HUDSON

1955

TECHNICAL SERVICE MANUAL

AUTOMATIC TRANSMISSIONS

HUDSON

TECHNICAL SERVICE MANUAL

for the 1955 "HORNET" "WASP" and "RAMBLER" SERIES

HYDRA-MATIC TRANSMISSION

TWIN ULTRA-MATIC TRANSMISSION

American Motors Corporation
Automotive Technical Service
3280 South Clement Avenue
Milwaukee 7, Wisconsin

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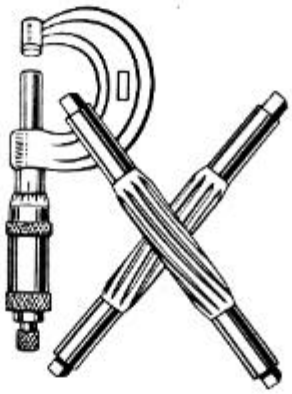
TECHNICAL SERVICE MANUAL



HYDRA-MATIC TRANSMISSION

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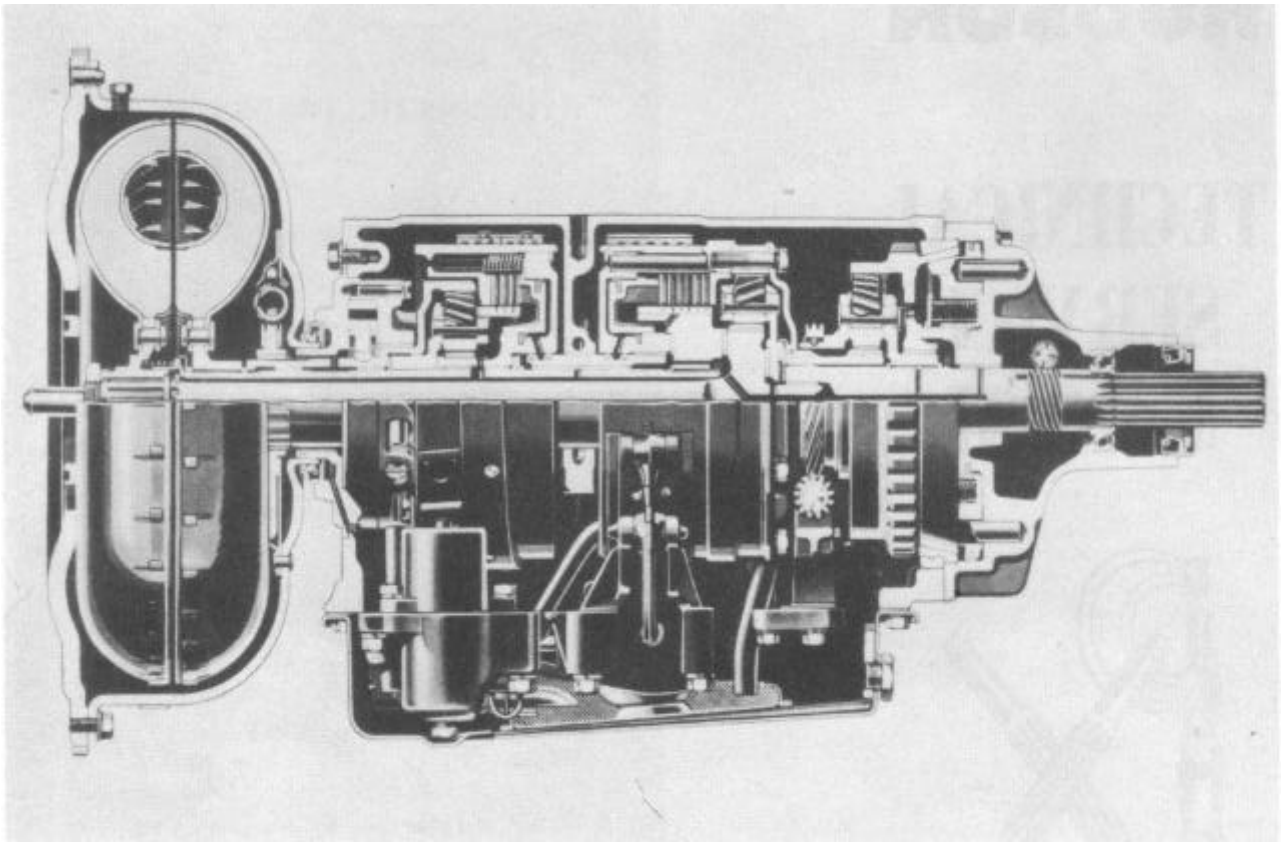
HYDRA—MATIC TRANSMISSION SECTION



Cross Sectional View of Hydra—Maiic Transmission

GENERAL DESCRIPTION

The Hydra—Matic Drive consists of a fluid coupling which replaces the clutch and is combined with a hydraulically controlled automatic transmission having four speeds forward and one reverse.

With Hydra—Matic Drive, the clutch pedal operation and conventional gear shifting are eliminated. The gear ratio in which the car is operating at any time is selected automatically in accordance with the performance demands by road condition and the car driver.

The selector lever position selected, will always provide the maximum efficiency under any combination of conditions.

HOW TO OPERATE HYDRA—MATIC

The selector lever (Fig. 1), located just below the steering wheel is used to select neutral, forward speed ranges or reverse. These positions are all shown on the indicator which is illuminated when the instrument lights are on. These positions are as follows:

N—Neutral.

D—4———For all normal forward driving.

D—3—For additional acceleration, congested traffic, or braking power.

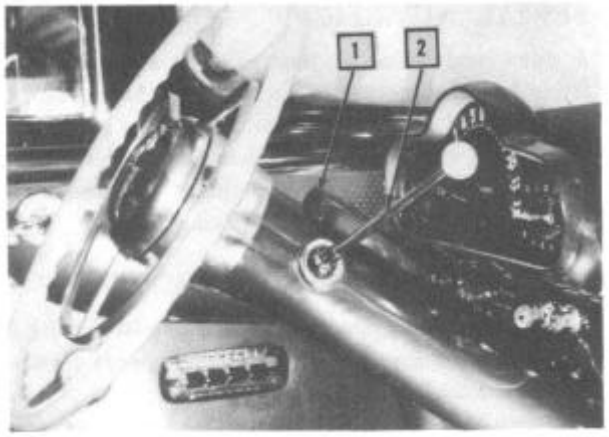
L—Prevents transmission from shifting above second speed and is provided for ascending and descending steep grades.

R—For reverse. (Note: Selector lever must be raised to engage low and reverse position.)

Engine Starting Instructions

The starting switch is adjusted so the starter will not operate unless the selector lever is in the neutral position. Press accelerator pedal, part way, to toe—board once, and release (in order to set the AUTOMATIC CHOKE on fast idle). To engage starter place the Hydra—Matic selector lever in N (neutral) position, and turn the ignition switch on.

NOTE: *When starting a warm or hot engine hold the accelerator pedal down half way when turning the ignition switch "On."*



1. Indicator 2. Selector Lever

FIGURE 1—I*ndicator and Selector Lever*

CAUTION: *Do not "pump" the accelerator pedal at any time. Avoid racing the engine during the warm—up period.*

NOTE: *Should the car fail to start in five to ten seconds, it is possible that the engine is flooded. In that case, it will be necessary to open the throttle to the wide open position while continuing to operate the starter.*

Operating in D—4 Range

After the engine is started, move the selector lever to D—4 position and leave it in this position for all normal forward driving. When the engine is cold and may be running on fast idle, the car will tend to creep forward when the selector lever is moved to the D position. A slight application of the foot brake will hold the car during this condition. After releasing the brakes, the car will move forward when the accelerator pedal is depressed.

