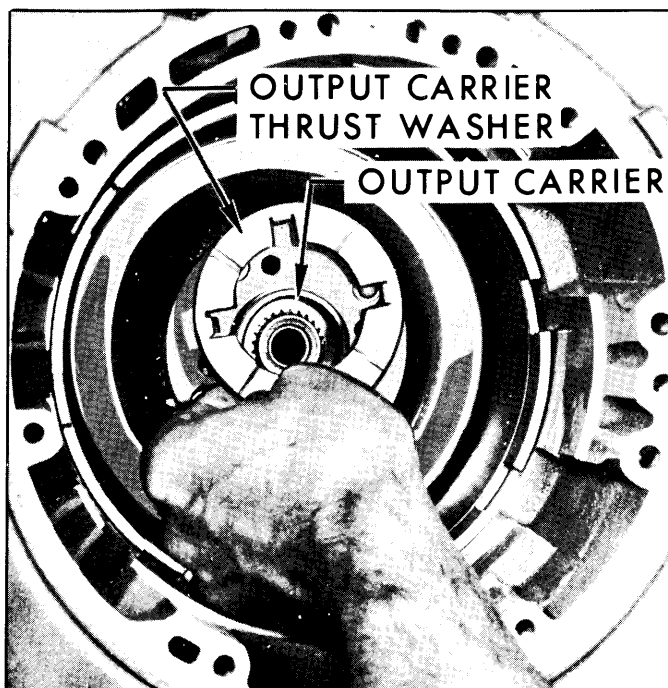


Fig. 7-42—Removing Input Ring Gear Rear Thrust Washer

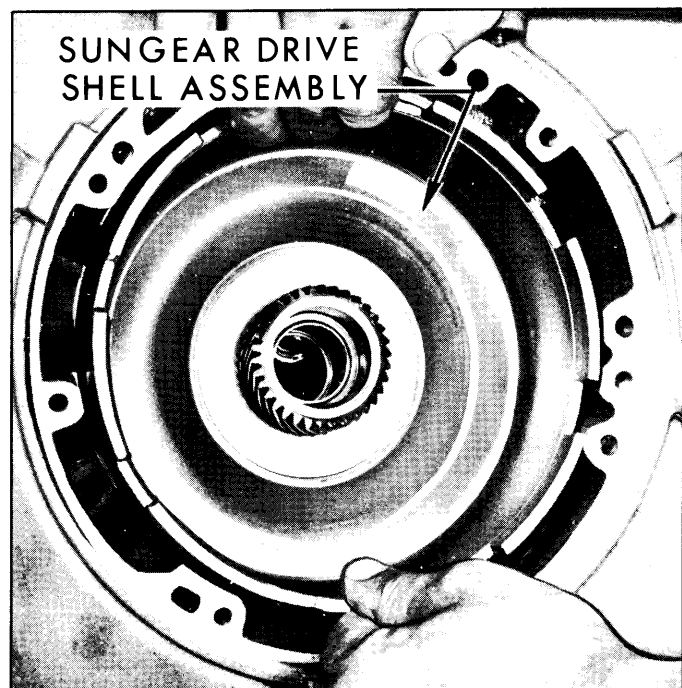


Fig. 7-44—Removing Sun Gear Drive Shell

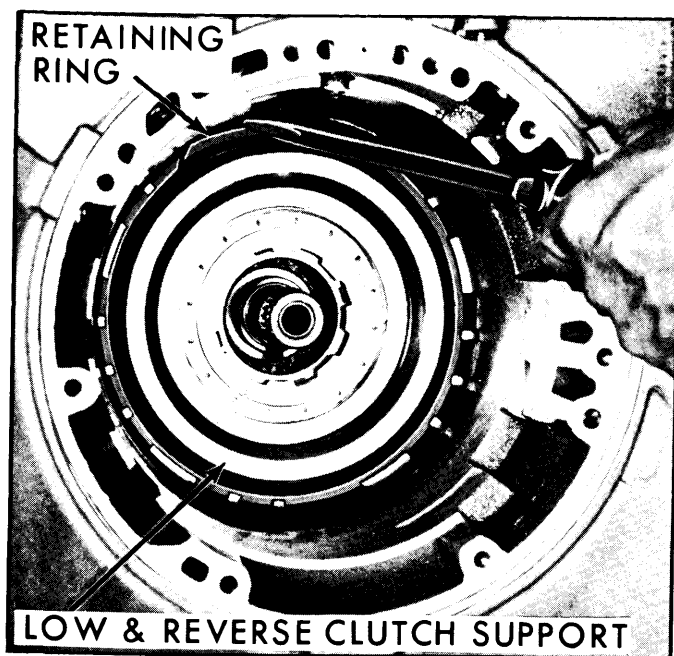


Fig. 7-45—Removing Low and Reverse Clutch Support Retaining Ring

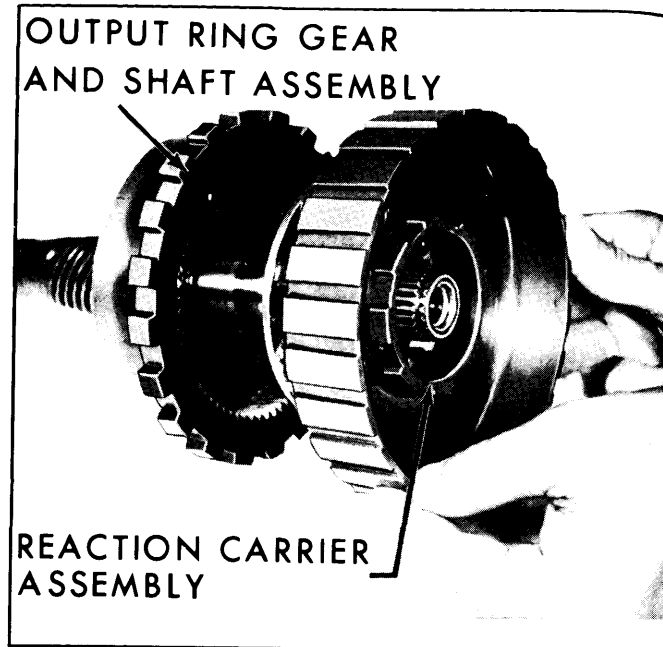


Fig. 7-47—Removing Reaction Carrier Assembly

13. Remove low and reverse roller clutch support to case retaining ring. (Fig. 7-45)

14. Remove low and reverse clutch support and race assembly and anti-clunk spring.

15. Remove low and reverse clutch faced plates and

steel reaction plate. (Fig. 7-46)

16. Remove reaction carrier assembly from output ring gear and shaft assembly. (Fig. 7-47)

17. Remove output ring gear and shaft assembly from case. (Fig. 7-48)

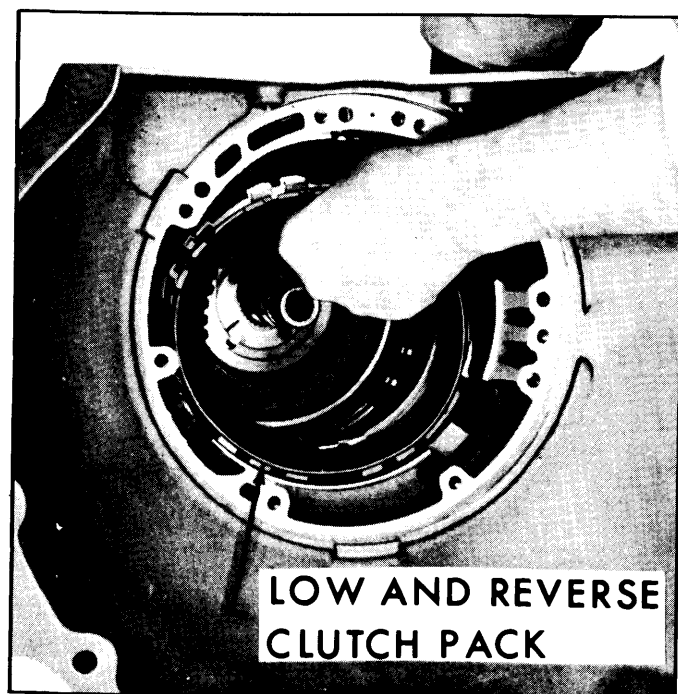


Fig. 7-46—Removing Low and Reverse Clutch Pack

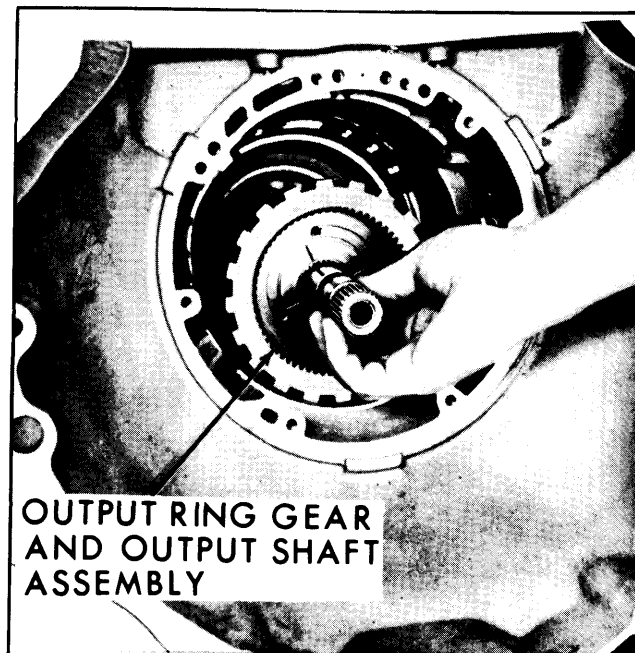


Fig. 7-48—Removing Output Ring Gear and Shaft Assembly

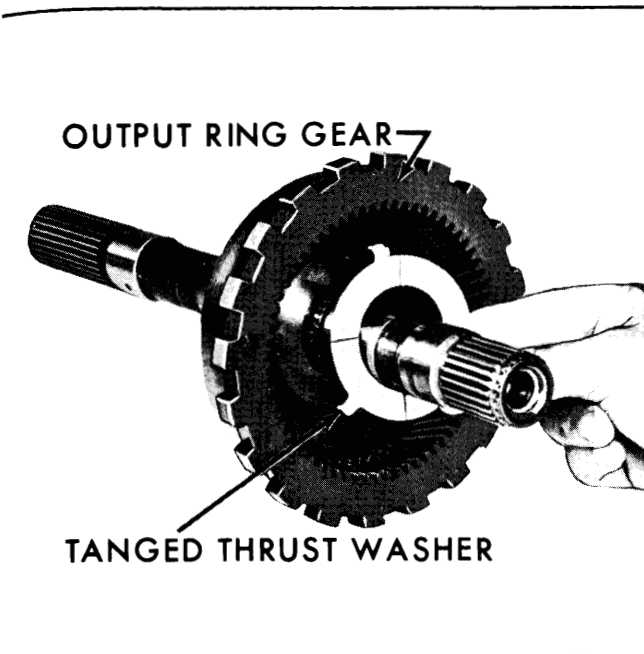


Fig. 7-49—Removing Output Ring Gear Tanged Thrust Washer

18. Remove reaction carrier to output ring gear tanged (front) thrust washer. (Fig. 7-49)
19. Remove output ring gear to case needle bearing assembly. (Fig. 7-50)

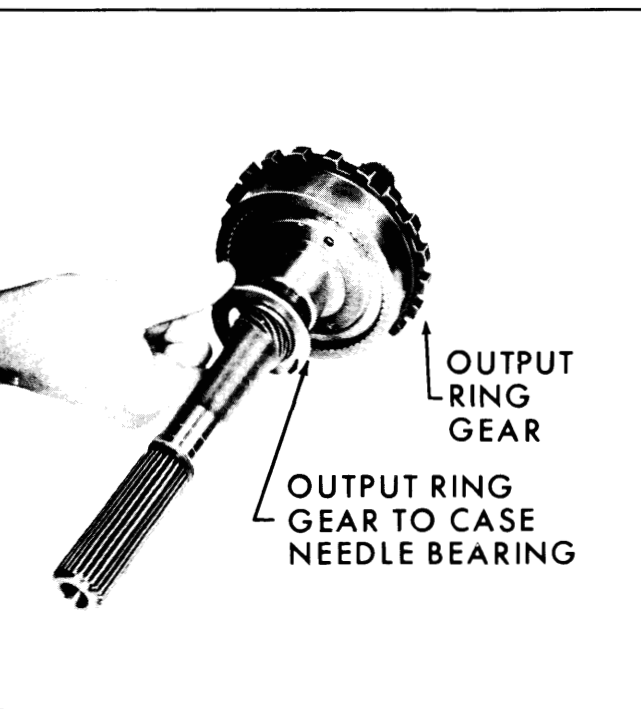


Fig. 7-50—Removing Output Ring Gear Needle Bearing Assembly

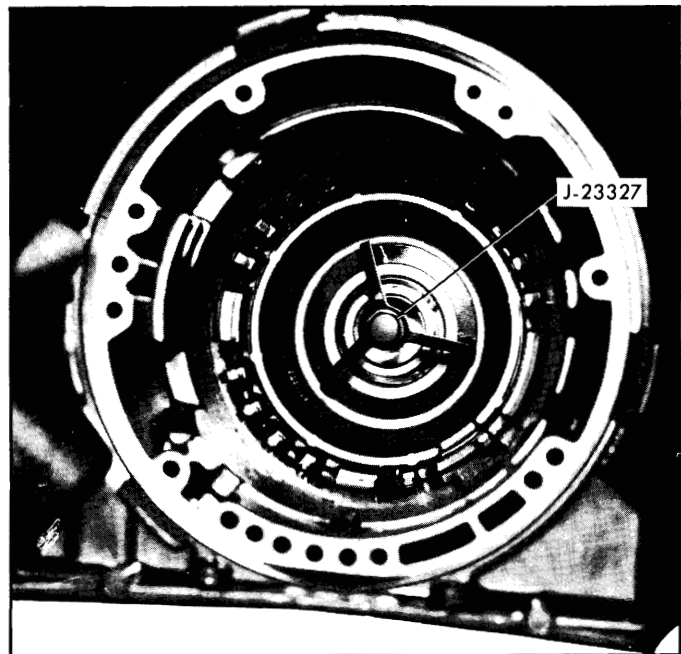


Fig. 7-51—Compressing Low and Reverse Clutch Piston Spring Retainer

20. Compress low and reverse clutch piston spring retainer using Tool J-23327 and remove piston retaining ring and spring retainer. (Fig. 7-51)
21. Remove (17) piston springs from piston. (Fig. 7-52)

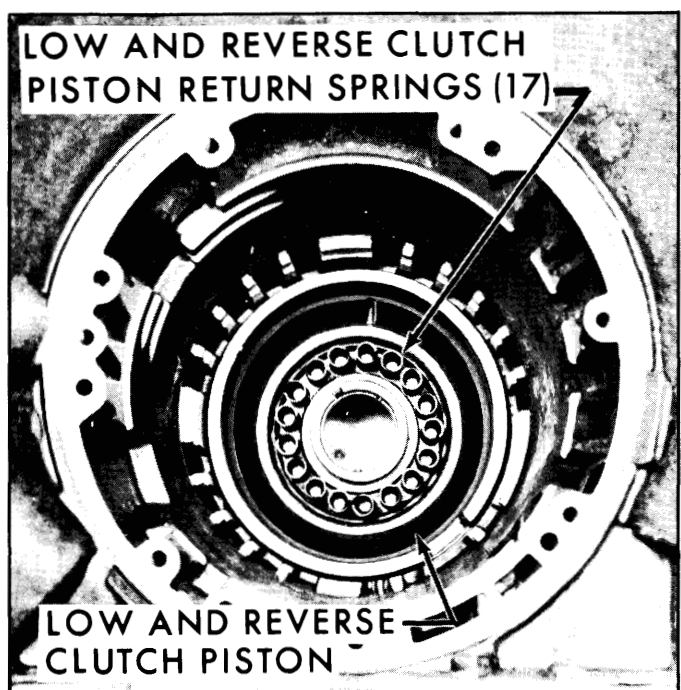


Fig. 7-52—Low and Reverse Clutch Piston Springs and Piston

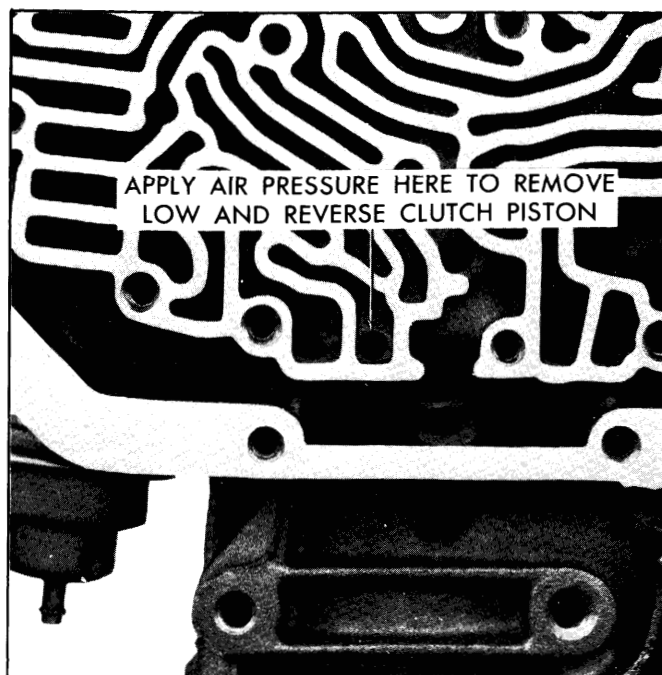


Fig. 7-53—Removing Low and Reverse Clutch Piston

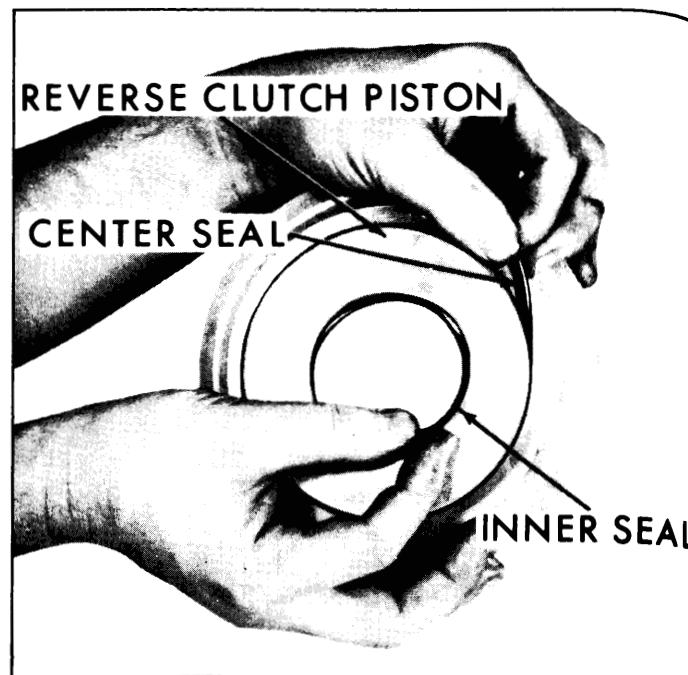


Fig. 7-55—Removing Low and Reverse Clutch Piston Center and Inner Seal

22. Remove low and reverse clutch piston assembly by applying compressed air in passage shown on Fig. 7-53.
23. Remove low and reverse clutch piston outer seal. (Fig. 7-54)