Acceleration

The shift events from first speed to second, second speed to third, and third to fourth (D—4) will occur at different car speeds depending upon the amount of carburetor throttle opening. With a minimum throttle opening, the shift events will be at lower speeds. As the carburetor throttle opening is increased, the car speed at which the shift event will occur will be higher.

The transmission will automatically shift into second speed somewhere between six and twenty—one miles per hour, into third speed between ten and thirty—seven miles per hour, and into fourth speed between nineteen and sixty—nine miles per hour. These speeds will vary according to rear axle ratio and tire size.

Forced Downshift, Fourth to Third— Third to Second—Second to First

When driving on the open highway at speeds below 60 miles per hour, an extra burst of speed needed for passing can be secured by pressing the accelerator pedal all the way down; but it will be noted that a slight resistance must be overcome to produce. this downshift. The drive then changes from fourth speed to third for rapid pickup and returns to direct drive automatically at some higher speed, depending upon how soon the accelerator pedal is released. If the accelerator pedal is held all the way down, the shift returns to fourth at approximately 70 miles per hour.

When driving at speeds less than 20 MPH in drive range, the transmission will downshift from third to second by pressing the foot accelerator all the way d own.

When driving at speeds less than 10 MPH in either drive or low range, the transmission will downshift from second to first by pressing the foot accelerator all the way down.

Deceleration

When car is decelerating with the accelerator pedal free and the selector lever in D—4 position, the shift from fourth speed to third occurs automatically at approximately sixteen to twelve miles per hour. Continuing to decelerate, the transmission will automatically shift to lower speeds.

Stopping the Car

To stop the car, merely release the accelerator pedal and apply the brakes in the conventional manner. Leave the selector lever in either D position; the transmission is "in gear" and the engine helps to slow down the car. The fluid coupling is none effective at engine idle preventing the engine from stalling.

CAUTION: Under no circumstances should the selector lever remain in any other position except N when driver leaves car, with the engine still running. For additional safety, apply parking brake when opening garage doors or removing mail from rural mail box, etc.

This precaution prevents movement of the vehicle, should the accelerator pedal be accidentally depressed by a passenger.

L Range Position

In addition to the D—4 and D—3 positions, the transmission has an L range position on the indicator segment. In this position, the transmission operates normally only in second speed; it will not change to third or fourth regardless of engine speed. The L range

position is provided for two special uses; descending steep hills, where traffic signs call for second gear, thus affording the maximum braking power of the engine, and pulling through deep sand, or up steep grades.

The change from either D to L range position can be made at any speed below 39 miles per hour on dry pavement where traction is good. It is not recommended to change from D to L range on slippery pavement since its use could induce a skid. On slippery roads safety demands that car speed be reduced by judicious use of the brakes.

Reverse

To engage reverse, (vehicle speed must be below 10 MPH) raise the lever slightly, and move the lever to the R position.

Parking

For additional safety, when the car is parked, it can be held in gear by placing the lever in R position and shutting off the engine. The parking pawl will then engage the external teeth of the reverse internal gear.

Coasting

To maintain better control of the car and to prevent possible damage to the Hydra—Matic unit, it is advisable to keep the selector lever in D or L range position when traveling.

When coasting in neutral with the engine shut off, the rear oil pump in the transmission is in operation. It must supply sufficient oil pressure to lubricate the transmission and also, keep the rear band released to maintain the transmission mechanism in neutral. If this rear oil pump pressure should drop for any reason, (such as low fluid level, etc.) serious damage to the transmission may result.

Pushing to Start the Engine

It is possible to start the engine by pushing the car. Should this ever be necessary, the car should be pushed in N (neutral) until a speed of approximately 20 MPH is reached, the ignition switch then turned on, and the selector lever moved to D range position (never to L), rear wheels then drive the engine.

HYDRA—MATIC DRIVE FLUID

It is important to use only Hydra—Matic Drive Fluid in the Hydra—Matic transmission.
It is an all—season fluid, ideal for year—round operation.
Ordinarily, flushing of the unit is not necessary; however, if it is flushed for any reason, use only HydraMatic Drive Fluid.

SERIAL NUMBER

A name and serial number plate is attached to the lower left hand corner of each Hydra—Matic transmission case. This serial number should be included in any report concerning the operation of the unit. In cases where parts interchangeability is affected, the serial number will aid in identifying parts.

HYDRA—MATIC DRIVE COMPONENTS

The Hydra—Matic transmission contains two planetary gear trains arranged to provide four speeds forward. This is accomplished by various combinations of bands and clutches. It also contains a third planetary gear train for reverse. In all forward speeds the reverse planetary unit has no function and simply revolves with the output shaft (Fig. 2).

Drive Torus

When the car is standing, with the engine running and the selector lever in D, L or R range, the drive torus turns at 7/ 0 engine speed. This reduction in the front unit makes possible an engine idle of 490 to 510 I Rambler 450) RPM without the car "creeping."

Power travels from the flywheel to the torus cover (Fig. 3) through the front planetary, which is in reduction because the band is applied, and then to the rear torus. The rear torus in the Hydra—Matic Drive is the drive member while the front torus is the driven member.

As the vehicle starts, power travels from the flywheel to the torus cover through the front planetary in reduction, then through the fluid coupling and back to the rear planetary unit. When the speed of the vehicle has increased to a point where the reduction of the front planetary unit is no longer required, the front planetary shifts to direct drive and the drive torus turns at the same speed as the engine.

CONTROL VALVE ASSEMBLY

The control valve assembly consists of a manual valve (the only valve operated by manual control), shifter valves, governor plugs, detent plugs, transition valve, compensator valve, throttle valve, regulator valve, regulator plug, timing valve, and springs which are operated through oil pressure.

These shifter valves, plugs and springs control the shifting in all driving ranges.

The control valve assembly incorporates valves for forced downshifts from fourth to third, third to second and second to first.

The throttle valve regulator valve regulates throttle or T.V. pressure. This regulated T.V. pressure is then delivered to the regulator plugs and shift valves to help delay the shifts.

The T.V. regulator valve is controlled by T.V.

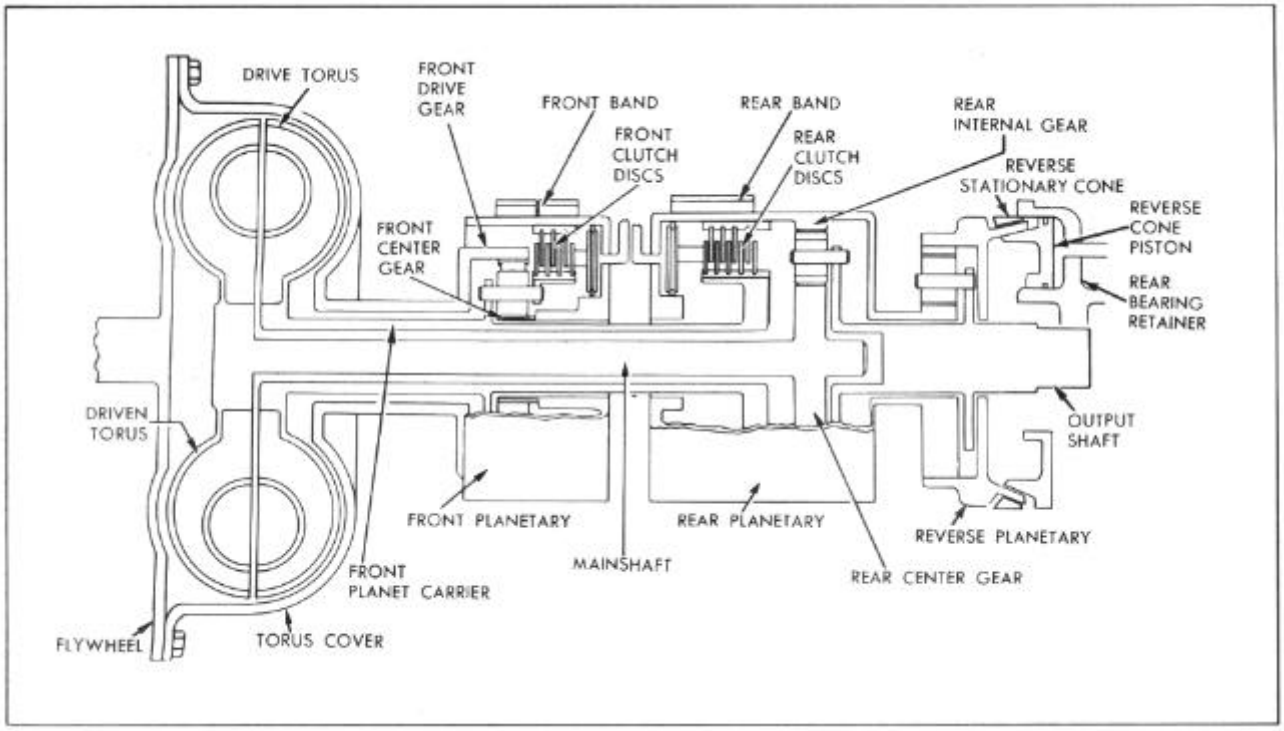


FIGURE 2—*Location of Hydra—Matic Components*

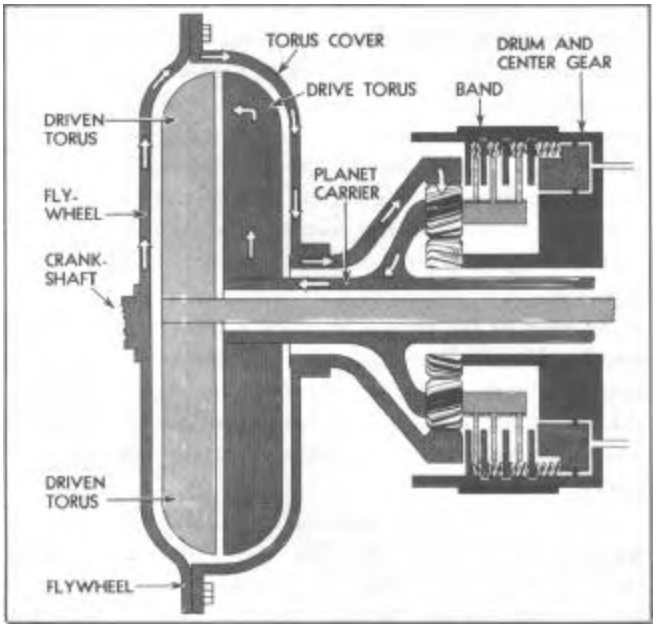


FIGURE 3—*Drive Torus Speed Reduced*

presure and spring tension. When T.V. pressure reaches a certain value, it opens the T.V. regulator valve and allows regulated T.V. pressure to act on the regulator plugs and shifter valves, to help time the shifts. On light throttle upshifts, there will be no T.V.. pressure to delay the shifts, while on heavy throttle upshifts, regulated T.V. pressure improves the shifts. When T.V. pressure reaches a given amount, the T.V.. regulator valve will close the exhaust port, allowing regulated T.V. pressure to become normal T.V. pressure (Fig. 4)

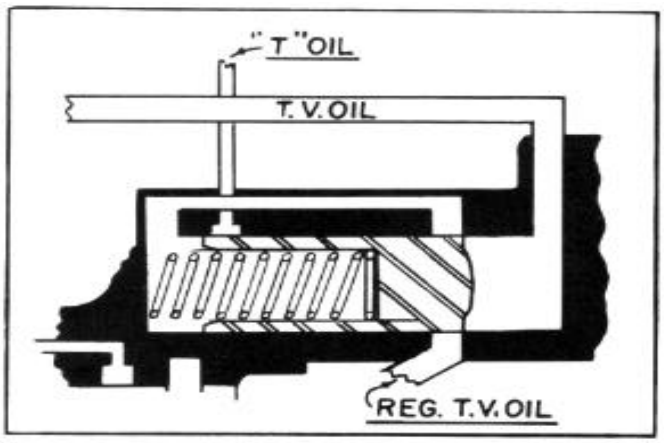


FIGURE 4—*Schematic Drawing of T.V. Regulator Valve*

The 3–2 timing valve delays the application of the rear band until the front clutch is applied during a 3–2 forced downshift, thus providing a smoother shift.

The operation of the 3–2 timing valve and the 3–2 detent plug are as follows: The 3–2 detent plug remains closed and the 3–2 timing valve open until the accelerator pedal is depressed down through the detent.

When the 3–2 detent plug is closed, regulated T.V.. pressure flows through it to act on the regulator plugs and shifter valves to help delay the shifts.

Because the 3–2 timing valve is open, main line pressure can flow through it freely during 2–3 upshifts and 3–2 downshifts (Fig. 5).

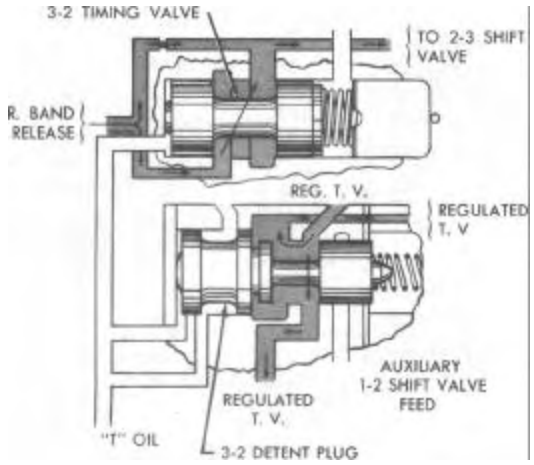


FIGURE 5—*3—2 Timing Valve and 3—2 Detent Plugs Opened Position*

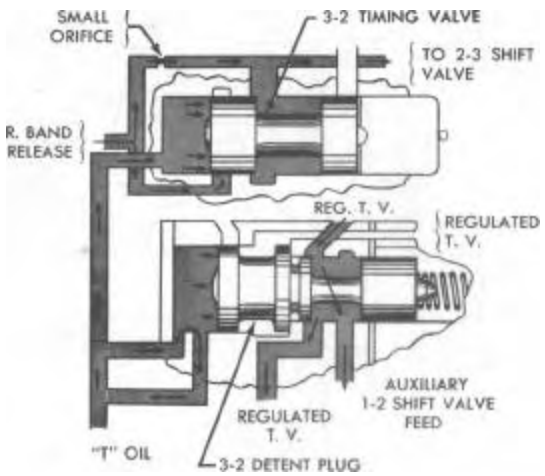


FIGURE 6—*Timing Valve and Detent Plug—Closed Position*

When the accelerator pedal is depressed down through the detent and the car is going slow enough to obtain a 3—2 downshift, main line pressure from the "T" valve will open the 3—2 detent plug which moves the 2—3 shift valve to the closed position and at the same time will close the 3—2 timing valve.