24. Remove low and reverse clutch piston center and inner seal. (Fig. 7-55)
25. Install Tool J-23069 to compress 1-2 accumulator piston cover and remove retaining ring. (Fig. 7-56)

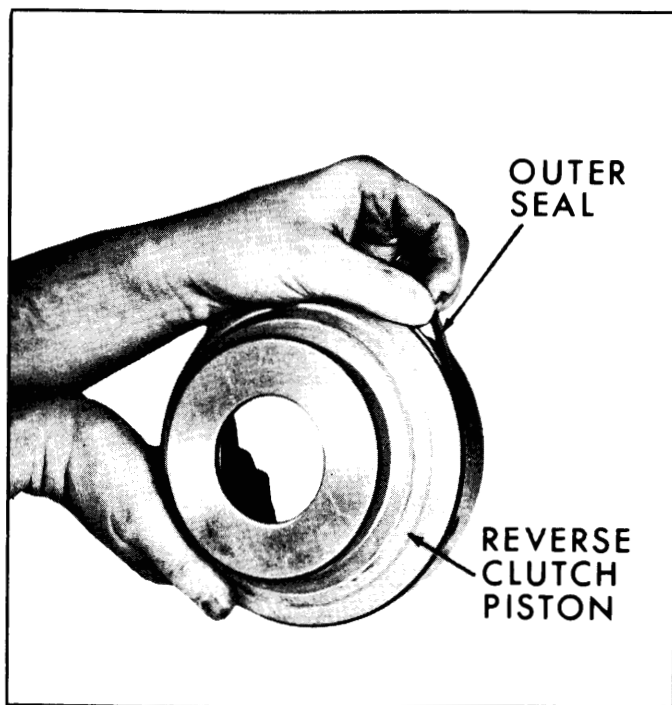


Fig. 7-54—Removing Low and Reverse Piston Outer Seal

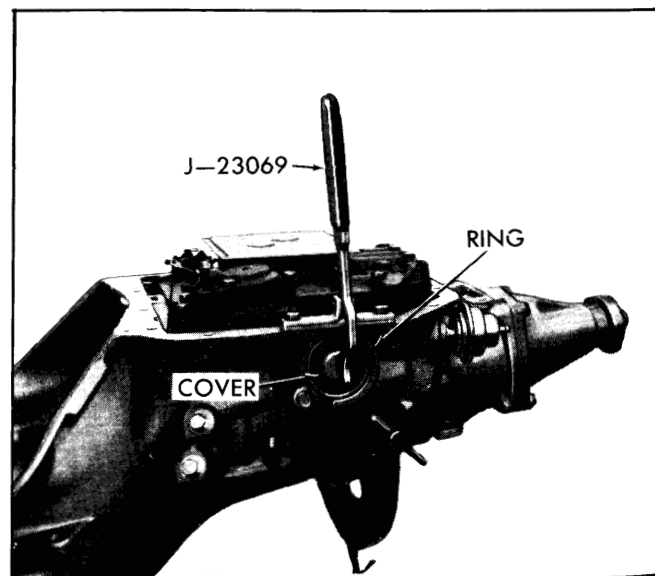


Fig. 7-56—Removing 1-2 Accumulator Piston Cover Retaining Ring

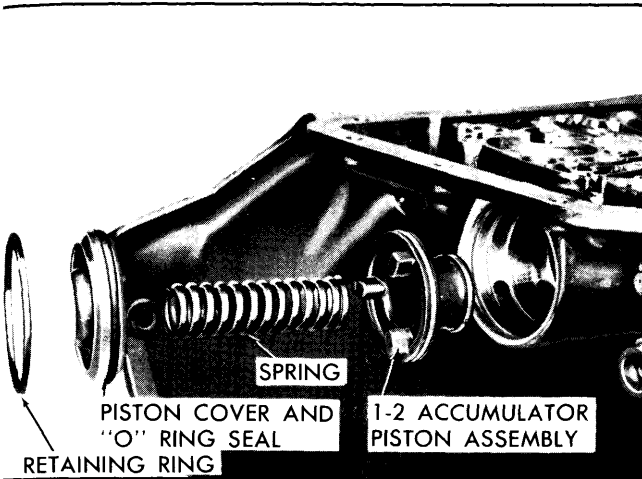


Fig. 7-57—Accumulator Parts

26. Remove 1-2 accumulator piston cover. Remove "O" ring seal from case.
  27. Remove 1-2 accumulator piston spring.
  28. Remove 1-2 accumulator piston assembly. (Fig. 7-57)
- Also remove inner and outer hook type oil seal rings if required.

### VALVE BODY (Fig. 7-58)

#### Disassembly

1. Position valve body assembly with cored face up and direct clutch accumulator piston pocket positioned as shown in Fig. 7-58.
2. Remove manual valve from lower left hand bore.

3. From lower right hand bore remove pressure regulator valve train retaining pin, boost valve sleeve, intermediate valve, reverse and modulator boost valve, pressure regulator valve spring, and pressure regulator valve.

4. From next bore, remove 2-3 shift valve train retaining pin, sleeve, control valve spring 2-3 shaft control valve, shift valve spring, and 2-3 shift valve.

5. From next bore, remove the 1-2 shift valve train retaining pin, sleeve, shift control valve spring, 1-2 shift control valve, and 1-2 shift valve.

6. From next bore, remove retaining pin, plug, manual low control valve spring, and manual low control valve.

7. From next bore, remove retaining pin, spring, seat, and detent regulator valve.

8. From bore on opposite side, remove detent actuating lever bracket bolt, bracket, stop, spring retainer, seat, outer spring, inner spring, washer and detent valve.

#### Inspection

1. Inspect all valves for scoring, cracks and free movement in their respective bores.
2. Inspect valve body for cracks, scored bores, interconnected oil passages and flatness of mounting face.
3. Check all springs for distortion or collapsed coils.

#### Reassembly

1. Install detent valve, washer, outer spring, inner spring, spring seat, and spring retainer. Install detent valve stop and detent valve actuating bracket. Torque bolt to 52 in. lbs.
2. Install pressure regulator valve, spring, reverse and modulator boost valve, intermediate boost valve, boost valve sleeve and retaining pin.
3. In next bore up, install 2-3 shift control valve, shift control valve spring, shift control valve sleeve and retaining pin.

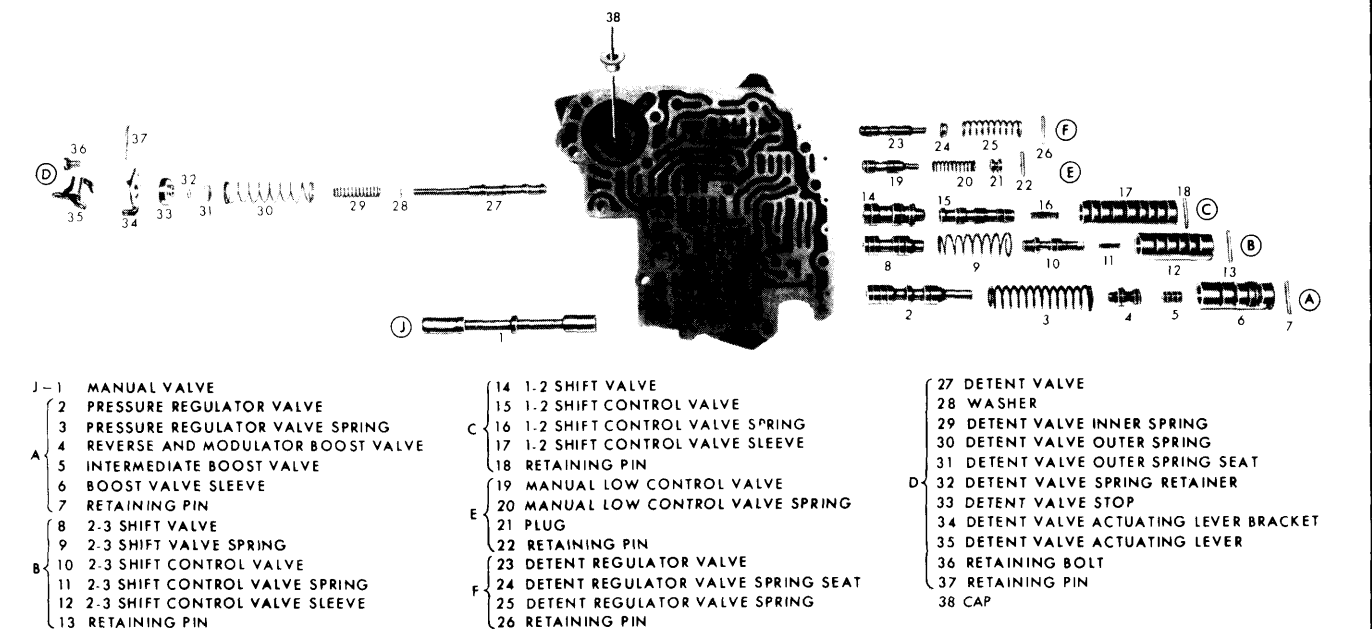


Fig. 7-58—Valve Body Exploded View



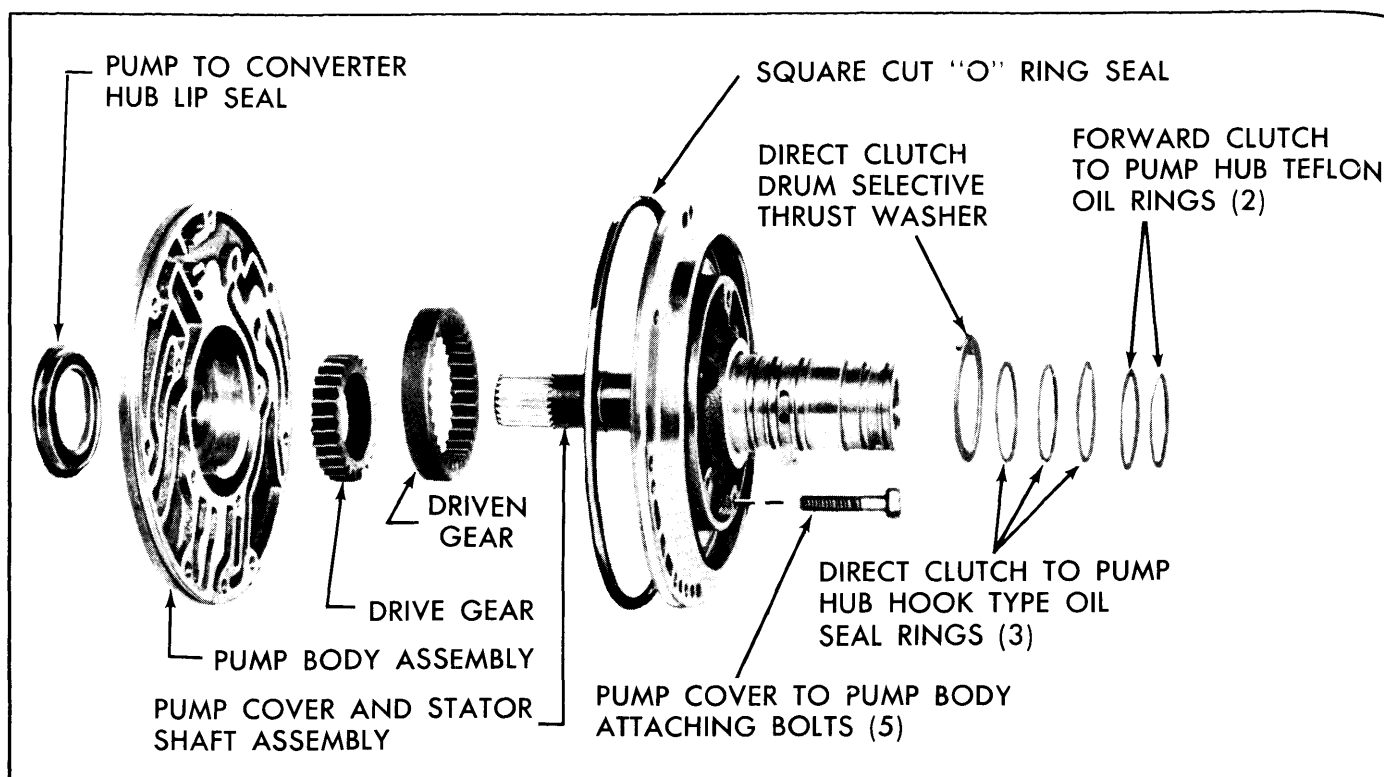


Fig. 7-59—Pump Assembly Exploded View

4. In next bore up, install 1-2 shift valve 1-2 shift control valve, control valve spring, control valve sleeve and retaining pin.

5. In next bore up, install manual low control valve, spring, plug and retaining pin.

6. In top right hand bore, install detent regulator valve, spring seat, spring and retaining pin.

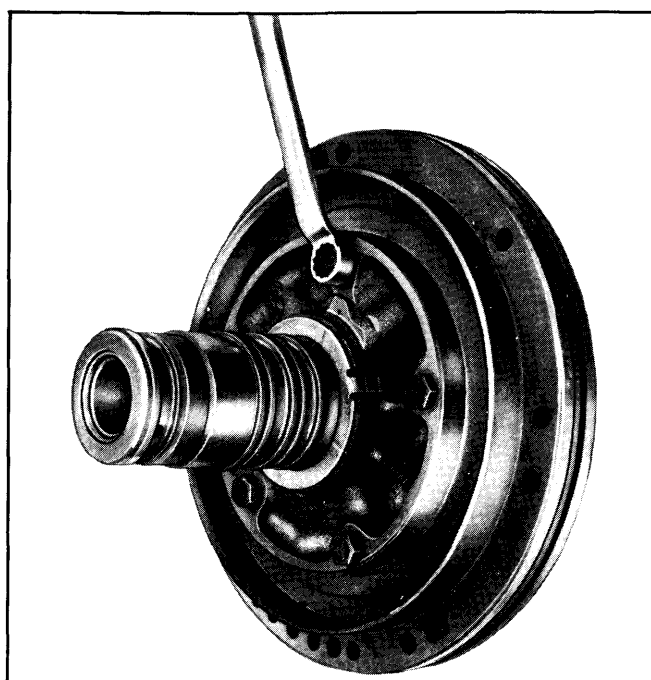


Fig. 7-60—Removing Pump Cover to Pump Body Bolts

#### OIL PUMP (Fig. 7-59)

##### Disassembly

1. Place pump cover and stator shaft assembly through hole in bench.

2. Remove pump cover to body attaching bolts 5/16 X 18-1 1/2. (Fig. 7-60)

3. Remove (2) forward clutch to pump hub hook type oil seal rings and (3) direct clutch to pump hub type oil rings. (Fig. 7-61)

4. Remove pump cover to direct clutch drum housing selective thrust washer.

5. Remove pump cover and stator shaft assembly from pump body. (Fig. 7-62)

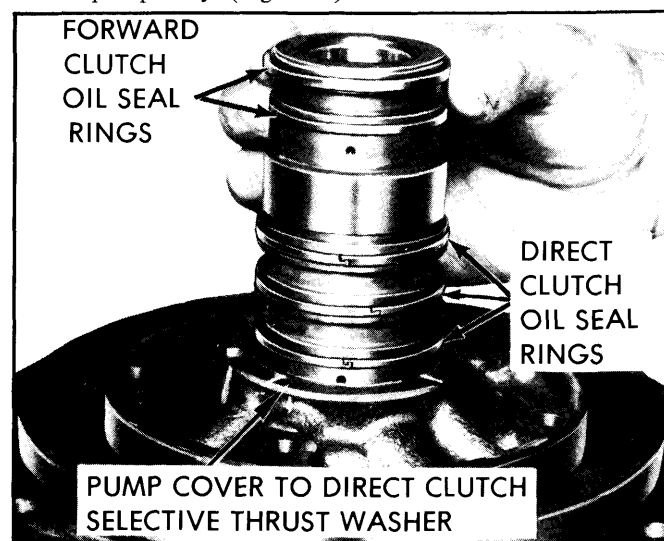


Fig. 7-61—Pump Hub Oil Seal Rings

# PUMP COVER AND STATOR SHAFT ASSEMBLY

## PUMP BODY



Fig. 7-62—Separating Pump Cover from Pump Body

6. Remove pump drive gear and driven gear.

7. Remove pump outside diameter to case (square cut) "O" ring seal. Discard seal.

### Inspection

1. Wash all parts in cleaning solvent and blow out all oil passages. DO NOT USE RAGS TO DRY PARTS.

**CAUTION:** Some solvents may be harmful to rubber seals.

2. Inspect pump gears for nicks or damage.

3. Inspect body and cover faces for nicks or scoring. Inspect cover hub O.D. for nicks or burrs which might damage clutch drum bushing journal.