With the 3—2 detent plug opened, regulated T.V. pressure to the 2—3 shifter valve is shut off.

Regulated T.V. pressure (main line pressure at full throttle) flows into a passage uncovered by the small end of the 3—2 detent plug. This passage delivers oil to the 1—2 shift valve through a larger port than normal in order to insure a fast application of the front clutch.

Because the 3—2 timing valve is closed, release oil from the rear servo that is exhausting through the 2—3 shift valve, must flow through the small orifice by the timing valve. This results in slow application of the rear band. Because the front clutch is applied quickly, and the rear band is applied slowly, the transmission will shift into second speed smoothly (Fig. 6) .

OPERATION OF FRONT SERVO

Neutral

When the selector lever is in N position there is no oil pressure to the servo and the retracting spring holds the servo apply piston in the released position.

Servo Applied—1st, 3rd, and Reverse

Main line pressure from the manual valve is directed to hold the front servo in the applied position in all ranges except neutral. The operation of the over—run valve is to prevent the front band from slipping when using the engine for braking in D—3 range. With the car speed below approximately 20 miles per hour, the over—run control valve spring force is greater than the G—1 oil force, and compensator oil is directed to the compensator piston. When the car speed exceeds approximately 20 miles per hour, governor pressure overcomes the spring pressure to move the over control valve, cutting off compensator oil and directing front band apply oil to the compensator piston. Thus at highway speeds over 20 miles per hour where engine braking may be desired, two servo apply areas are supplied with line pressure to prevent band slippage. Below 20 miles per hour, line pressure is directed only to the apply piston with the pressure to the compensator piston varied to suit the engine output. This is illustrated in Figures 7 and 8.

As soon as the front unit shifts to direct drive, front band release oil assists the over—run control valve spring to overcome G—1 pressure. Therefore, whenever the front unit is in direct drive regardless of car speed, only compensator oil is allowed to the compensator piston (Fig. 9) .

Below 25 miles per hour, the 4—3 valve is held open by front—band apply oil (Fig. 7). At speeds greater than 25 miles per hour, G—1 pressure operating on a larger area moves the 4—3 downshift valve into the passage blocking off front servo apply oil (Fig. 8).

The apply oil is forced to go through the passage with a restricted orifice, thus slowing the front servo apply at speeds above 25 miles per hour to give the engine time to speed up for a smooth forced 4—3 downshift.

Servo Released—2nd and 4th

When the transmission shifts into second or fourth speeds, the front band is released. Main line band release oil pressure coming into the front servo acts