4. Inspect body bushing for galling or scoring. Check clearance between body bushing and converter pump hub. Maximum clearance is .005". If bushing is damaged, oil pump body should be replaced. If necessary to replace, refer to "THM 250 Bushing Service" at the end of this section.

5. Inspect converter housing hub O.D. for nicks or burrs which might damage pump seal or bushing. Repair or

replace as necessary.

6. If hub lip seal is damaged or is leaking (and pump body is otherwise suitable for reuse), replace seal.

7. With parts clean and dry, pump gears in pump body and check pump body face to gear face clearance. Clearance should be .005"-.0015". (Fig. 7-63)

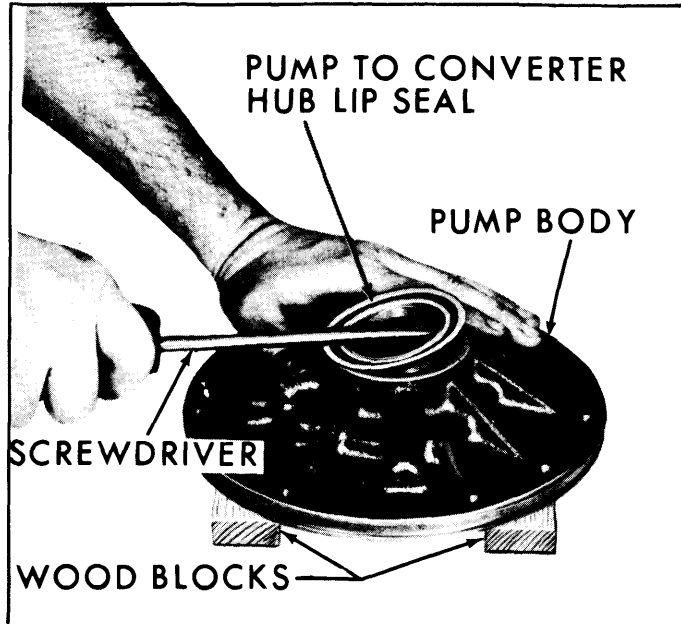


Fig. 7-64—Removing Pump to Converter Hub Lip Seal

### Reassembly

1. Replace hub lip seal if defective. (Figs. 7-64 & 7-65)

2. Place pump body on wood blocks and pry out defective seal. Coat outer diameter of new seal with a non-hardening sealer and seal using seal installer J-21359 to seat full in counterbore.

3. Install pump drive gear and driven gear. (Fig. 7-66)

4. Install direct clutch drum housing to pump cover selective thrust washer over pump cover delivery sleeve.

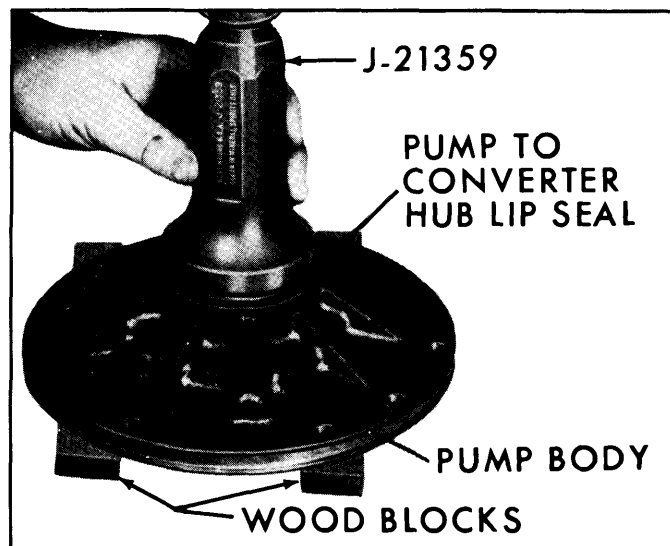


Fig. 7-65—Installing Hub Lip Seal



Fig. 7-63—Checking Pump Body to Gear Face Clearance



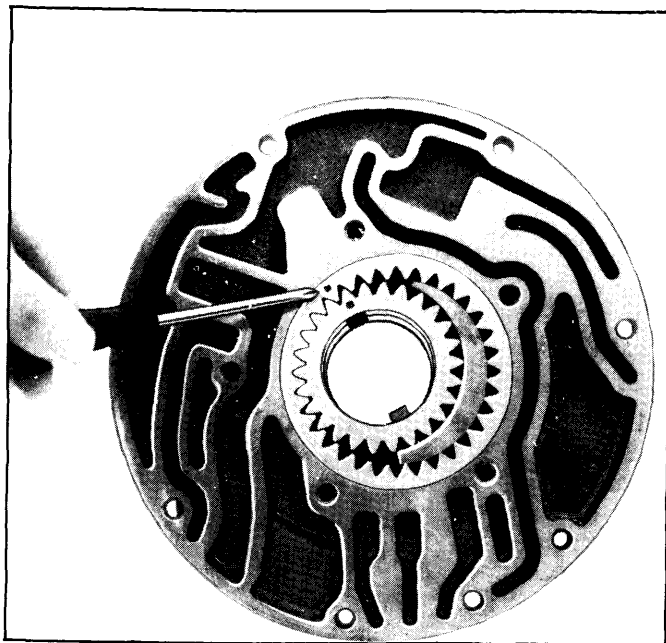


Fig. 7-66—Installing Pump Drive and Driven Gears

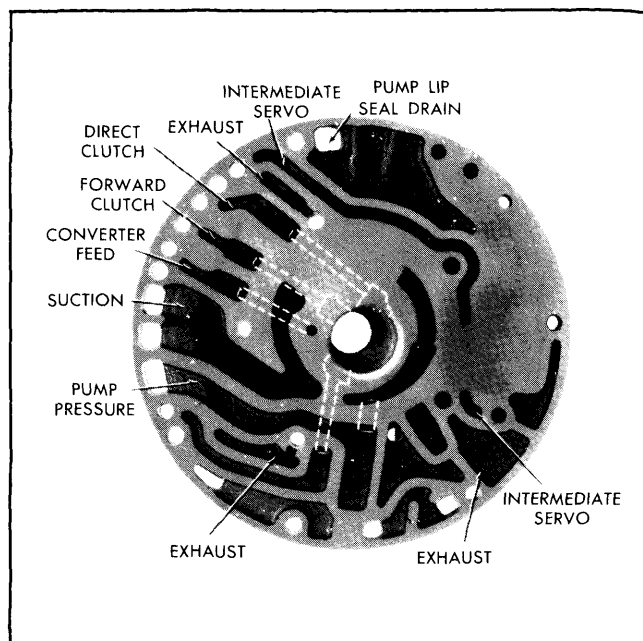


Fig. 7-68—Pump Cover Oil Passages

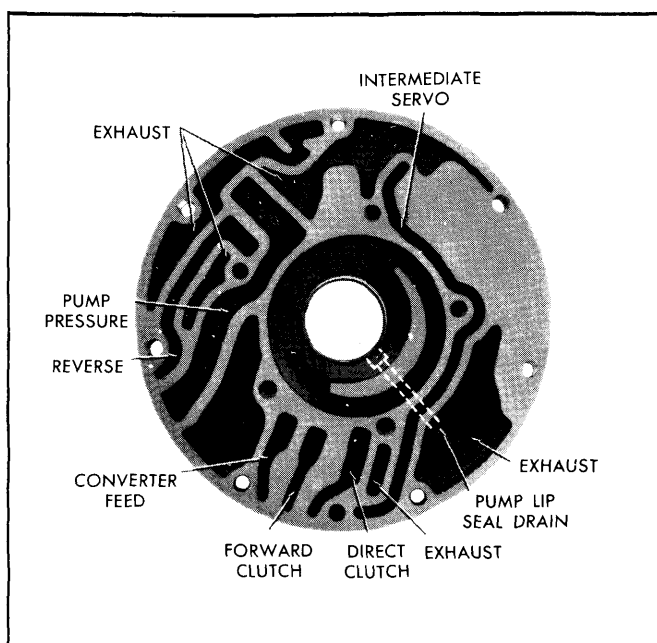


Fig. 7-67—Pump Body Oil Passages

5. Install (3) direct clutch to pump hub hook type oil seal rings. Install (2) forward clutch to pump hub hook type oil seal rings.

**CAUTION:** Check pump cover and body oil passages to make sure they are not restricted. (Figs. 7-67 and 7-68)

6. Install pump outside diameter to case (square cut) "O" ring seal.

7. Align pump body to cover and install (5) attaching bolts. Tighten bolts to 18 ft. lbs.

#### DIRECT CLUTCH (Fig. 7-69)

##### Disassembly

1. Remove direct clutch pressure plate to clutch drum retaining ring and pressure plate. (Fig. 7-70)

2. Remove three lined drive plates and three steel driven plates. (Fig. 7-71)

3. Using Compressor Tool J-23327-1, remove direct clutch piston return spring seat retaining ring, spring seat and (17) clutch return coil springs. (Fig. 7-72)

4. Remove direct clutch piston assembly.

5. Remove direct clutch piston outer seal and inner seal. (Fig. 7-73)

6. Remove direct clutch piston center seal on drum. (Fig. 7-74)

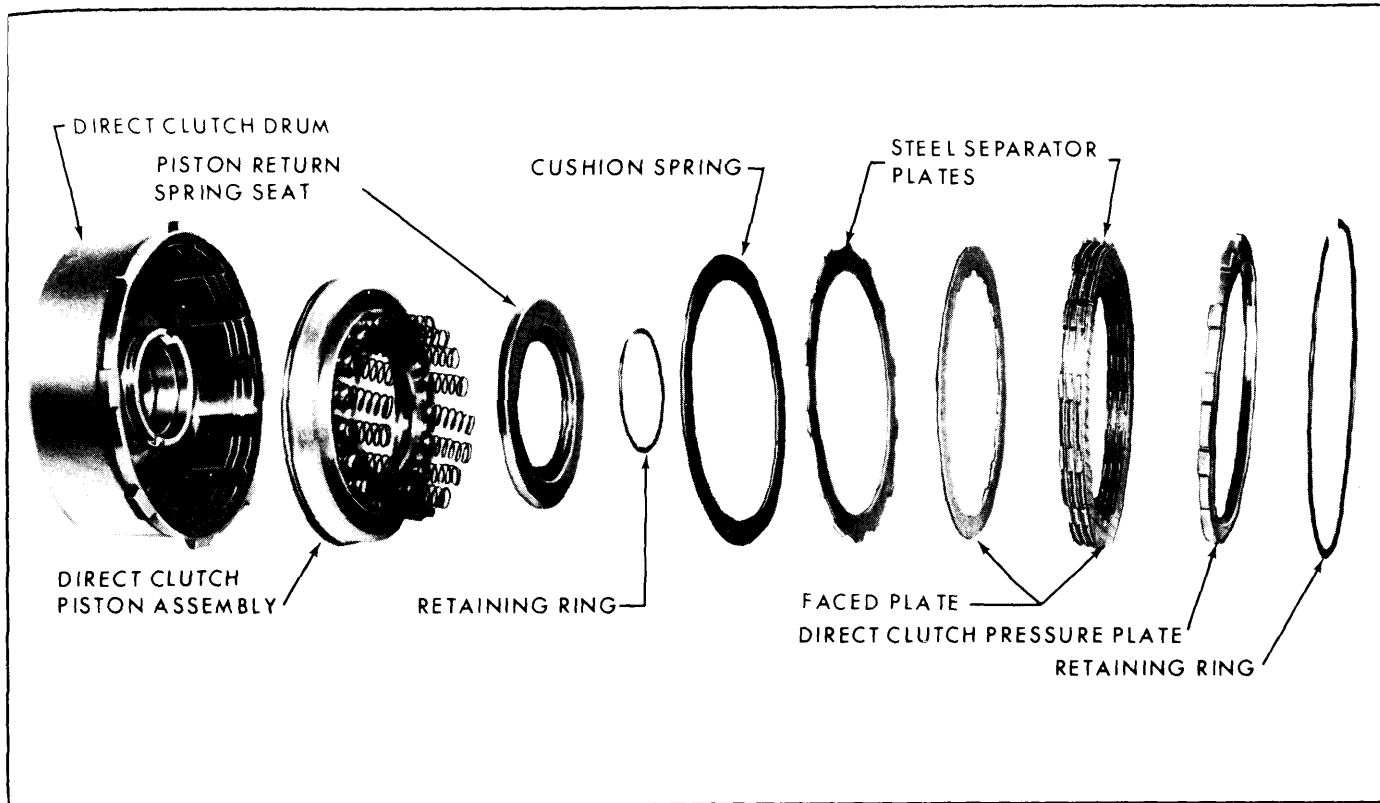


Fig. 7-69—Direct Clutch Assembly - Exploded View

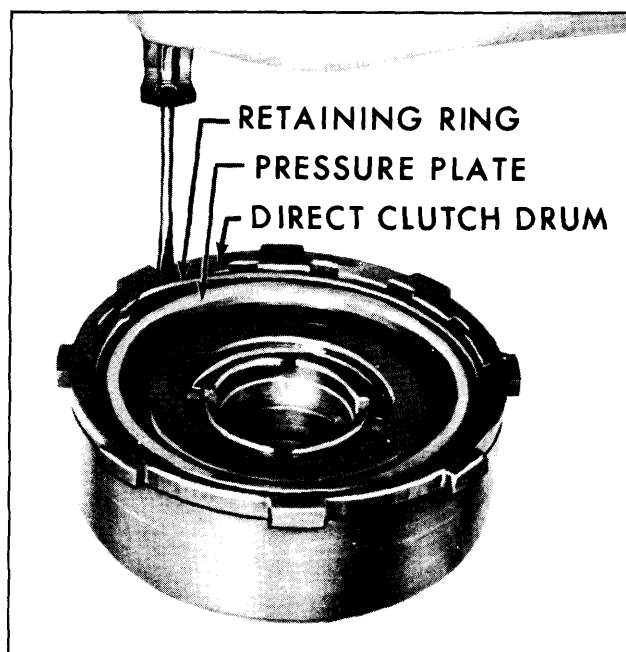


Fig. 7-70—Removing Direct Clutch Pressure Plate

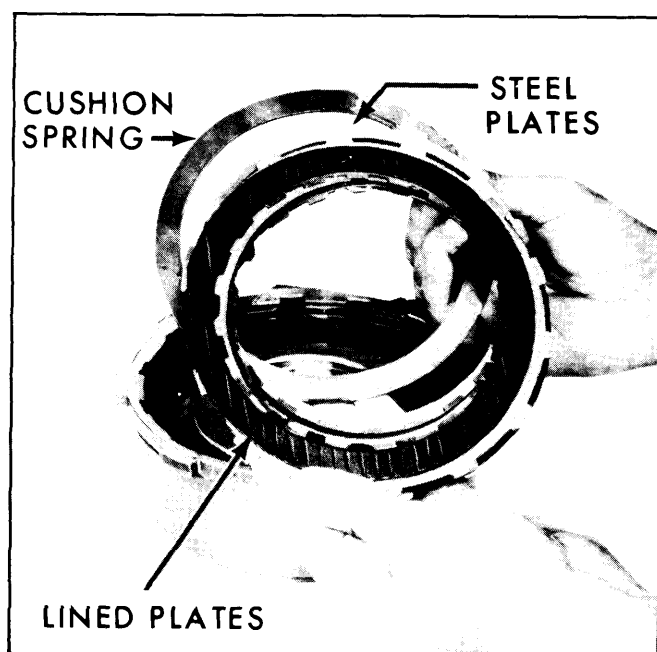


Fig. 7-71—Removing Lined Plates and Steel Plates

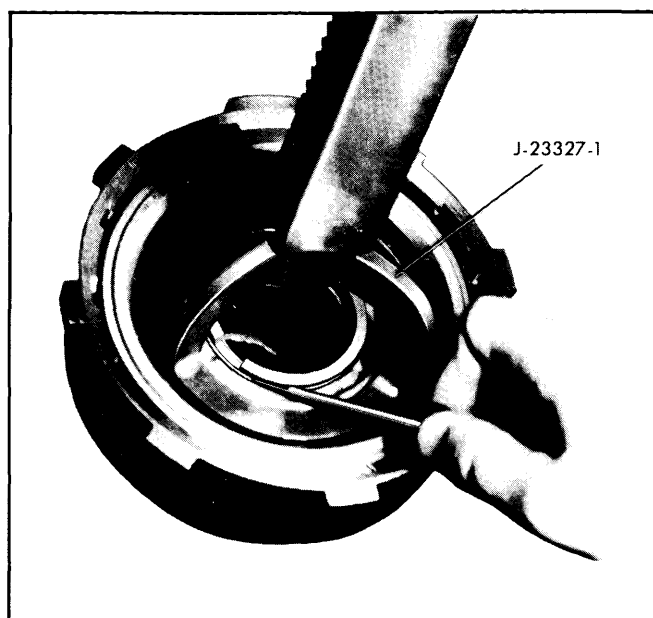


Fig. 7-72—Compressing Direct Clutch Spring Seat

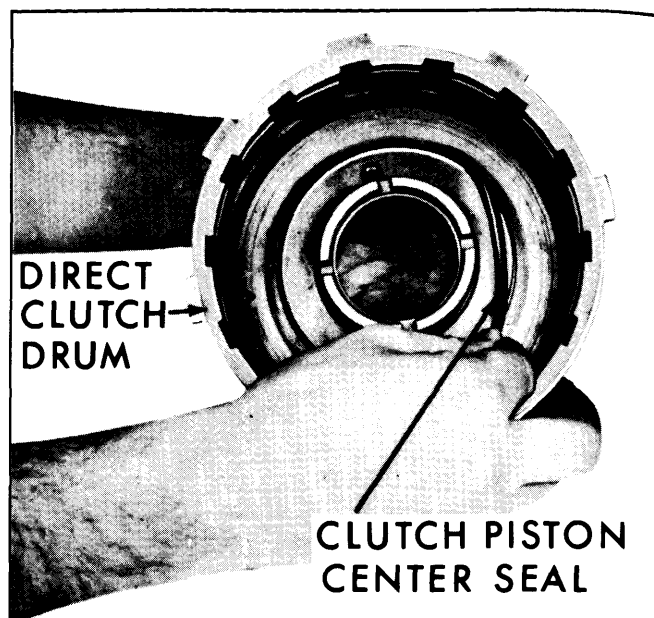


Fig. 7-74—Removing Direct Clutch Piston Center Seal on Drum

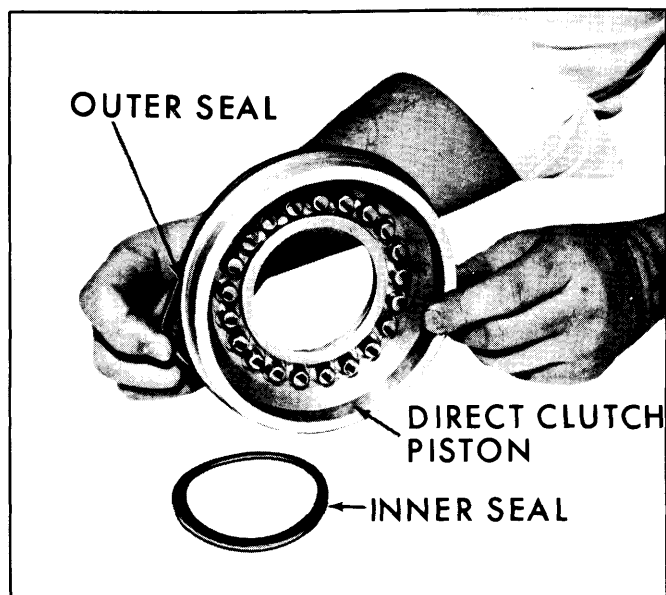


Fig. 7-73—Removing Direct Clutch Inner and Outer Seals

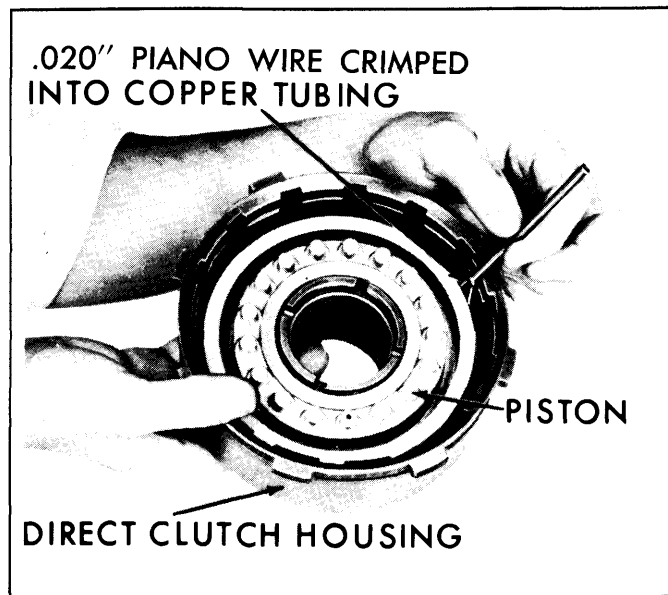


Fig. 7-75—Installing Direct Clutch Piston

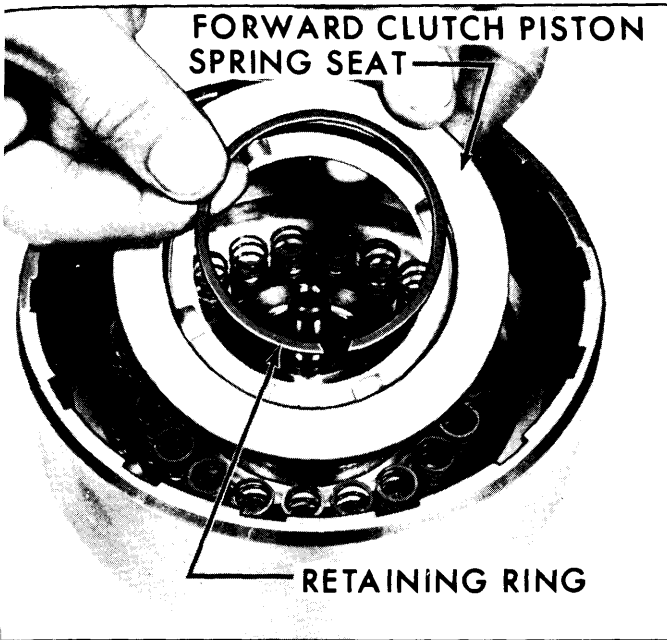


Fig. 7-76—Installing Direct Clutch Springs, Spring Seal and Retaining Ring

#### Inspection

1. Inspect drive and driven clutch plates for signs of burning, scoring or wear.
2. Inspect (17) springs for collapsed coils or signs of distortion.
3. Inspect piston for cracks.
4. Inspect clutch housing for wear, scoring, open oil passages and free operation of ball check.

#### Reassembly

1. Install new direct clutch piston outer seal and inner

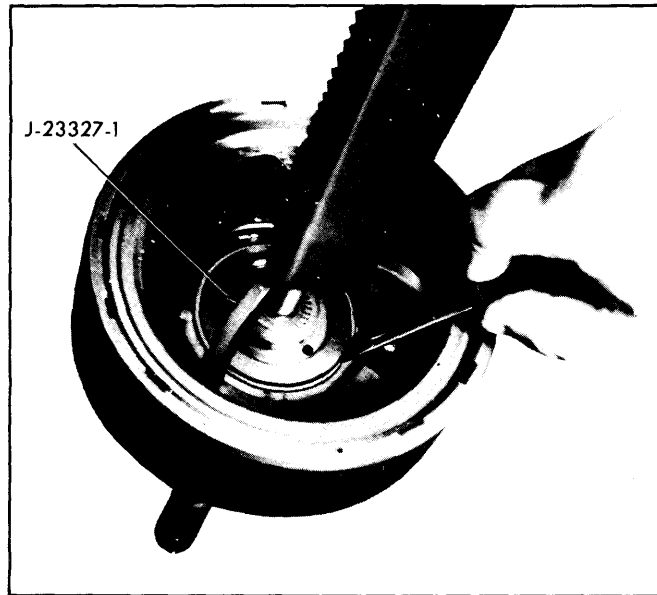


Fig. 7-77—Compressing Direct Clutch Piston Return Seat seal.

2. Install new direct clutch piston center seal on drum with lip facing upward.
3. Install direct clutch piston into housing with aid of a feeler gauge or a piece of .020" piano wire crimped into copper tubing. (Fig. 7-75)
4. Install (17) clutch return coil springs.
5. Install piston return spring seat. (Fig. 7-76) Compress spring seat with Tool J-23327 and install retaining ring. (Fig. 7-77)
6. Lubricate with transmission fluid and install face plates and steel separator plates, alternating steel and faced plates.

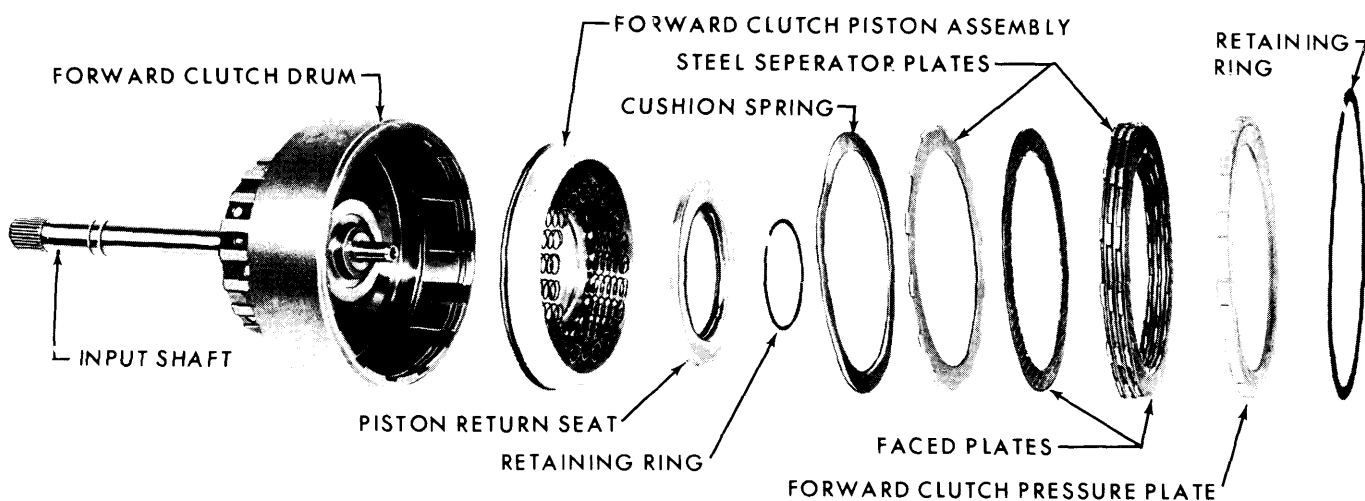
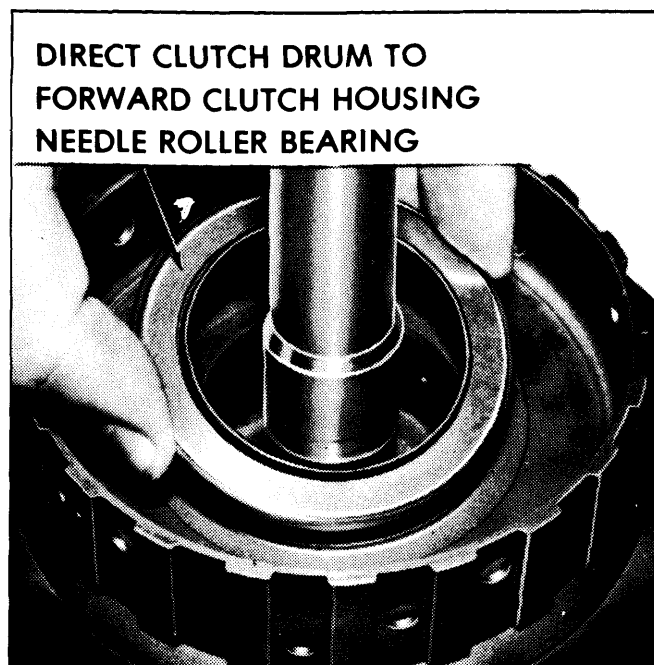


Fig. 7-78—Forward Clutch Assembly - Exploded View

7. Install direct clutch pressure plate and retaining ring.

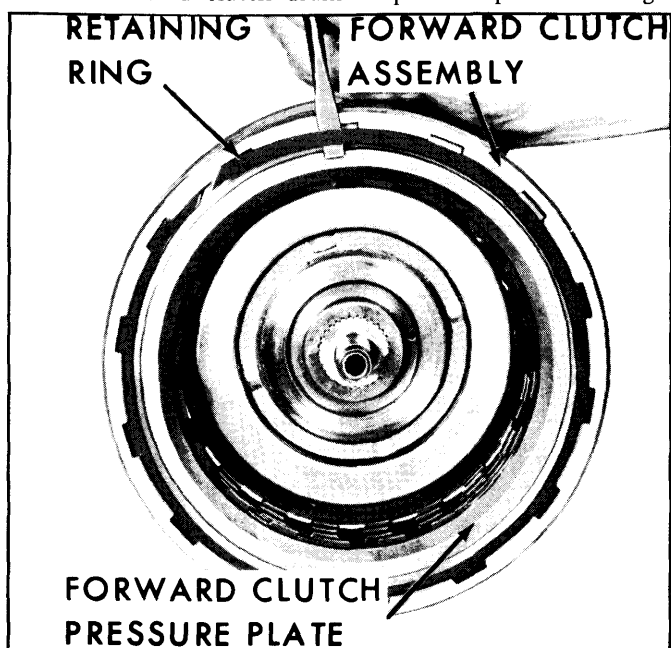


**Fig. 7-79—Direct Clutch Drum to Forward Clutch Housing Needle Roller Bearings**

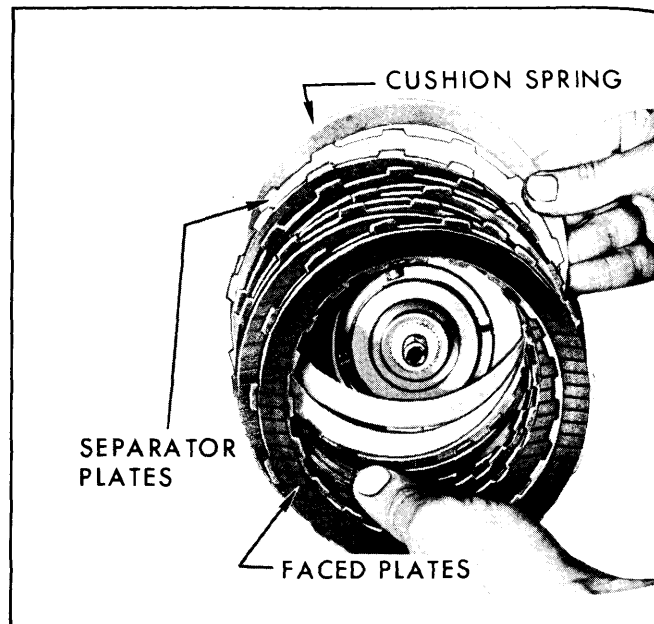
#### FORWARD CLUTCH (Fig. 7-78)

##### Disassembly

1. Remove direct clutch drum to forward clutch housing needle roller bearing. (Fig. 7-79)
2. Remove forward clutch retaining ring and pressure plate. (Fig. 7-80)
3. Remove four face plates, four steel separator plates and cushion spring. (Fig. 7-81)
4. Using Tool J-23327-1, compress retainer and remove forward clutch drum to pressure plate retaining



**Fig. 7-80—Removing Forward Clutch Retaining Ring and Pressure Plate**



**Fig. 7-81—Removing Forward Clutch, Clutch Pack**

ring. (Fig. 7-82)

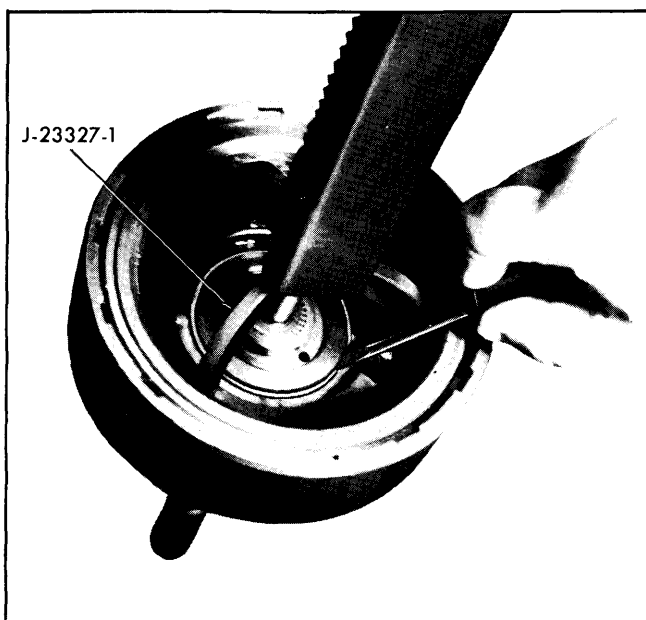
5. Remove piston return seat and (21) clutch return coil springs.

6. Remove forward clutch piston assembly.

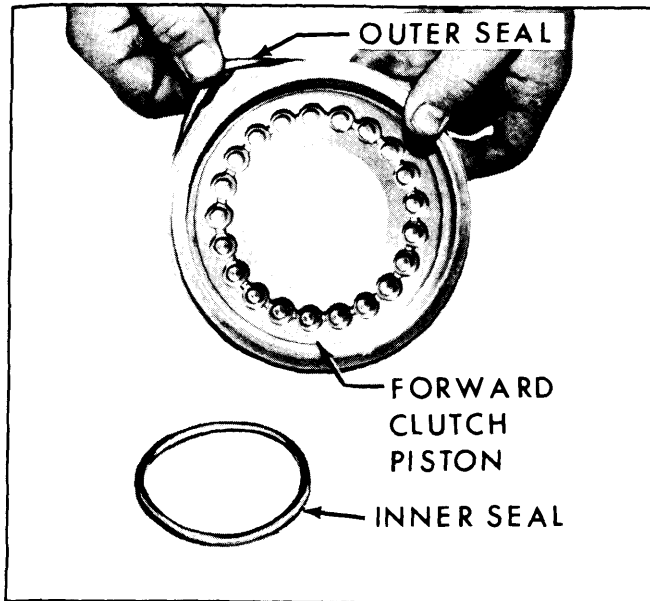
7. Remove the forward clutch inner and outer piston seals. (Fig. 7-83)

##### Inspection

1. Inspect drive and driven clutch plates for signs of burning, scoring or wear.
2. Inspect (21) springs for collapsed coils or signs of distortion.
3. Inspect piston for cracks.
4. Inspect clutch housing for wear, scoring, open oil passages and free operation of exhaust check. (Fig. 7-84)



**Fig. 7-82—Compressing Forward Clutch Spring Retaining Seat**



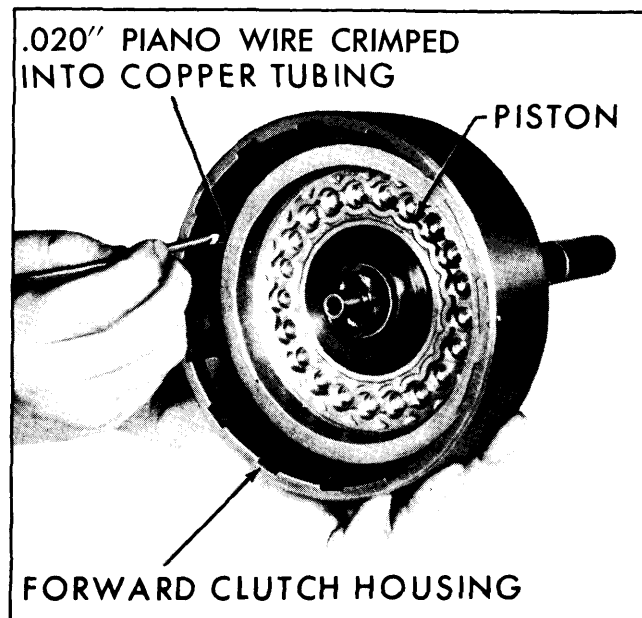
**Fig. 7-83—Removing Forward Clutch Piston Inner and Outer Seals**

5. Inspect output shaft.
  - a. Inspect for open lubrication passages at each end.
  - b. Inspect splines for damage.
  - c. Inspect ground bushing journals for damage.
  - d. Inspect shaft for cracks or distortion.