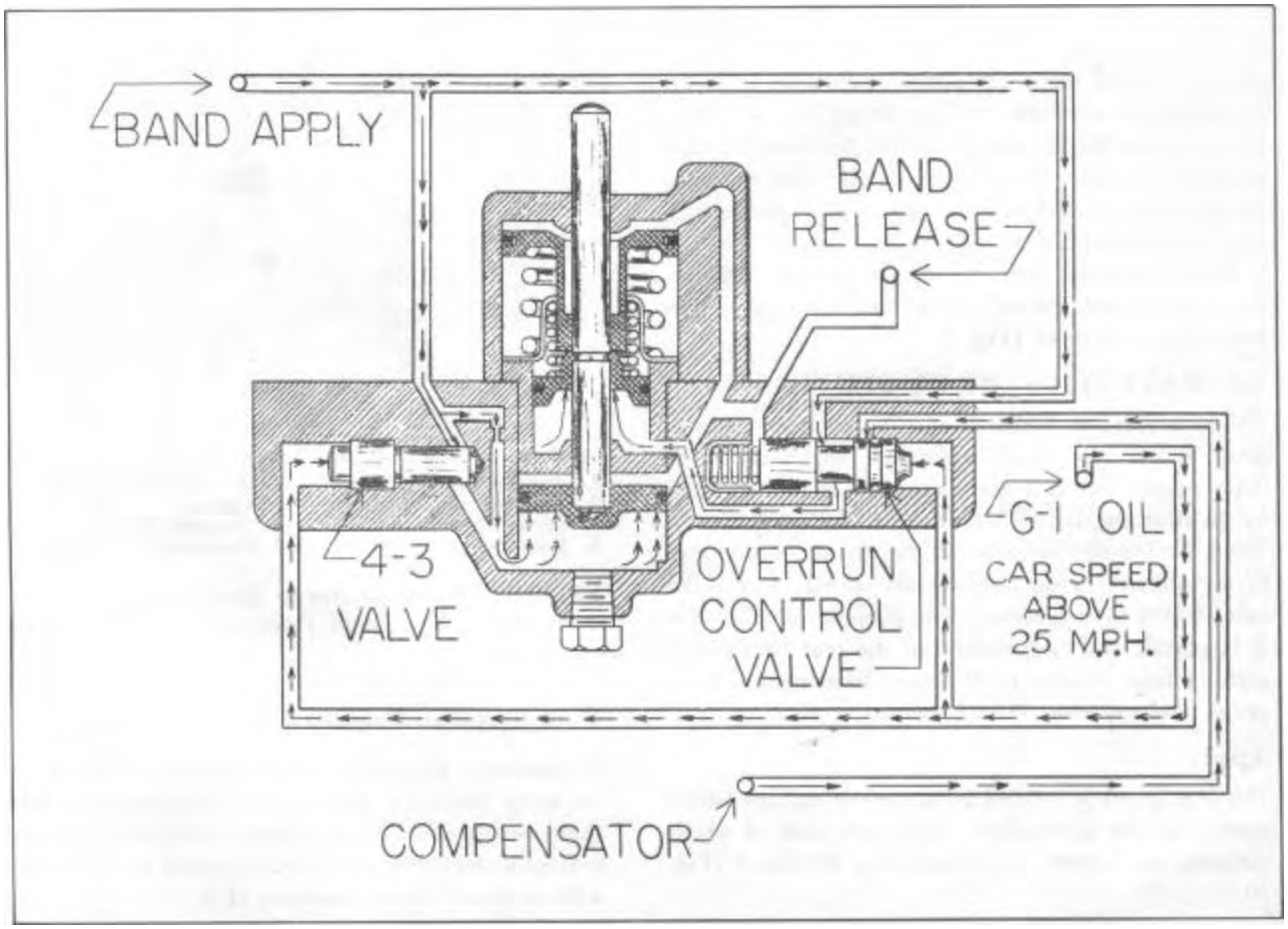


FIGURE 7—*FRONT SERVO APPLIED*

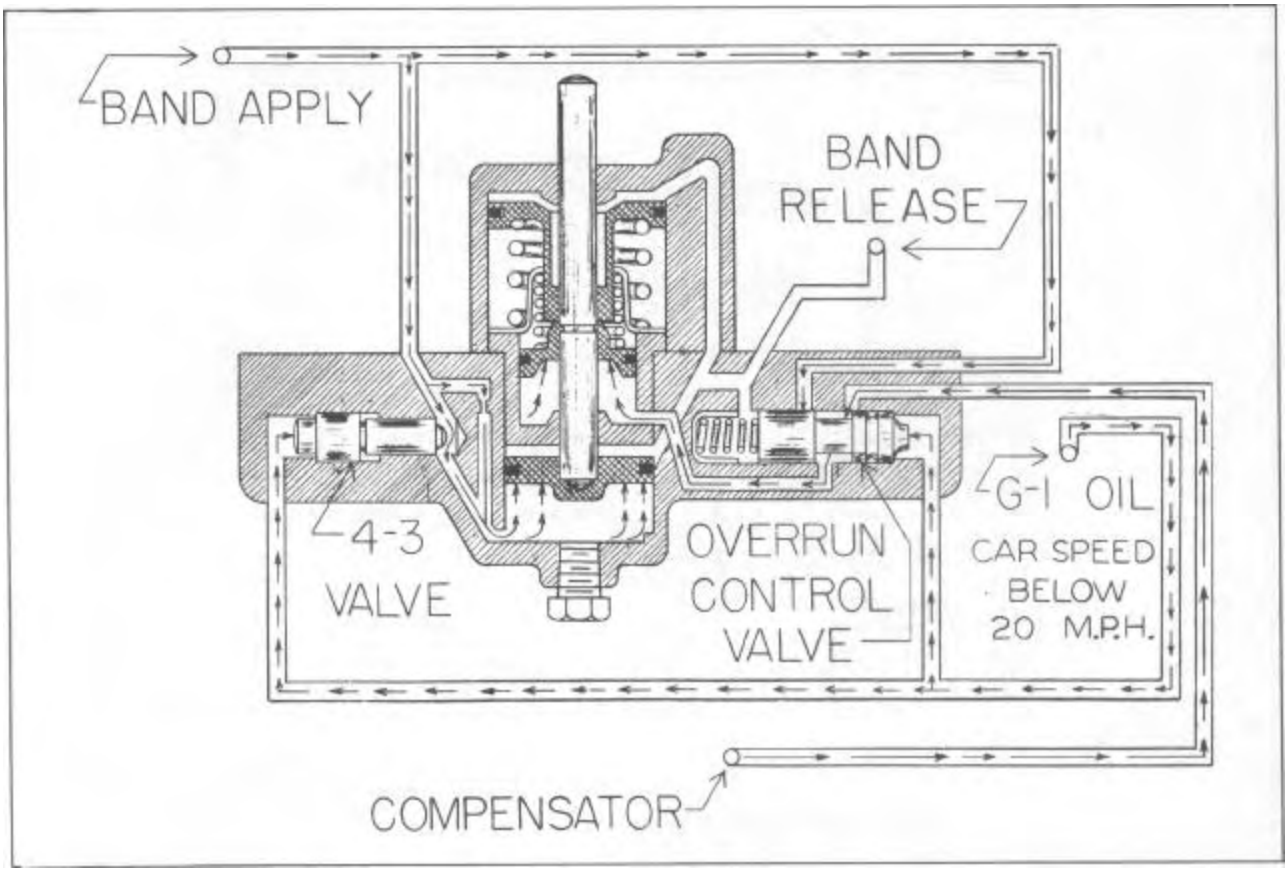


FIGURE 8—*FRONT SERVO APPLIED*

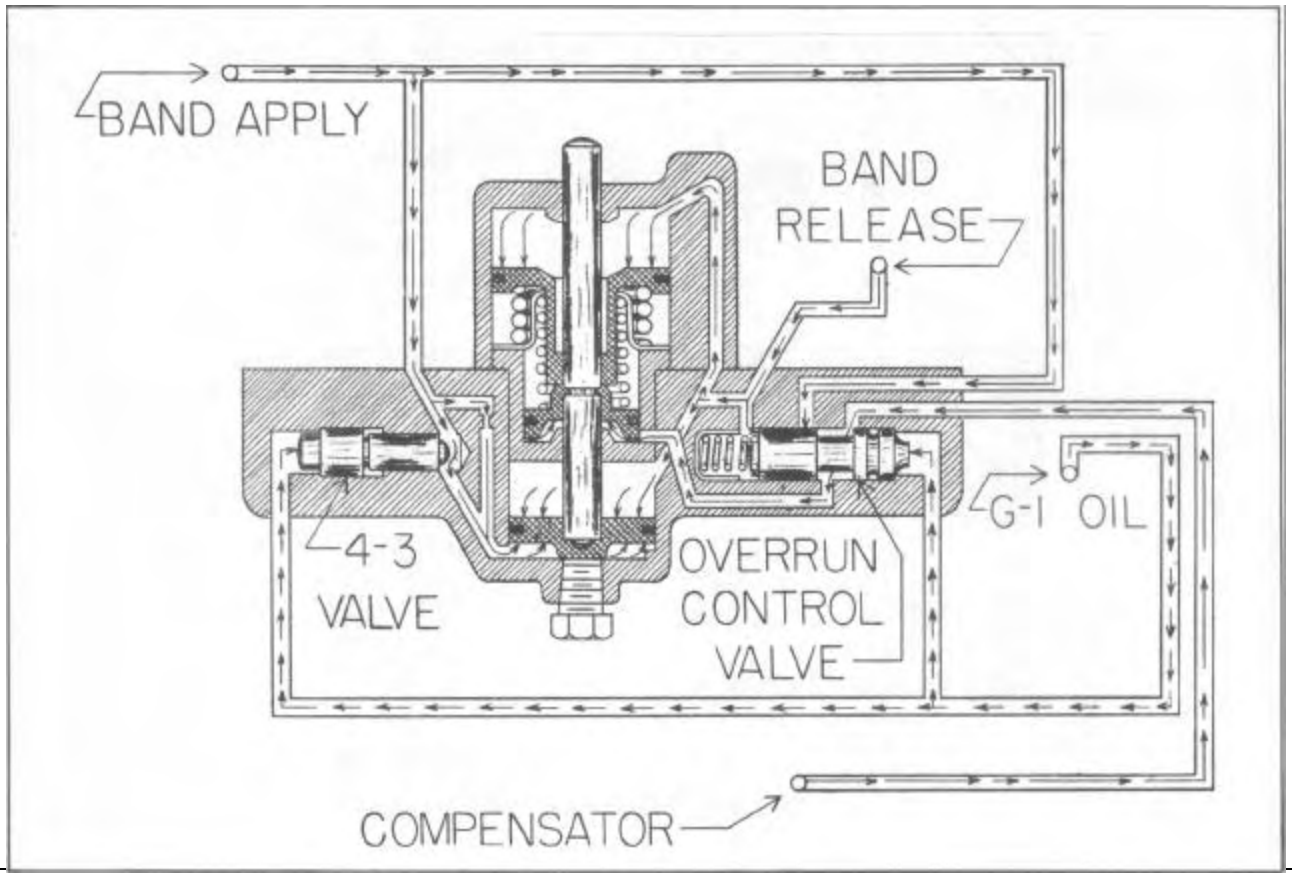


FIGURE 8—*FRONT SERVO Re;eased*

on the back of the apply piston, travels through the servo body and release cylinder to act on the release piston. Band release oil also moves the over—run control valve cutting off the flow of apply oil to the compensator piston and directs compensator pressure to the compensator piston.

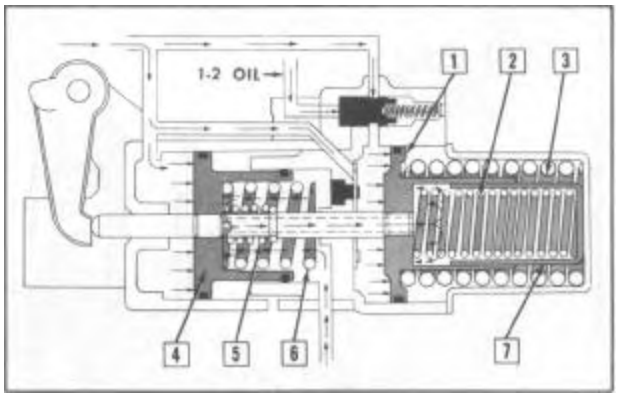
Spring pressure, plus oil pressure, acting on the release piston and release side of the apply piston releases the front servo (Fig. 9).