(NOTE: Input shaft and clutch housing are serviced separately.)

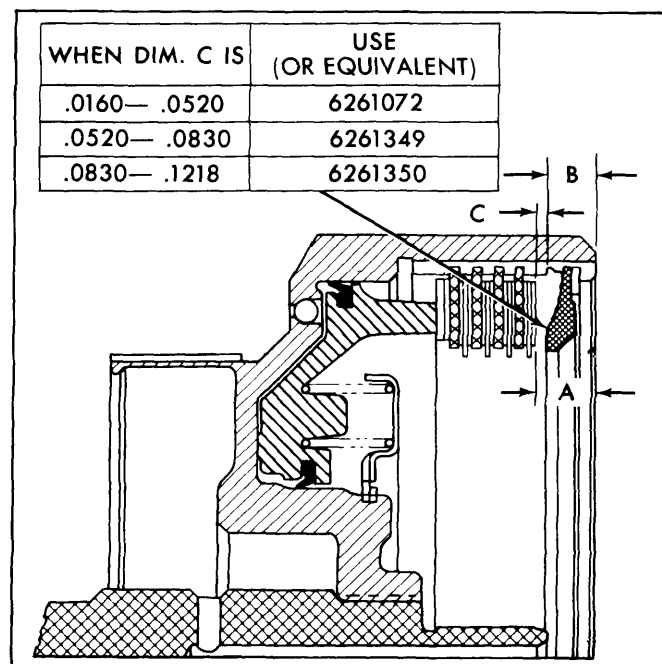
#### Reassembly

1. Install new forward clutch inner piston seal and outer piston seal.
2. Install the forward clutch piston assembly (with the aid of a feeler gauge or piece of .020" piano wire crimped into copper tubing). (Fig. 7-85)

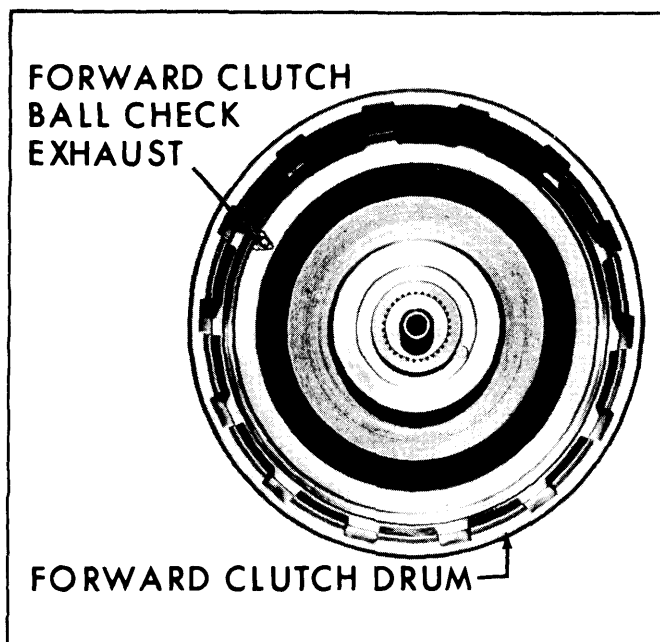


**Fig. 7-85—Installing Forward Clutch Piston**

3. Install (21) clutch return coil springs.
4. Install spring retainer. Compress spring retainer and install retaining ring using Tool J-23327 as shown on Fig. 7-82.
5. Lubricate with transmission fluid and install cushion spring face plates and steel separator plates, starting with the cushion spring and alternating steel and faced.
6. Install forward clutch pressure plate (selective fit and retaining ring). Using chart on Fig. 7-86 to select correct pressure plate (dimension C), measure distance from the top of clutch pack to the top of clutch drum (dimension A). Measure distance from the lower edge of the notch on the inner surface of the drum to the end of the drum (dimension B). Subtract B from A to get dimension C.



**Fig. 7-86—Determining Selective Fit for Forward Clutch Pressure Plate**



**Fig. 7-84—Forward Clutch Exhaust Check Ball**

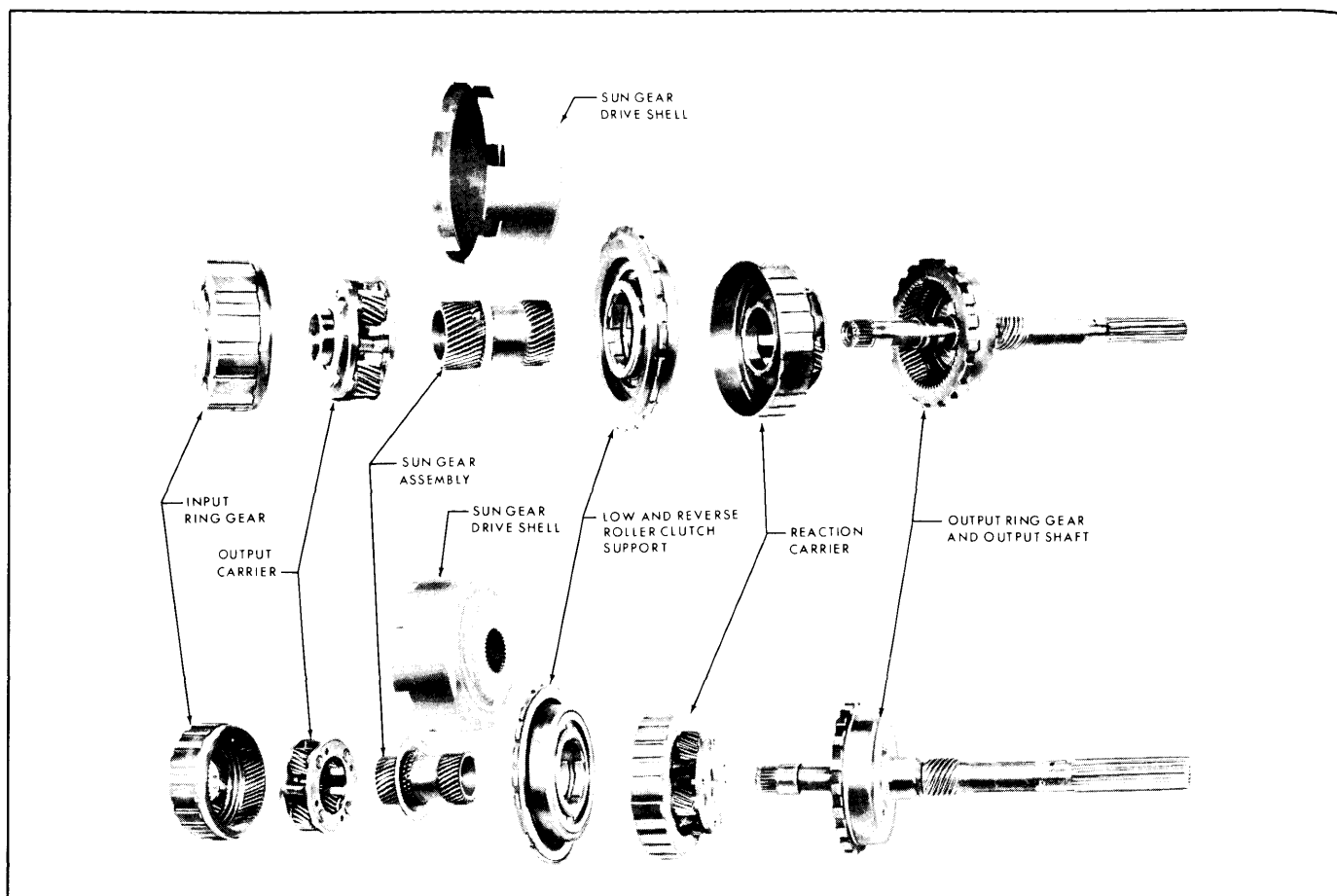


Fig. 7-87—Planetary Gear Train - Exploded View

**SUN GEAR AND SUN GEAR DRIVE SHELL (Fig. 7-87)****Disassembly**

1. Remove sun gear to sun gear drive shell rear retaining ring. (Fig. 7-88)

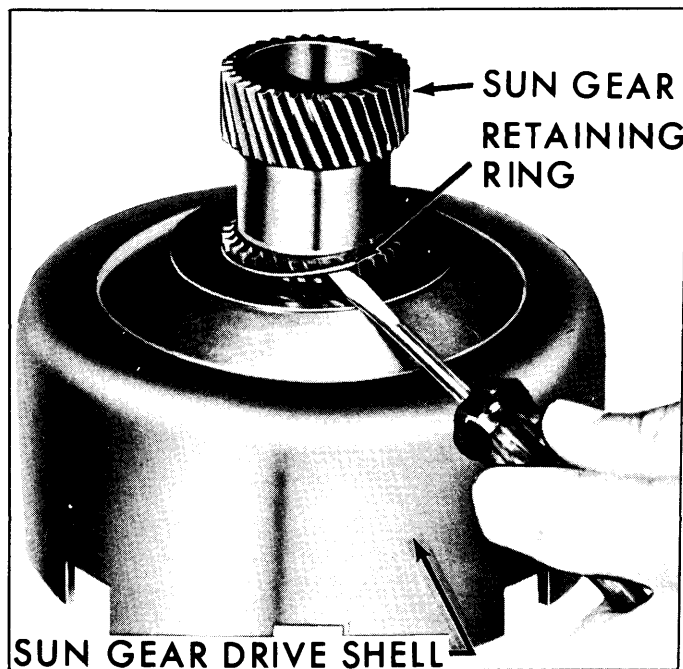


Fig. 7-88—Removing Sun Gear Shell REar Retaining Ring

2. Remove sun gear to drive shell flat rear steel thrust washer. (Fig. 7-89)
3. Remove sun gear assembly from drive shell.
4. Remove sun gear to drive shell front retaining ring. (Fig. 7-90) Discard retaining ring.
5. If bushing is to be replaced, refer to "THM 250

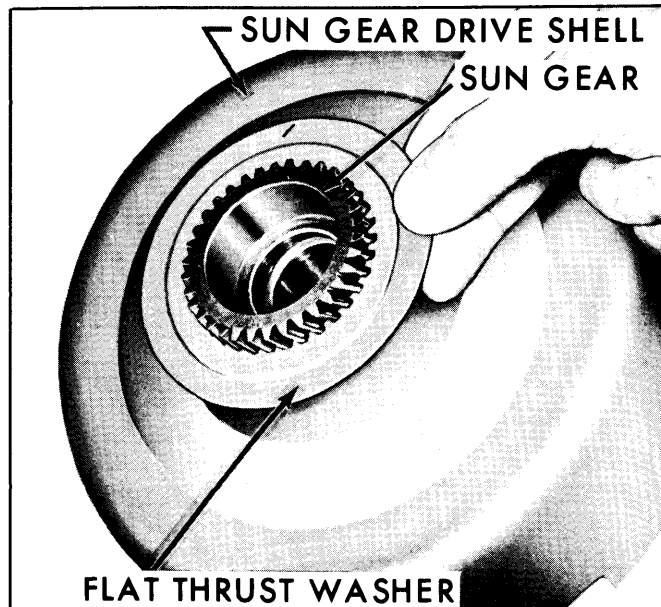


Fig. 7-89—Removing Sun Gear to Drive Shell Rear Steel Thrust Washer

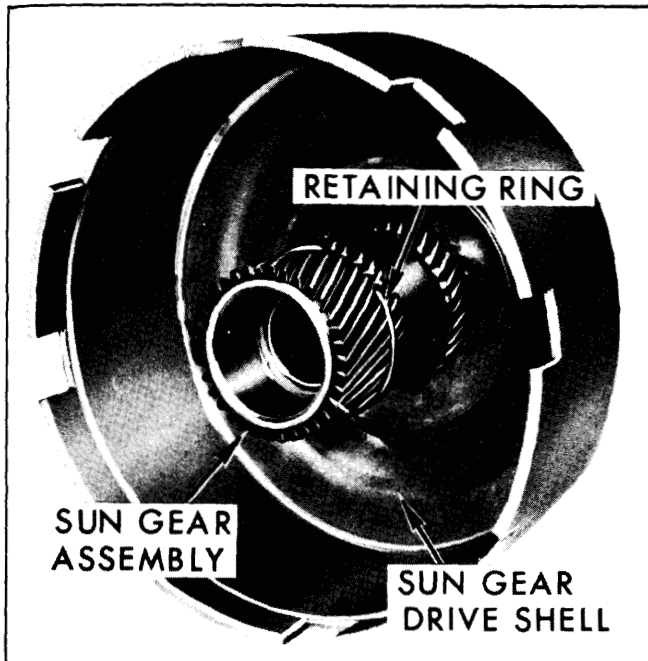


Fig. 7-90—Removing Sun Gear to Drive Shell Front Steel Thrust Washer

Bushing Service" in the back of this section. (Fig. 110)

#### Inspection

Check gear and sun gear shell for damage or wear.

#### Reassembly

1. Install new sun gear to drive shell front retaining

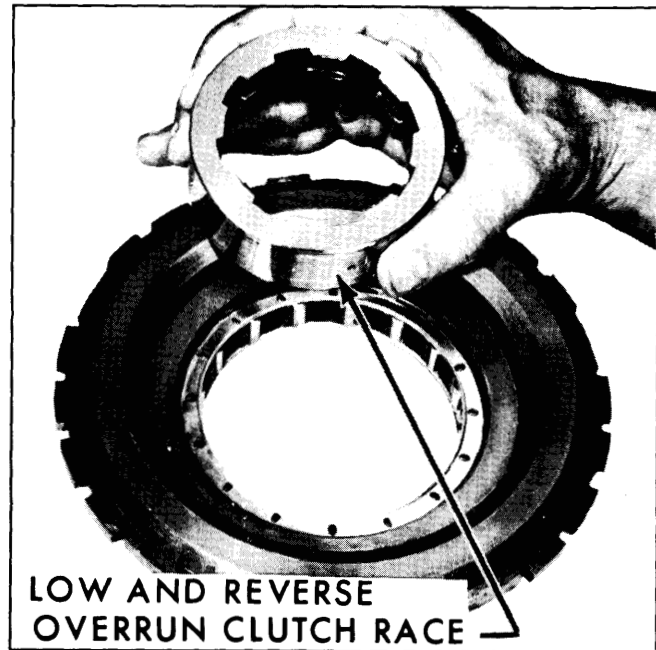


Fig. 7-92—Removing Overrun Clutch Inner Race

ring.

2. Install sun gear assembly into drive shell.
3. Install sun gear to drive shell flat steel thrust washer.
4. Install new sun gear to sun gear drive shell retaining ring.

(NOTE: Do not stress front and rear retaining rings at installation.)