OPERATION OF REAR SERVO

The rear servo is designed with an exhaust valve to allow a fast rear band application from reverse to drive range. The rear servo exhaust valve is actuated by oil from the 1—2 shifter valve and by spring force. The 1—2 oil moves the valve to the closed position and in the absence of oil pressure the spring returns the valve to the open position. The purpose of this valve is to permit rapid application of the rear band when shifting from reverse to D range, from neutral to L range, and smoother D to L range.

Apply

The rear servo is applied by the servo springs which operate on the accumulator piston, the stem of which contacts the booster piston applying the band (Fig. 10)



1. Accumulator Piston
2. Compensator Spring
3. Servo Spring
4. Booster
5. Accumulator Apply Spring
6. Booster Spring
7. Compensator Piston

FIGURE 10—*Rear Servo Band Apply Springs and Pistons*

Compensator Pressure

Compensator pressure is applied at A and B to assist the servo springs to prevent the band slipping under rapid acceleration. Compensator pressure is always present with carburetor throttle opening and increased with continued throttle opening (Fig. 11).

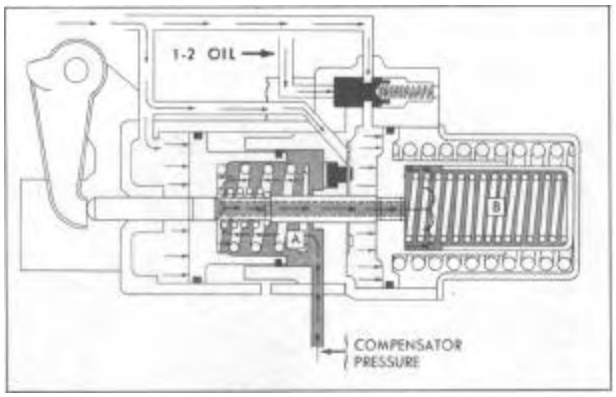


FIGURE 11—*Rear Servo Compensator Pressure*

Release

Regulated main line pressure is applied at points C and D to release bands. The force applied at these two areas is greater than the force of the servo springs and compensator pressure and the servo pistons are moved to the released position (Fig. 12).

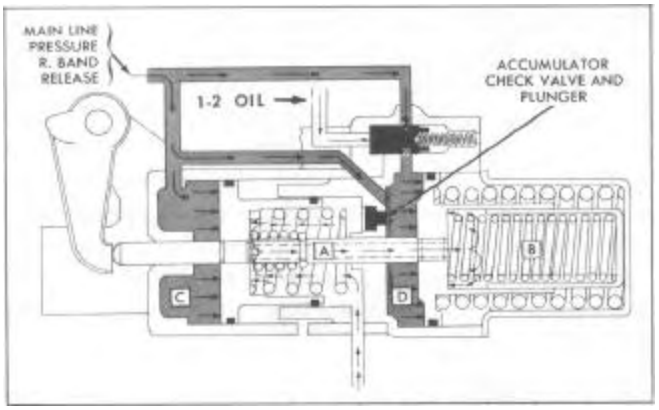


FIGURE 12—*Rear Band Release*

Rear Servo Accumulator Check Valve and Plunger

The accumulator check valve controls the passage through which oil flows to the face of the accumulator piston at D (Fig. 12). The oil going through this passage lifts the check valve off its seat and allows the oil to flow through freely to release the band.

There are two different ways in which this valve operates when the servo is being applied, namely, closed and open carburetor throttle.

On a closed carburetor throttle down–shift when main line pressure applied at point D is released, the check valve then returns to its seat, causing the oil under the accumulator piston to pass through the small hole in the check valve and in this way delays application of the band (Fig. 12).

On an open carburetor throttle downshift, compensator pressure is effective at points A and B and also on the end of the check valve plunger which is connected to the accumulator check valve.

When the pressure applied at point D is released the compensator pressure applied on the check valve plunger holds the check valve off its seat and the oil under the accumulator piston is allowed to exhaust freely for a rapid application of the band (Fig. 12).

PRESSURE REGULATOR ASSEMBLY

The pressure regulator valve, which is controlled by the pressure in the system, positions the slide in the front pump to control the pump output. It also contains the throttle valve pressure plug and reverse booster plug and spring.

FRONT OIL PUMP ASSEMBLY

The transmission has a vane type pump which pumps only the amount of oil required in the system. In place of gears, the pump has paddles called vanes. The vanes are rotated in a circle within a slide, and the output of the pump is determined by the position of the slide. When the slide is up the pump delivers maximum output; when the slide is centered the output is zero.

The pressure regulator, which is controlled by pressure in the system, positions the slide to control pump output. The priming springs keep the slide up to insure maximum output when the pump is started. However, the springs have no effect on the pump once it is primed.

The front oil pump consists of the pump body, cover, slide, rotor, seven vanes, two guide rings, relief valve and two priming springs.

The pump rotor is turned by the front drive gear which is driven by the engine. The priming springs keep the slide up causing the pump to deliver maximum output to the transmission. The pressure regulator valve spring holds the valve in until the transmission hydraulic system comes up to operating pressure. This allows the pressure regulator valve to meter oil into the lower chamber, thus oil pressure keeps the slide up. If any oil should be trapped in the upper control chamber, it will bleed through the hole in the slide to the suction side of the pump or exhaust past the land on the pressure regulator valve (Fig. 13).

When the transmission system comes up to pressure, the pressure regulator will move out against spring pressure and T.V. pressure. With the pressure regulator in the out position, pump pressure is directed through the pressure regulator to build up pressure in the upper control chamber. Pressure in the lower chamber is allowed to exhaust by the pressure regulator. The slide then moves down reducing the output of the pump.

As the slide moves down, it uncovers a port that allows pump pressure to flow to

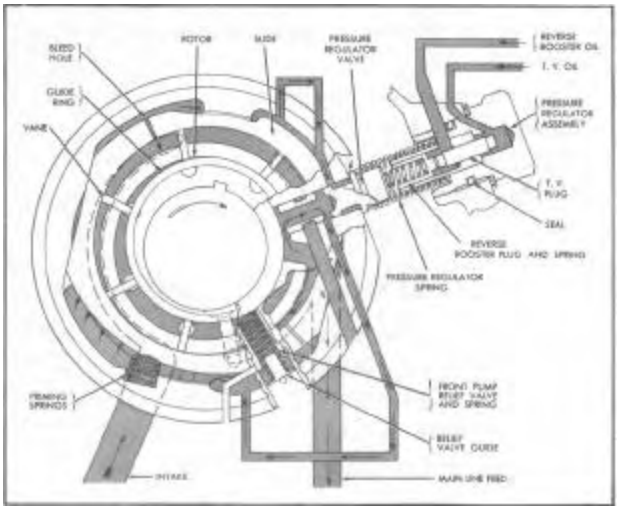


FIGURE 13—Schematic Drawing of Front Oil Pump (Slide Up)

the fluid coupling and supply lubrication. Since the pump supplies the proper amount of oil to the system at any time it is running, the front pump relief valve has no effect while the front pump is operating. However, the front pump relief valve is required in order to relieve excessive output of the rear pump which may develop when the car is being towed and the front pump is not operating (Fig. 14).

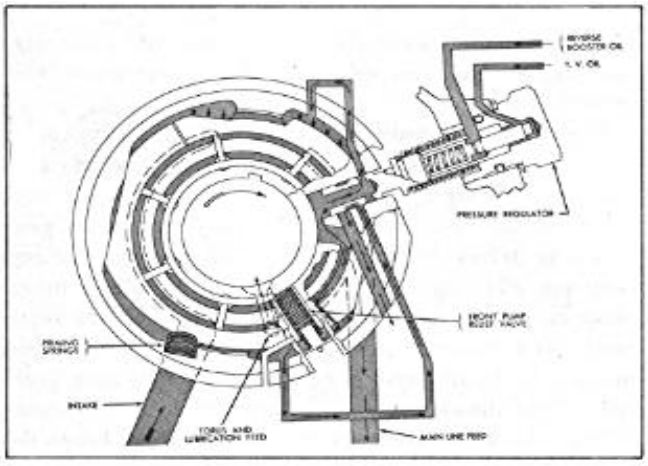


FIGURE 14—Schematic Drawing of Front Oil Pump (Slide Down)

GOVERNOR

The governor controls the flow of oil to the shifter valves, front servo valve body, and reverse blocker piston depending upon vehicle speed.

Governor Oil Delivery Pipe

The governor oil delivery pipe is assembled between the front servo and the case near the parking brake bracket assembly. Oil feeding the governor by—passes the control valve assembly by flowing directly from the front servo, through the case into the parking brake bracket assembly to the governor (Fig. 15).

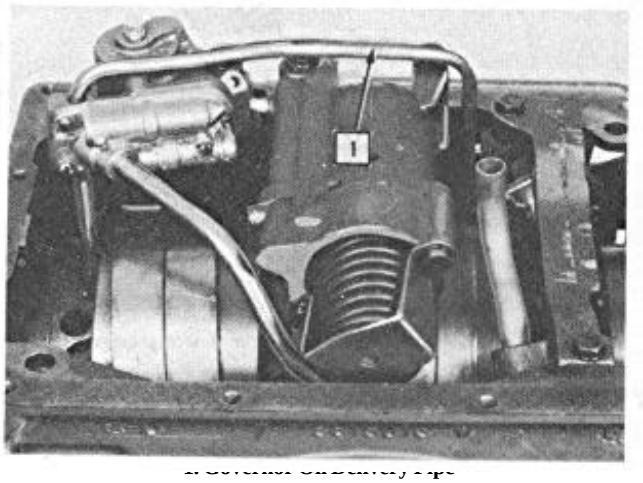


FIGURE 15—*Governor Oil Delivery Pipe*

PARKING BRAKE BRACKET ASSEMBLY

The main line oil pressure flows through the governor oil delivery pipe, case, parking brake bracket assembly and to the governor. A recessed pin holds the parking blocker piston release spring in position. The parking blocker piston releases the parking pawl (which is only used for parking) when the selector lever is placed in the "R" position and the ignition turned off. The reverse blocker piston engages the reverse lever (through G—1 governor pressure) preventing the driver from placing the selector lever into reverse above 10 MPH.

MAIN LINE EXHAUST VALVE

The main line pressure exhaust valve, is located in the front servo. Whenever either or both oil pumps are operating the valve is held closed against the release spring by main line oil pressure. When the engine is turned off and the car is at a standstill, the release spring opens the valve allowing main line oil pressure to exhaust rapidly, permitting a rapid engagement of the parking pawl to the external teeth of the reverse internal gear, when the selector lever is placed in the "R" position (Fig. 16).

FRICTION TYPE REVERSE

With the selector lever in the R position, oil flow is directed from the manual valve to the reverse cone clutch, which is spring released and oil pressure applied, to the front servo to apply the band and to the rear servo to release the band. Oil flow is also directed to the reverse booster plug in the pressure regulator to increase main line pressure from the cone clutch to prevent slipping (Fig. 17).

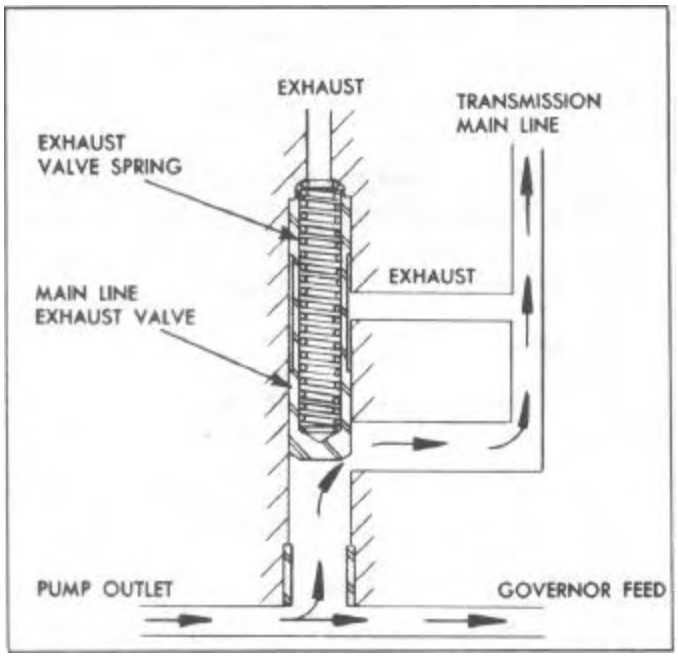


FIGURE 16—*Schematic Drawing of Main Line Exhaust System*

PERIODIC SERVICE RECOMMENDATIONS

Transmission Fluid

Hydra—Matic transmission fluid level should be checked every 1,000 miles at the time chassis lubrication is performed.

Checking Oil Level

Set selector lever in "N" (neutral) position, and apply the hand brake. Run engine at a speed equivalent to 20 MPH for several minutes.

Reduce the engine speed to slow idle (carburetor off the fast idle step), remove the fluid level indicator and wipe clean, and reinsert it in the transmission oil filler tube.

Always check the fluid level with the engine running at idle, transmission in neutral, in order to fill the fluid coupling and obtain an accurate reading.

Remove the indicator and note reading. The two dots on the indicator are marked "F" (full) and "L" (low). It requires 11/2 to 2 pints to raise the level from the "L" to "F" mark. If the fluid level is at the