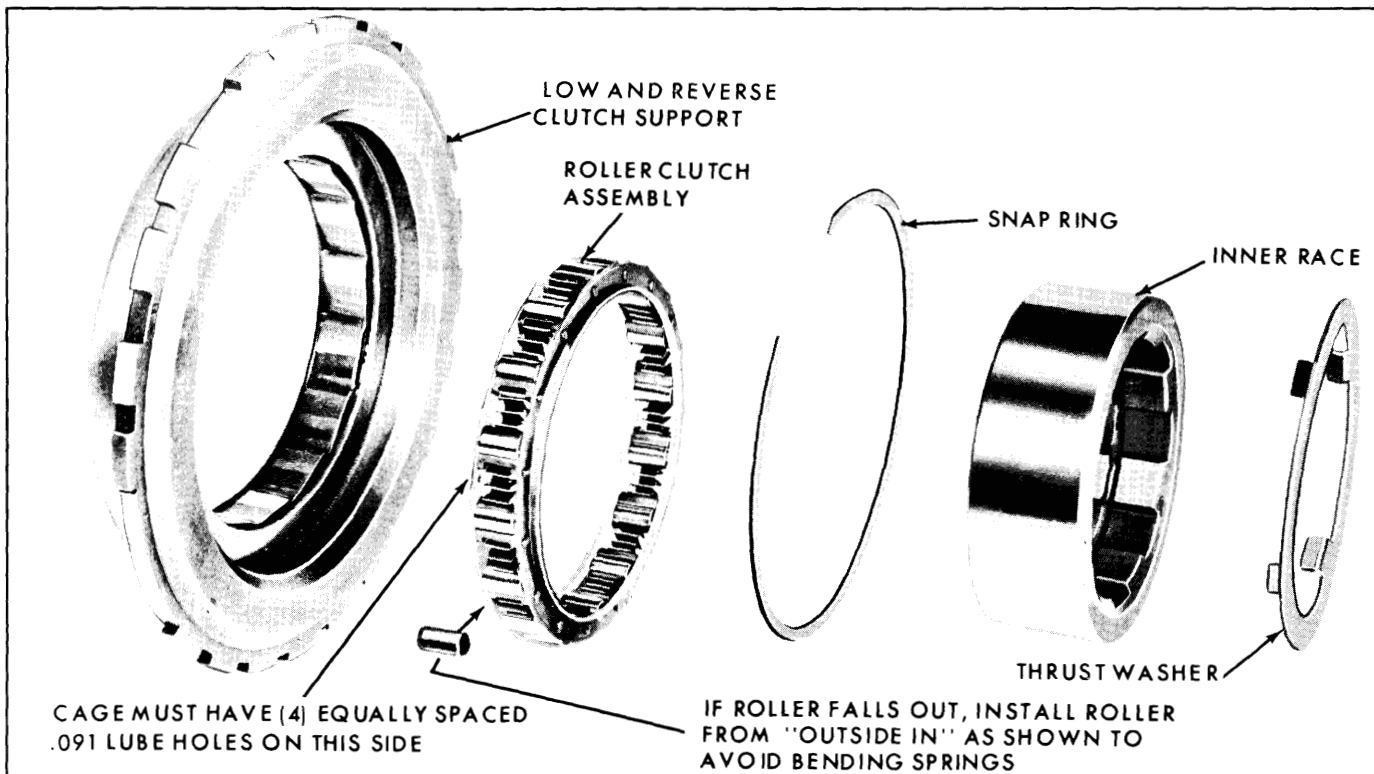


Fig. 7-91—Low and Reverse Clutch Assembly - Exploded View



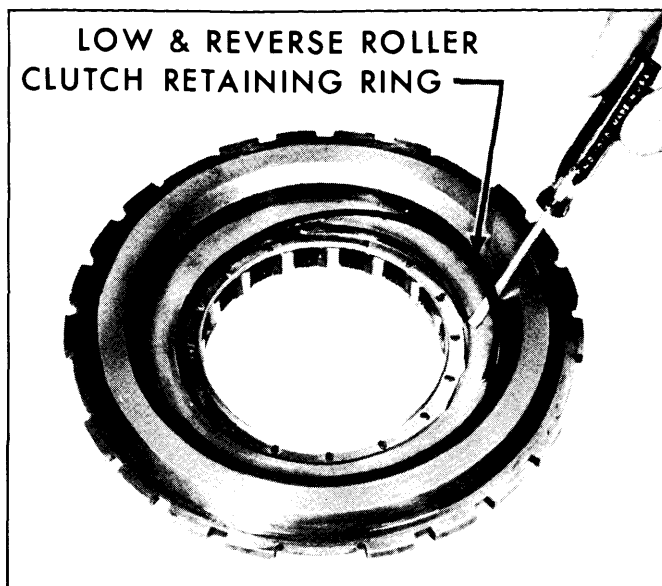


Fig. 7-93—Removing Overrun Clutch Retaining Ring

**LOW AND REVERSE CLUTCH SUPPORT (Fig. 7-91)****Disassembly**

1. Remove low and reverse clutch to sun gear shell thrust washer.
2. Remove low and reverse overrun clutch inner race form support. (Fig. 7-92)
3. Remove low and reverse clutch roller clutch retaining ring. (Fig. 7-93)
4. Remove low and reverse roller clutch assembly. (Fig. 7-94)

**Inspection**

1. Inspect roller clutch inner and outer race for scratches and indentations.
2. Inspect rollers for wear and roller springs for distortion.

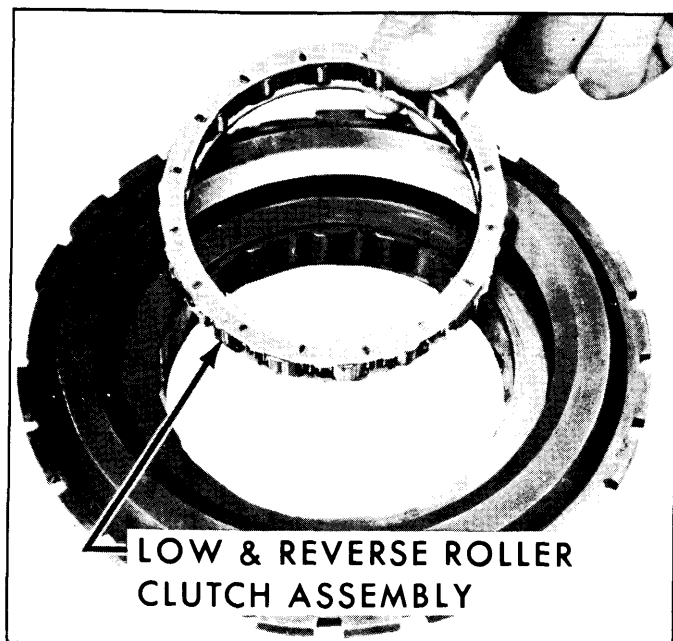


Fig. 7-94—Removing Overrun Roller Clutch Assembly

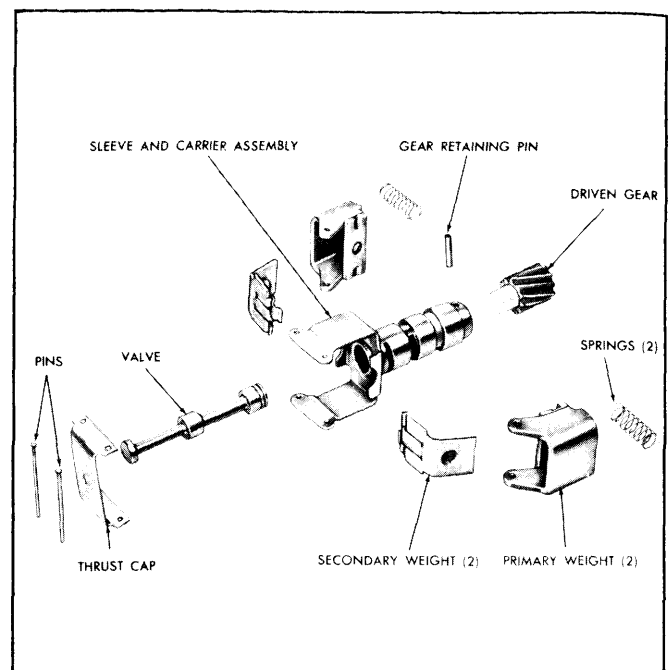


Fig. 7-95—Governor Assembly - Exploded View (Typical)

**Reassembly**

1. Install low and reverse roller clutch assembly to inner race with oil holes toward rear of transmission.
2. Install low and reverse overrun clutch outer race.
3. Install low and reverse clutch to cam retaining ring.

(NOTE: Low and reverse overrun clutch inner race should free wheel in the clockwise direction only.)

**GOVERNOR ASSEMBLY (Fig. 7-95)**

All parts of the governor assembly, with exception of the driven gear, are a select fit and each assembly is calibrated. The governor, including driven gear, is serviced as a complete assembly. The driven gear can be serviced separately.

It is necessary to disassemble the governor assembly in order to replace the driven gear. Disassembly may also be necessary due to improper operation. In such cases, proceed as follows:

**Disassembly**

1. Cut off one end of each governor weight pin and remove pins, governor thrust cap, governor weights, and springs. Governor weights are interchangeable from side to side and need not be identified. (Fig. 7-95)
2. Remove governor valve from governor sleeve. Be careful not to damage the valve.
3. Perform following inspections and replace governor driven gear, if necessary.

**Inspection**

1. Wash all parts in cleaning solvent, air dry and blow out all passages.
2. Inspect governor sleeve for nicks, burrs, scoring or galling.
3. Check governor sleeve for free operation in bore of transmission case.
4. Inspect governor valve for nicks, burrs, scoring or galling.
5. Check governor valve for free operation in bore of governor sleeve.

6. Inspect governor driven gear for nicks, burrs, or damage.
7. Check governor driven gear for looseness on governor sleeve.
8. Inspect governor weight springs for distortion or damage.
9. Check governor weights for free operation in their retainers.
10. Check valve opening at entry and exhaust (.020" minimum).

#### Governor Driven Gear Replacement

To facilitate governor repair in the field, a governor driven gear and replacement pins are available for service use. The service package contains a nylon driven gear, two governor weight retaining pins and one governor gear retaining split pin. Replacement of gear must be performed with care in the following manner:

1. Drive out governor gear retaining split pin using small punch.
2. Support governor on 3/16" plates installed in exhaust slots of governor sleeve, place in arbor press, and with a long punch, press gear out of sleeve.
3. Carefully clean governor sleeve of chips that remain from original gear installation.
4. Support governor on 3/16" plates installed in exhaust slots of sleeve, position new gear in sleeve and, with a suitable socket, press gear into sleeve until nearly seated. Carefully remove any chips that may have shaved off gear hub and press gear in until it bottoms on shoulder.
5. A new pin hole must be drilled through sleeve and gear. Locate hole position 90° from existing hole, center punch and then, while supporting governor in press, drill a new hole through the sleeve and gear using a standard (1/8") drill.
6. Install split retaining pin.
7. Wash governor assembly thoroughly to remove any chips that may have collected.

#### Reassembly

1. Install governor valve in bore of sleeve, large land end first.
2. Install governor weights and springs, and thrust cap on governor sleeve.
3. Align pin holes in thrust cap, governor weight assemblies and governor sleeve, and install new pins. Crimp both ends of pins to prevent them from falling out.
4. Check governor weight assemblies for free operation on pins.
5. Check governor valve for free movement in governor sleeve.

#### TRANSMISSION REASSEMBLY

When servicing transmission, use only transmission fluid or petroleum jelly as lubricants to retain bearings or races during assembly. Lubricate all bearings, seal rings and clutch plates prior to assembly.

#### TRANSMISSION INTERNAL PARTS

1. Install low and reverse clutch piston assembly with notch in piston installed adjacent to parking pawl.
2. Install (17) piston return (coil) springs.
3. Install spring retainer and retaining ring. Using Tool J-23327, compress return seat so spring retainer retaining ring may be installed. Install output ring gear rear thrust bearing in case.
4. Install output ring gear on output shaft.
5. Install reaction carrier to output ring gear front thrust washer (3 tangs) into output ring gear support.

6. Install output shaft assembly into case.
7. Install reaction carrier assembly into output ring gear and shaft assembly.
8. Lubricate and install low reverse clutch steel reaction plates and face plates, starting with a steel plate and alternating with face plates. Install low and reverse clutch support retainer spring (anti-clunk) spring.

(NOTE: Notch in steel separator plates should be placed toward bottom of case.)

9. Install low and reverse clutch support assembly with position of notch with low and reverse clutch support retainer (anti-clunk) spring as shown in Fig. 7-96.

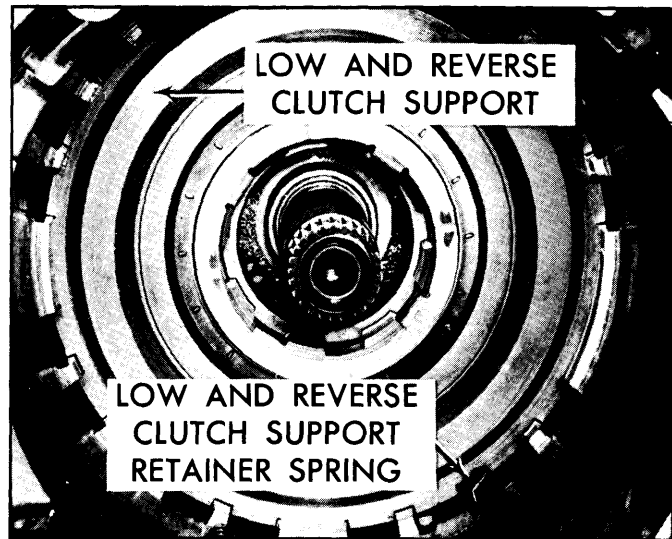


Fig. 7-96—Installing Low and Reverse Clutch Support Assembly

**IMPORTANT:** Make certain the splines on inner race of the roller clutch align with splines on reaction carrier.

10. Install low and reverse roller clutch inner race to sun gear shell thrust washer.
11. Install low and reverse clutch support to case snap ring with anti-clunk spring between gap.
12. Install rear thrust washer and sun gear drive shell assembly.
13. Install output carrier assembly.
14. Install input ring gear rear thrust washer.
15. Install input ring gear.
16. Install input ring gear to output shaft snap ring.

**CAUTION:** Do not over stress snap ring.

17. Install input gear front thrust washer.
18. Install direct clutch assembly, and special thrust washer to forward clutch assembly.
19. Install direct and forward clutch assemblies into case.

**CAUTION:** Make certain forward clutch face plates are positioned over input ring gear and the tangs on direct clutch housing are installed into slots on the sun gear drive shaft.

20. Install intermediate servo.

21. Install intermediate band. Make sure band ends are properly located on adjusting screw and servo rod ends. Turn adjusting screw into case until end of screw has picked up slot in band lug.

22. Check for proper thickness of selective fit thrust washer between oil pump cover and direct clutch assembly, proceed as follows:

a. Install selective fit thrust washer (Fig. 7-97) oil pump gasket and using guide studs from J-3387 set, install oil pump. Install two pump to case bolts.

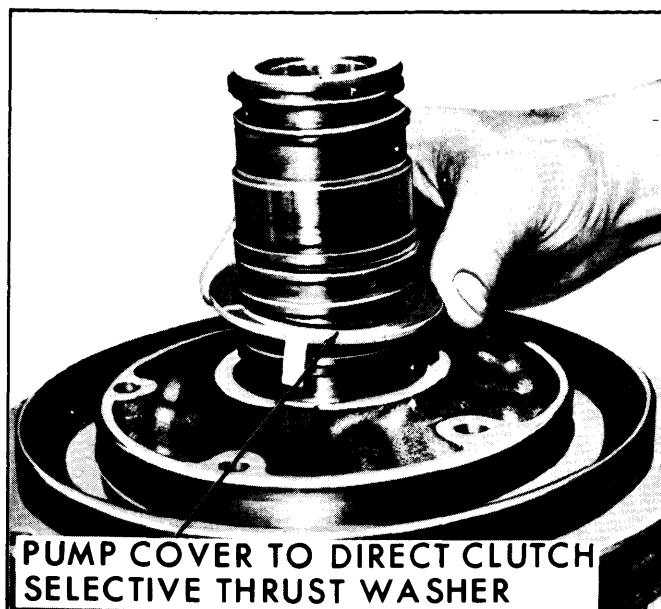


Fig. 7-97—Pump Cover to Direct Clutch Selective Thrust Washer

b. Position transmission so that output shaft points down. Install dial indicator as shown in Fig. 7-98. Zero indicator.

c. Lift up on transmission output shaft and observe total indicator movement.

d. Indicator should read .032" to .064". If reading is within limits, proper selective fit washer is being used. If reading is not within limits, it will be necessary to remove pump and change to a thicker or

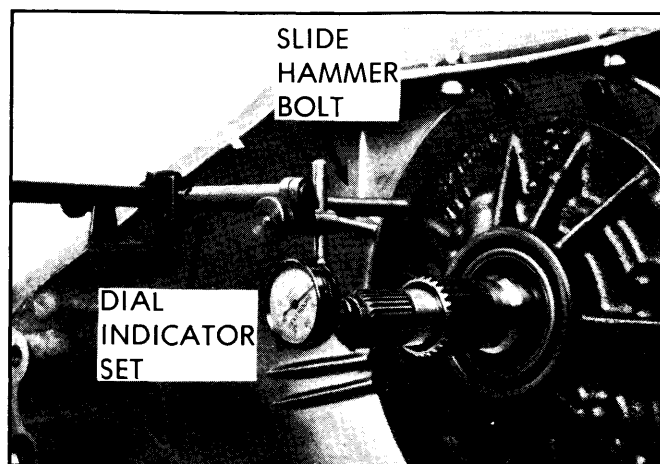


Fig. 7-98—Checking End Play for Proper Thrust Washer Selection

thinner selective fit thrust washer, as required to obtain the specified clearance. Repeat the above checking procedure.

(NOTE: Selective fit thrust washers are available in thicknesses of .065"-.067", .082"-.084" and .099"-.101".)

23. Install new pump assembly to case gasket.

24. Install new pump assembly square cut oil seal ring.

25. Install guide pins into case.

26. Install pump assembly into case. Install attaching bolts with new washer type seals.

(NOTE: If input shaft cannot be rotated as the pump is being pulled into place, direct and forward clutch housings have not been properly installed to index faced plates with their respective parts. This condition must be corrected before pump is pulled into place.)

27. After pump assembly is completely installed, adjust intermediate band. Tighten adjusting screw to 30 in. lbs. and then back-off 3 complete turns, while holding screw in position.

#### SPEEDOMETER DRIVE GEAR AND EXTENSION

1. Place speedometer drive gear retaining clip into hole in output shaft.

2. Heat a new speedometer drive gear using heat lamp or suitable heat method.

3. Align slot in speedometer drive gear with retaining clip and install.

4. Install extension housing to case square cut "O" ring seal.

5. Attach extension housing to case using attaching bolts. Torque to 25 ft. lbs.

6. If necessary, install a new extension housing seal using Seal Installer J-5154 or J-21426. (Fig. 7-99)

#### MANUAL LINKAGE

1. If necessary, install a new manual shaft to case lip seal using 3/4" diameter rod, seat seal in case.

2. Install parking pawl, tooth toward the inside of

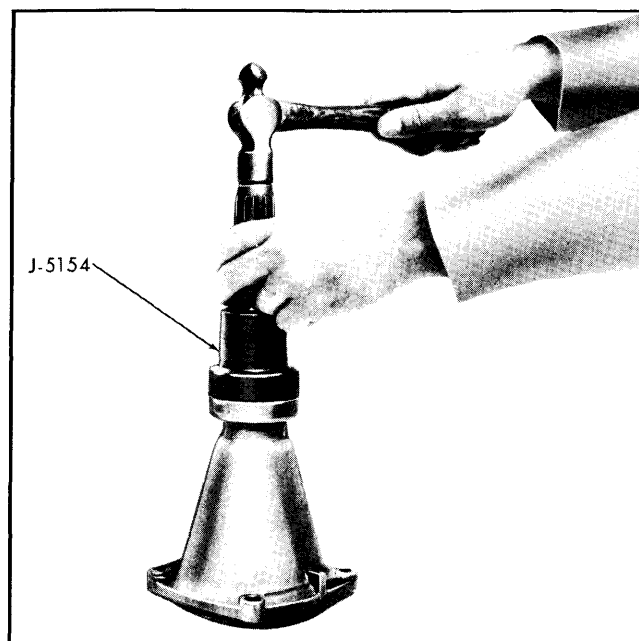


Fig. 7-99—Installing Extension Housing Seal

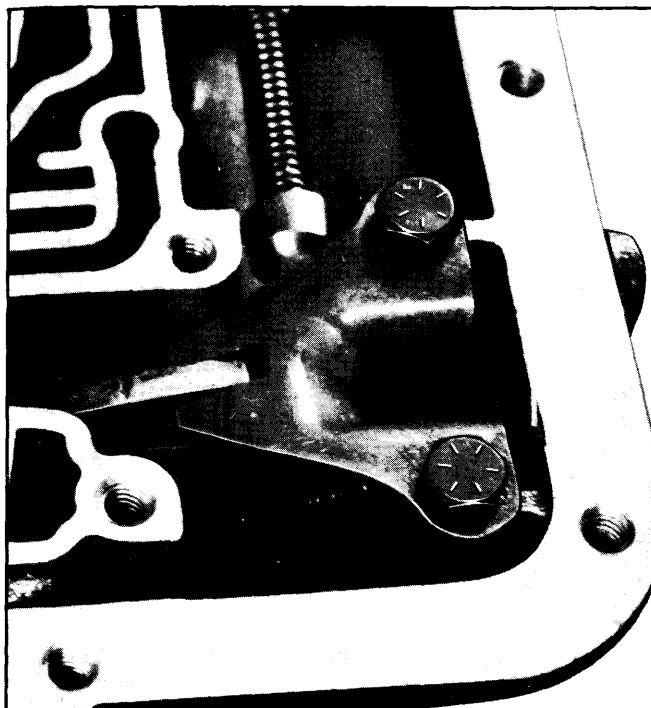
case, into case.

3. Install parking pawl shaft into case and through parking pawl.

4. Install parking pawl shaft retainer plug. Drive into case using a 3/8" diameter rod, until retainer plug is .130"-.170" below face of case, then stake in three places.

5. Install parking pawl disengaging spring, square end hooked on pawl.

6. Install park lock bracket, using 2 special bolts (GM 300M, 6 marks on head or equivalent) and torque bolts to 29 ft. lbs. (Fig. 7-100)



**Fig. 7-100—Park Lock Bracket Special Bolt Identification**

7. Install range selector inner lever to parking pawl actuator rod.

8. Install actuating rod under the park lock bracket and parking pawl.

9. Install manual shaft through case and range selector inner lever.

10. Install retaining nut on manual shaft. Torque to 30 ft. lbs.

11. Install manual shaft to case spacer clip.

#### VALVE BODY, OIL PAN AND GASKET

1. Install oil pump pressure screen and governor feed screen.

2. Install (4) check balls into proper transmission case pockets. (Fig. 7-101)

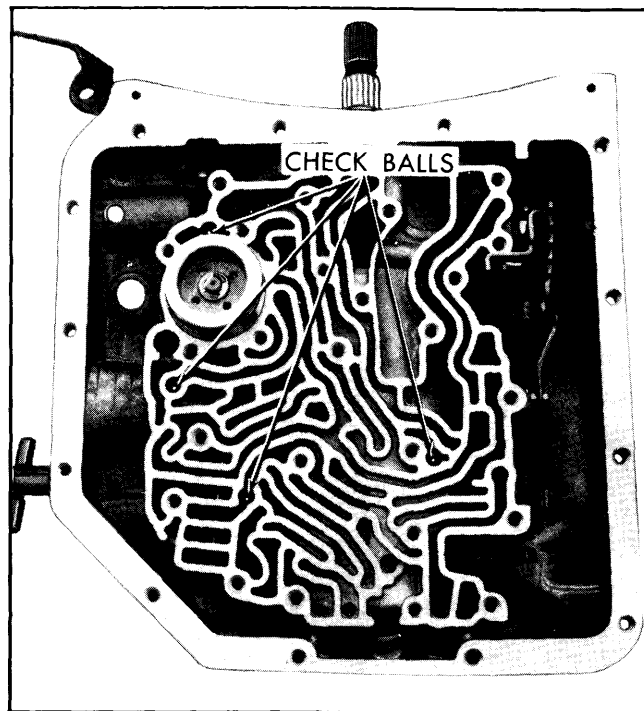
3. Install valve body transfer plate and lower valve gasket.

4. Install upper valve gasket.

5. Install intermediate servo return spring.

6. Install valve body. Connect manual control valve link to range selector inner lever. Torque bolts in random sequence to 130 in. lbs.

7. Install transfer support plate, torque bolts to 130 in. lbs.



**Fig. 7-101—Check Ball Four (4) Locations**

8. Connect detent control valve wire to detent valve actuating lever, then attach lever to valve body.

9. Install detent roller and spring assembly to valve body.

10. Align lube holes in suction screen with those in valve body and install screen gasket and screen.

(NOTE: Be sure lube holes in screen match up with those in valve body.)

11. Install oil pan using a new gasket. Tighten bolts to 130 in. lbs. in succession until bolts maintain torque specification.

(NOTE: If a new oil pan is being installed, transfer production code number from right side of old pan to new pan.)

#### GOVERNOR AND VACUUM MODULATOR

1. Install governor assembly, cover and seal and retainer wire.

2. Install vacuum modulator valve.

3. Install vacuum modulator and retainer clip. Torque bolts to 130 in. lbs.

(NOTE: Position retainer with tang pointing toward modulator.)

#### 1-2 ACCUMULATOR (Figs. 7-102 and 7-103)

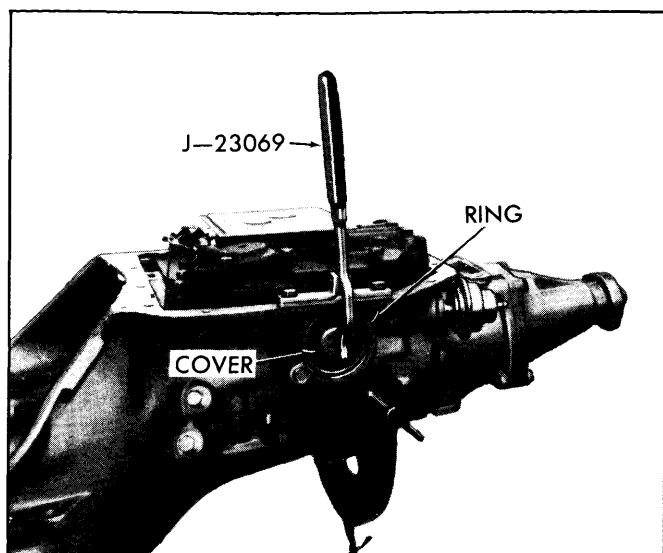
1. Install 1-2 accumulator piston assembly.

2. Install accumulator spring.

3. Install new "O" ring seal in groove in case before installing cover.

4. Install 1-2 accumulator cover and retaining ring.

## TURBO HYDRA-MATIC 250 BUSHING SERVICE



**Fig. 7-102—Removing 1-2 Accumulator Piston Cover Retaining Rings**

### EXTENSION HOUSING BUSHING

#### Removal

Remove extension housing bushing from housing using Tool J-21424-9 with drive handle J-8092.

#### Installation

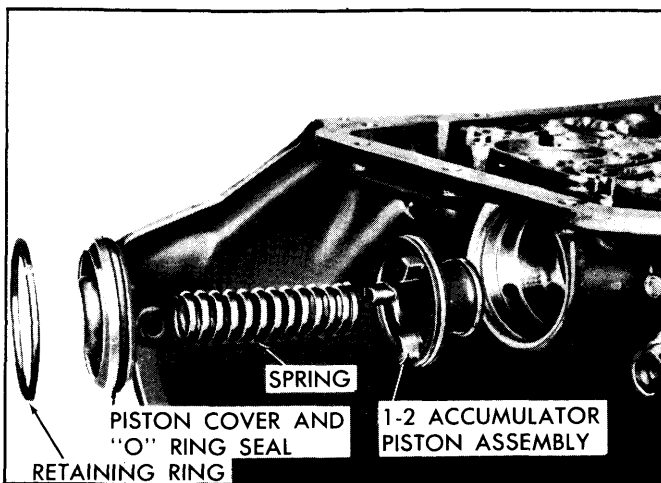
Using Tool J-21424-9 and Driver Handle J-8092, install extension housing bushing flush to .010 below seal counter bore surface. (Fig. 7-104)

Using Tool J-23062-1 and Drive Handle J-8092, install output shaft bushing.

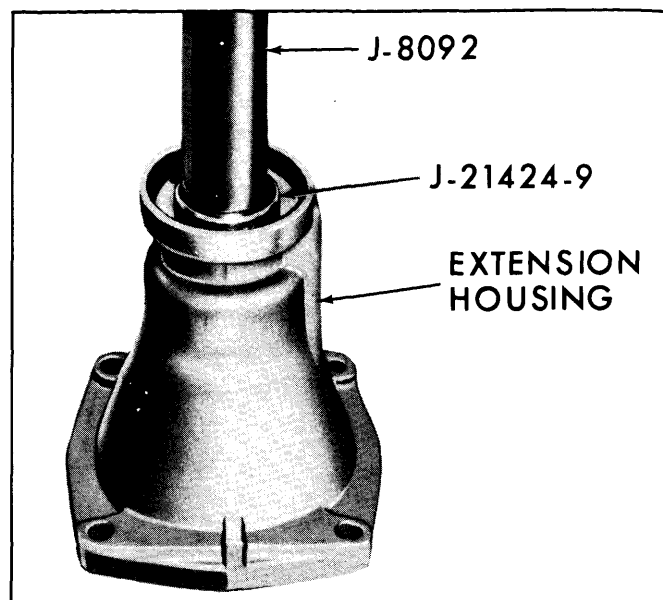
### OUTPUT SHAFT BUSHING

#### Removal

With output shaft properly supported, remove bushing



**Fig. 7-103—Accumulator Parts**



**Fig. 7-104—Installing Extension Housing Bushing**

using remover J-9534-01 and Slide Hammer J-7004 (Fig. 7-105)

#### Installation

Using Tool J-23062-1 and Drive Handle J-8092, install output shaft bushing.

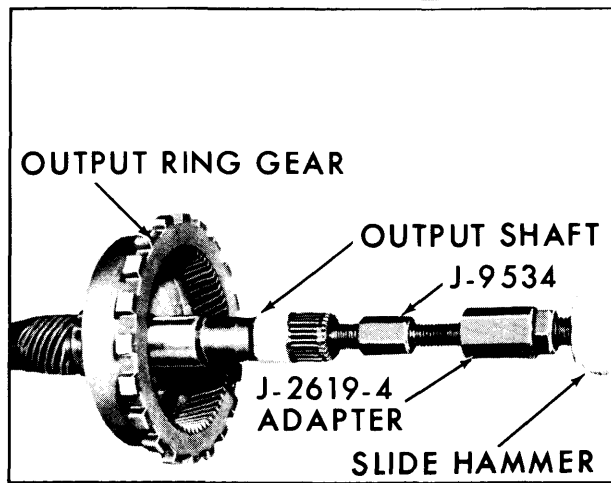
### CASE BUSHING

#### Removal

With case properly supported drive out bushing from rear of case using Tool J-23062-1 and Drive Handle J-8092.

#### Installation

Using Tool J-23062-1 and Drive Handle J-8092 with Extension J-21465-13, install case bushing from interior of case to 3/16" from surface with split in the bushing located at governor pilot upper bore wall area.



**Fig. 7-105—Removing Output Shaft Bushing**

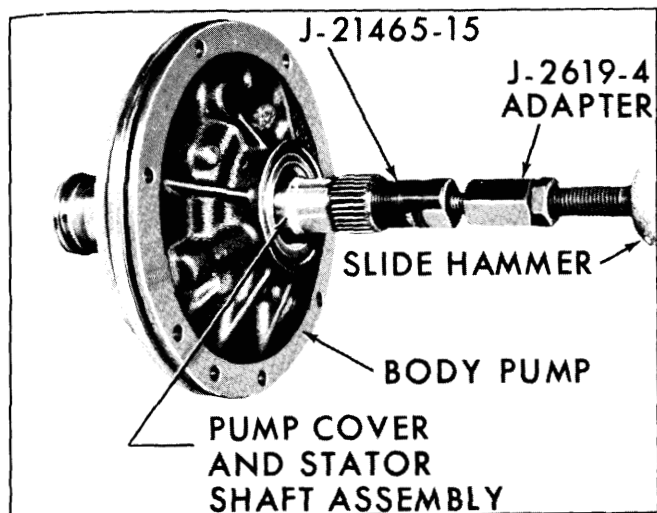


Fig. 7-106—Removing Stator Shaft Front Bushing

#### STATOR SHAFT FRONT BUSHING

##### Removal

With stator shaft properly supported, remove front bushing using Tool J-21465-16 with Slide Hammer J-2619-01 and Adapter J-2619-4. (Fig. 7-106)

##### Installation

Using Tool J-21424-7 and Drive Handle J-8092, install front stator shaft bushing to .250" from front face. (Fig. 7-107)

#### STATOR SHAFT REAR BUSHING

##### Removal

With stator shaft properly supported, remove front bushing (Fig. 7-107). Place Tool J-21424-7 and drive handle J-8092 with Extension J-21465-13 through front of the stator shaft and drive out rear (2) bushings.

##### Installation

Using Tool J-23062-2 and Extension J-21465-13, install inner bushing to approximately 1-5/32" below front

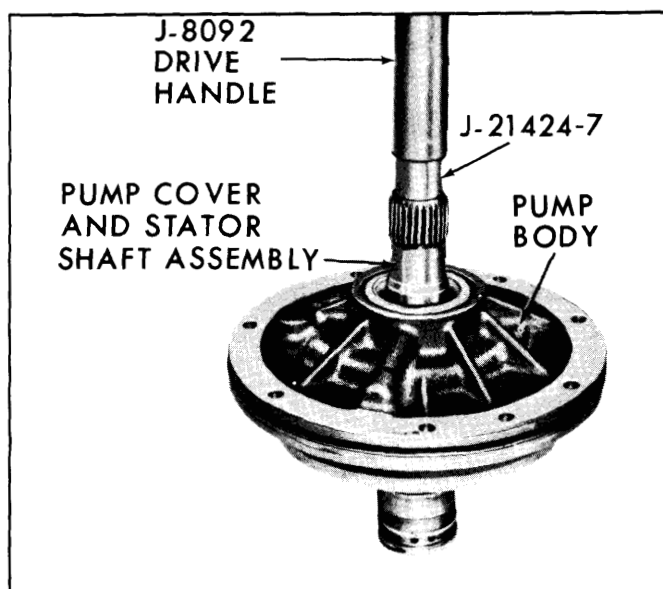


Fig. 7-107—Installing Front Stator Shaft Bushing

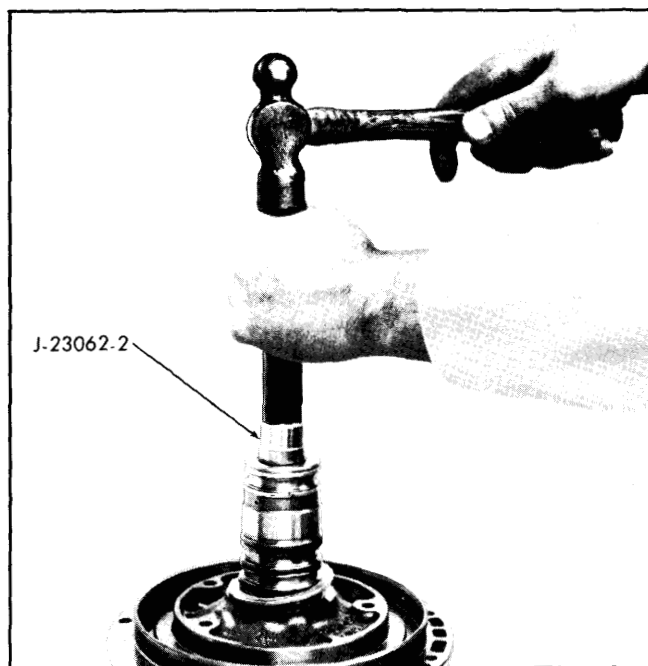


Fig. 7-108—Installing Inner and Outer Stator Shaft Bushings

face and outer bushing 3/32" below front face. (Fig. 7-108)  
Install new front bushing. (Fig. 7-109)

#### INPUT RING GEAR SUPPORT BUSHING

##### Removal

With input ring gear support properly supported, remove bushing using Tool J-23062-5 and drive handle J-8092.

##### Installation

Using Tool J-23062-5 and Drive Handle J-8092, install input ring gear bushing to approximately 1/16" below rear face inside gear end. (Fig. 7-109)

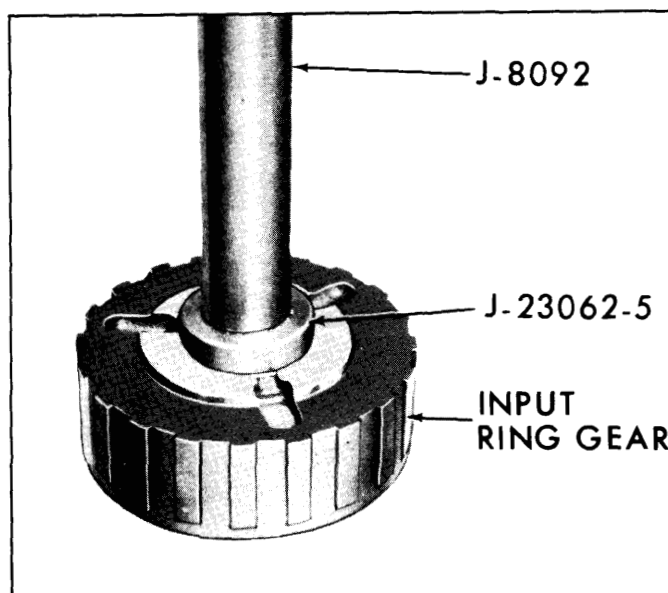


Fig. 7-109—Installing Input Ring Gear Support to Bushing

**SUN GEAR BUSHING****Removal**

With sun gear properly supported, remove (2) sun gear bushings using Tool J-23062-3 and drive handle J-8092 with extension J-21465-13.

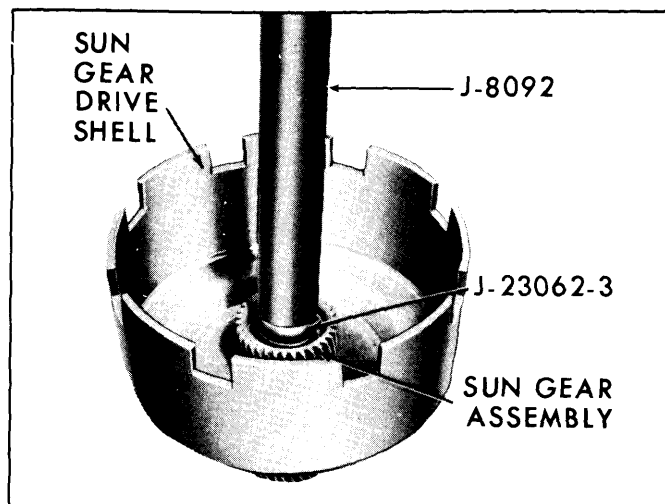


Fig. 7-110—Installing Sun Gear Bushings

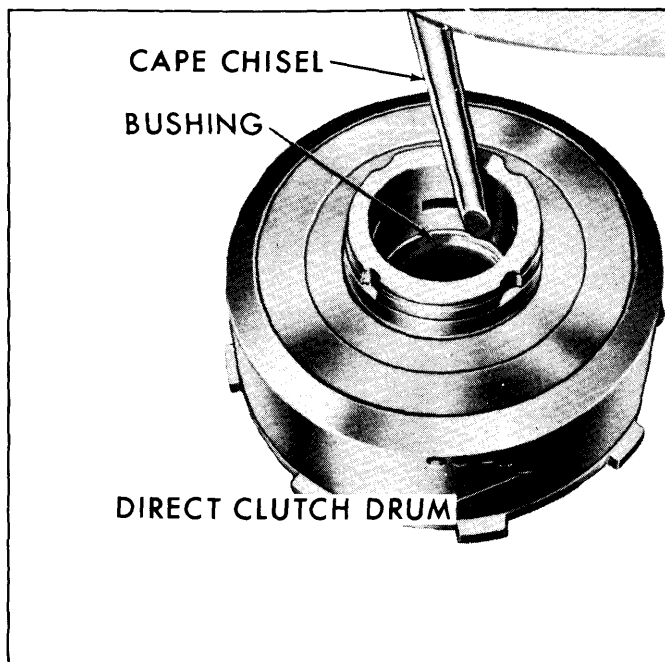


Fig. 7-111—Removing Direct Clutch Drum Bushing

**Installation**

Using Tool J-23062-3 and drive handle J-8092, install sun gear bushings to .010" below surface at either end. (Fig. 7-110)

**REACTION CARRIER BUSHING****Removal**

With reaction carrier properly supported, remove bushing using Tool J-23062-3 and drive handle J-8092.

**Installation**

Using Tool J-23062-3 and Drive Handle J-8092, install bushing to flush or .010" below inside face.

**DIRECT CLUTCH BUSHING****Removal**

With direct clutch drum properly supported, remove bushing. (Fig. 7-111)

**Installation**

Using Tool J-23329 and Drive Handle J-8092, install direct clutch bushing. (Fig. 7-112)

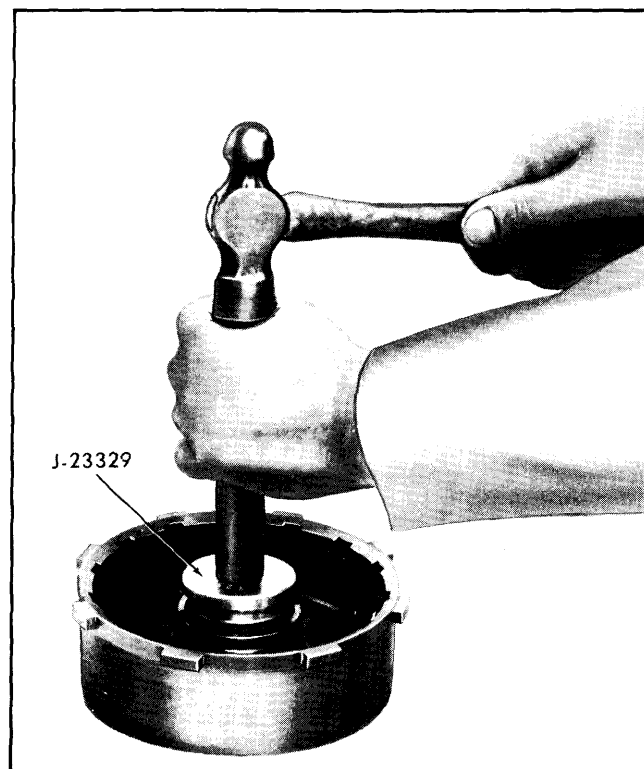
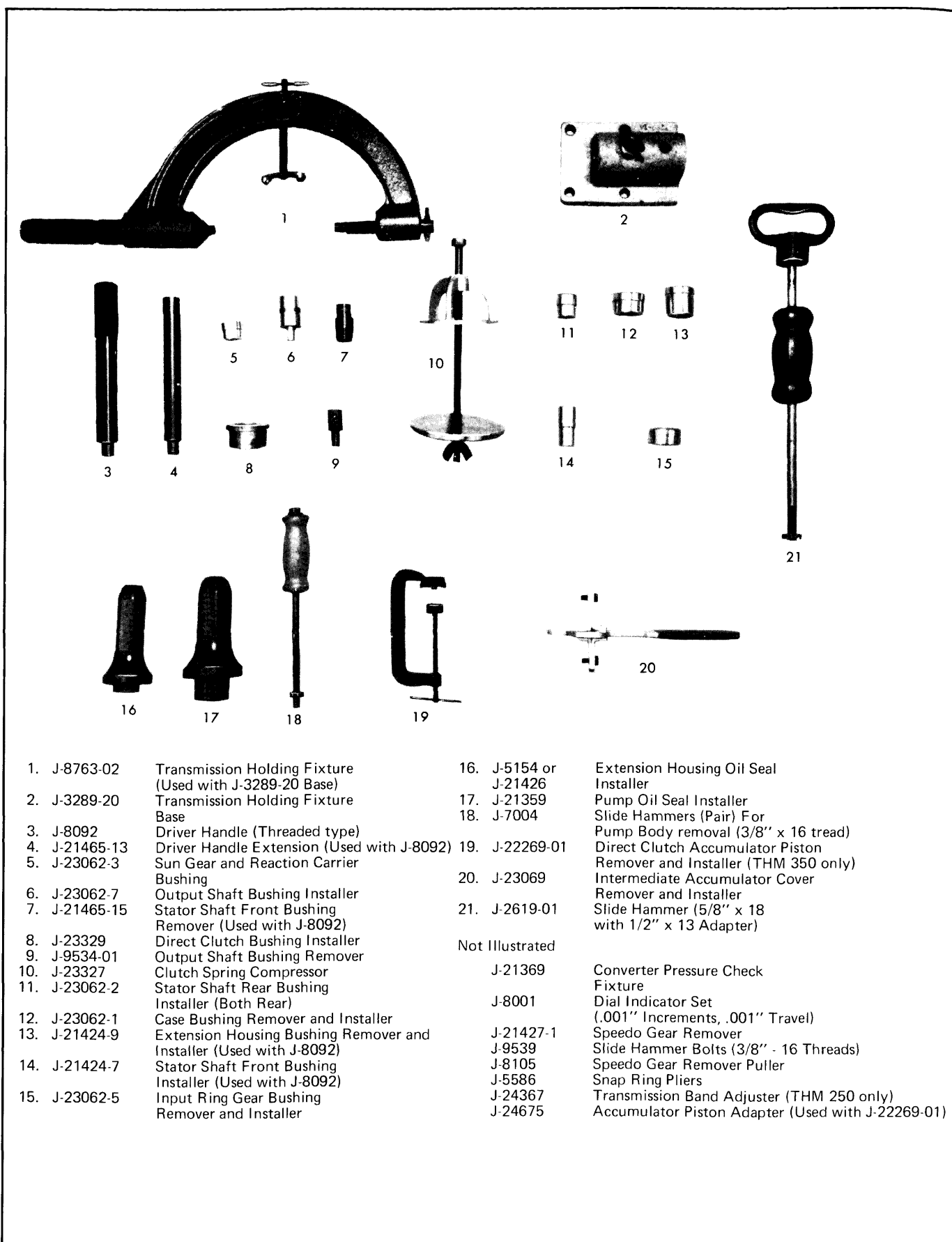


Fig. 7-112—Installing Direct Clutch Drum Bushing



## TORQUE SPECIFICATIONS

Pump Cover to Pump Body . . . . .	17 ft. lbs.
Pump Assembly to Case . . . . .	18-1/2 ft. lbs.
Valve Body and Support Plate . . . . .	130 in. lbs.
Parking Lock Bracket . . . . .	29 ft. lbs.
Oil Suction Screen . . . . .	40 in. lbs.
Oil Pan to Case . . . . .	130 in. lbs.
Extension to Case . . . . .	25 ft. lbs.
Modulator Retainer to Case . . . . .	130 in. lbs.
Inner Selector Lever to Shaft . . . . .	25 ft. lbs.
Detent Valve Actuating Bracket . . . . .	52 in. lbs.
Converter to Flywheel Bolts . . . . .	35 ft. lbs.
Under Pan to Transmission Case . . . . .	110 in. lbs.
Transmission Case to Engine . . . . .	35 ft. lbs.
Control Lever . . . . .	25 in. lbs.
Manual Shaft to Lever . . . . .	20 ft. lbs.
Control Rod to Swivel . . . . .	120 in. lbs.



- |               |  |                       |   |
|---------------|--|-----------------------|---|
| 1. J-8763-02  | Transmission Holding Fixture (Used with J-3289-20 Base)            | 16. J-5154 or J-21426 | Extension Housing Oil Seal Installer                                  |
| 2. J-3289-20  | Transmission Holding Fixture Base                                  | 17. J-21359           | Pump Oil Seal Installer   |
| 3. J-8092     | Driver Handle (Threaded type)                                      | 18. J-7004            | Slide Hammers (Pair) For Pump Body removal (3/8" x 16 thread)         |
| 4. J-21465-13 | Driver Handle Extension (Used with J-8092)                         | 19. J-22269-01        | Direct Clutch Accumulator Piston Remover and Installer (THM 350 only) |
| 5. J-23062-3  | Sun Gear and Reaction Carrier Bushing                              | 20. J-23069           | Intermediate Accumulator Cover Remover and Installer                  |
| 6. J-23062-7  | Output Shaft Bushing Installer                                     | 21. J-2619-01         | Slide Hammer (5/8" x 18 with 1/2" x 13 Adapter)                       |
| 7. J-21465-15 | Stator Shaft Front Bushing Remover (Used with J-8092)              | Not Illustrated       |   |
| 8. J-23329    | Direct Clutch Bushing Installer                                    | J-21369               | Converter Pressure Check Fixture                                      |
| 9. J-9534-01  | Output Shaft Bushing Remover                                       | J-8001                | Dial Indicator Set (.001" Increments, .001" Travel)                   |
| 10. J-23327   | Clutch Spring Compressor   | J-21427-1             | Speedo Gear Remover   |
| 11. J-23062-2 | Stator Shaft Rear Bushing Installer (Both Rear)                    | J-9539                | Slide Hammer Bolts (3/8" - 16 Threads)                                |
| 12. J-23062-1 | Case Bushing Remover and Installer                                 | J-8105                | Speedo Gear Remover Puller  |
| 13. J-21424-9 | Extension Housing Bushing Remover and Installer (Used with J-8092) | J-5586                | Snap Ring Pliers  |
| 14. J-21424-7 | Stator Shaft Front Bushing Installer (Used with J-8092)            | J-24367               | Transmission Band Adjuster (THM 250 only)                             |
| 15. J-23062-5 | Input Ring Gear Bushing Remover and Installer                      | J-24675               | Accumulator Piston Adapter (Used with J-22269-01)                     |

Fig. 7-113—Turbo Hydra-Matic 250 Special Tools

# MANUAL TRANSMISSION FOUR SPEED (70mm)

Code DH

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Transmission Assembly . . . . .	7C-7		

### GENERAL DESCRIPTION

The four speed manual transmission is a floor shift transmission of a constant-mesh design.

The input shaft has an integral main drive gear and rotates with the clutch driven plate; that is, the input shaft rotates all the time the clutch is engaged and the engine is running. The input shaft is supported in the case by a ball bearing and at the front end by an oil impregnated bushing mounted in the engine crankshaft.

The input shaft (main drive gear) is in constant mesh with the countershaft drive gear. Since all gears in the countershaft cluster are integral to the shaft, they also rotate at the time the clutch is engaged. The countergear is carried on a needle bearing at the front and rollers at the rear and thrust is taken through a thrust washer at the front and rollers at the rear.

The transmission mainshaft is held in line with the input shaft by a pilot bearing at its front end, which allows it to rotate or come to rest independently of the input shaft. It is carried at the rear by a ball bearing mounted in the rear face of the case. Helical gears are used throughout. The mainshaft gears are free to rotate independently on the mainshaft and are in constant mesh with the countershaft gears. The reverse idler gear is carried on a bushing.

This transmission is fully synchronized in all forward speeds, reverse gear is not.

The gearshift lever is mounted in the transmission extension housing. The gearshift lever is connected to the transmission shifter shaft. Moving the lever from side to side rotates the shifter shaft, selecting either reverse, 1-2 or 3-4 shifter forks. Moving the lever forward or rearward causes forward or rearward movement of the previously selected shifter fork to engage the desired gear.

### MAJOR REPAIRS

#### TRANSMISSION

##### Removal

Before raising car, disconnect battery and release the parking brake.

1. From inside car, pull down shift lever boot and loosen lock nut. Then, unscrew upper portion of shift lever with knob attached.

2. Remove floor console, retainer and boot.

3. Remove three (3) bolts on extension housing and remove shift control assembly.

4. Raise car on hoist and drain lubrication from

transmission.

5. Remove prop shaft.

6. Disconnect speedometer cable and back-up light connector.

7. Disconnect clutch return spring and clutch cable at clutch shift fork.

8. Remove crossmember-to-transmission mount bolts, catalytic converter-to-transmission bracket, remove damper if so equipped and remove crossmember-to-frame bolts.

9. Raise transmission to take weight off support and remove crossmember.

10. Remove clutch housing-to-engine retaining bolts, slide transmission and clutch housing rearward and remove.

### DISASSEMBLY

With transmission resting on the front of the bellhousing:

1. Drive roll pin from shifter shaft arm assembly and shifter shaft. Remove shifter shaft arm assembly. (Fig. 7C-1)

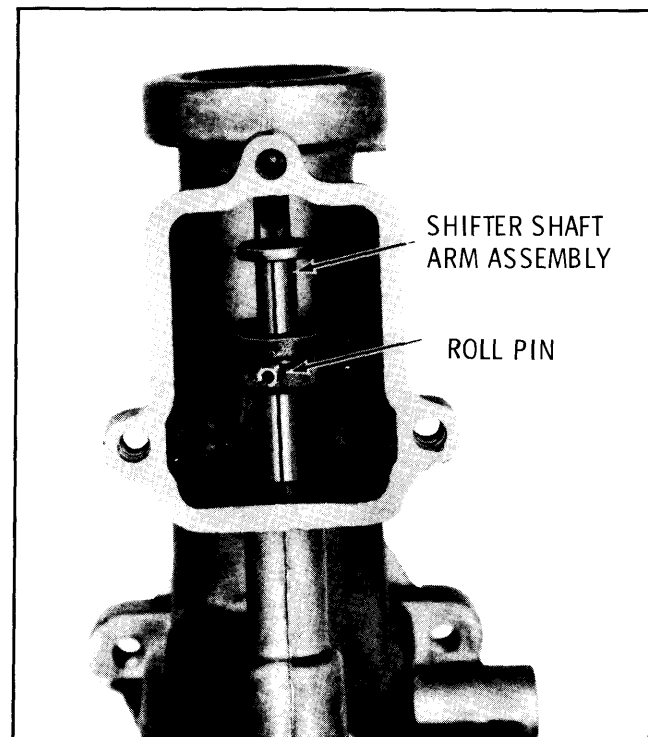


Fig. 7C-1—Shifter Shaft Roll Pin