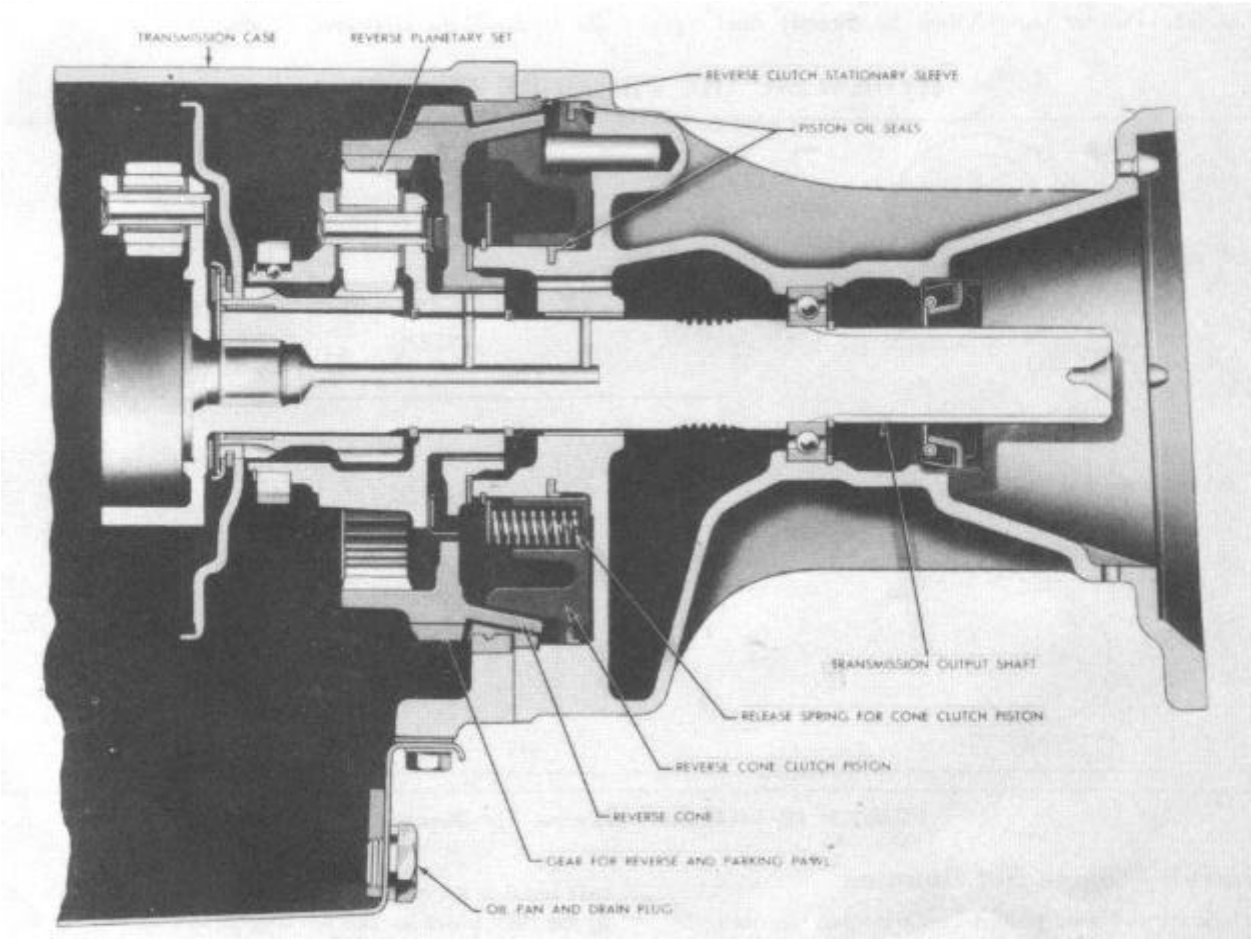


FIGURE *17—Reverse Cone Clutch Unit*

"L" (low) mark, add "AQ—ATF" approved Hydra—Matic fluid to bring the level to the "F" mark.

CAUTION: — *Do not fill above "F" mark on fluid level indicator as this will cause foaming when transmission is warm.*

Stop the engine. Replace the fluid level indicator and lower hood.

NOTE: *If the fluid level is low when checked, and there are indications of fluid leakage, correction should be made to eliminate all leaks.*

New Car—1,000—2,000 Mile Inspections

New car, 1,000—2,000 mile inspections should be performed as outlined on Delivery Inspection on New Car, 1,000 and 2,000 Mile Warranty Inspection and Adjustment Form. For Hydra—Matic equipped cars, the following items must be performed in addition to the conventional operations.

New Car Inspections

1. Inspect starter neutral switch adjustment.
2. Inspect position of selector pointer.Move the selector lever from "N" to "D", stopping when detent is felt. Pointer should then be directly lined up with the Figure 4 or 3.
3. Hydra—Matic fluid level should be to the "Full" mark with the engine running.
4. Tighten hand adjusting screw lock nuts.
5. Inspect for fluid leaks.
6. Set engine idle speed at 490 to 510 (Rambler 450) RPM with selector lever in "N" position (with air conditioning compressor running).
7. Inspect throttle linkage adjustment.

1,000 Mile Inspection

Road test car for operation of Hydra—Matic using Hydra—Matic Diagnosis Guide. Inspect items 1, 2, 3, 6, and 7 as listed in New Car Inspection. In addition, adjust the front and rear bands.

2,000 Mile Inspection

Road test car for operation of Hydra—Matic using Hydra—Matic Diagnosis Guide. Inspect items 1, 2, 3, 5, 6, and 7 as listed in New Car Inspection.

General Recommendation

Observe operation of transmission on Hydra—Matic equipped cars when road tested for any reason. Use the Hydra—Matic Diagnosis Guide.

HYDRAULIC OIL PRESSURE CIRCUITS

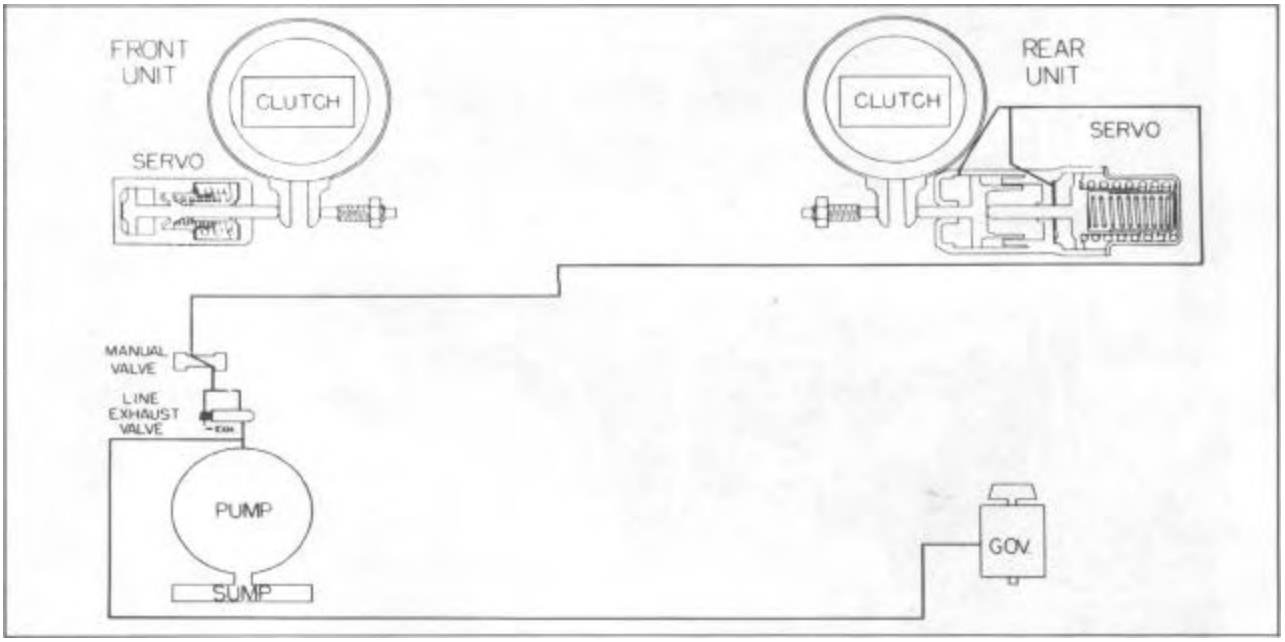


FIGURE 18 —*Neutral—Engaine Not Runnina*

NeutraL—Engine Not Running

Both front and rear pumps being inoperative there is no oil pressure. Therefore, the front band, front clutch, rear clutch, and reverse clutch are released and the rear band is applied. When the selector lever is moved to the "R" position, the parking pawl engages the external teeth of the reverse internal gear, and with the rear band applied, locks the output shaft for parking.

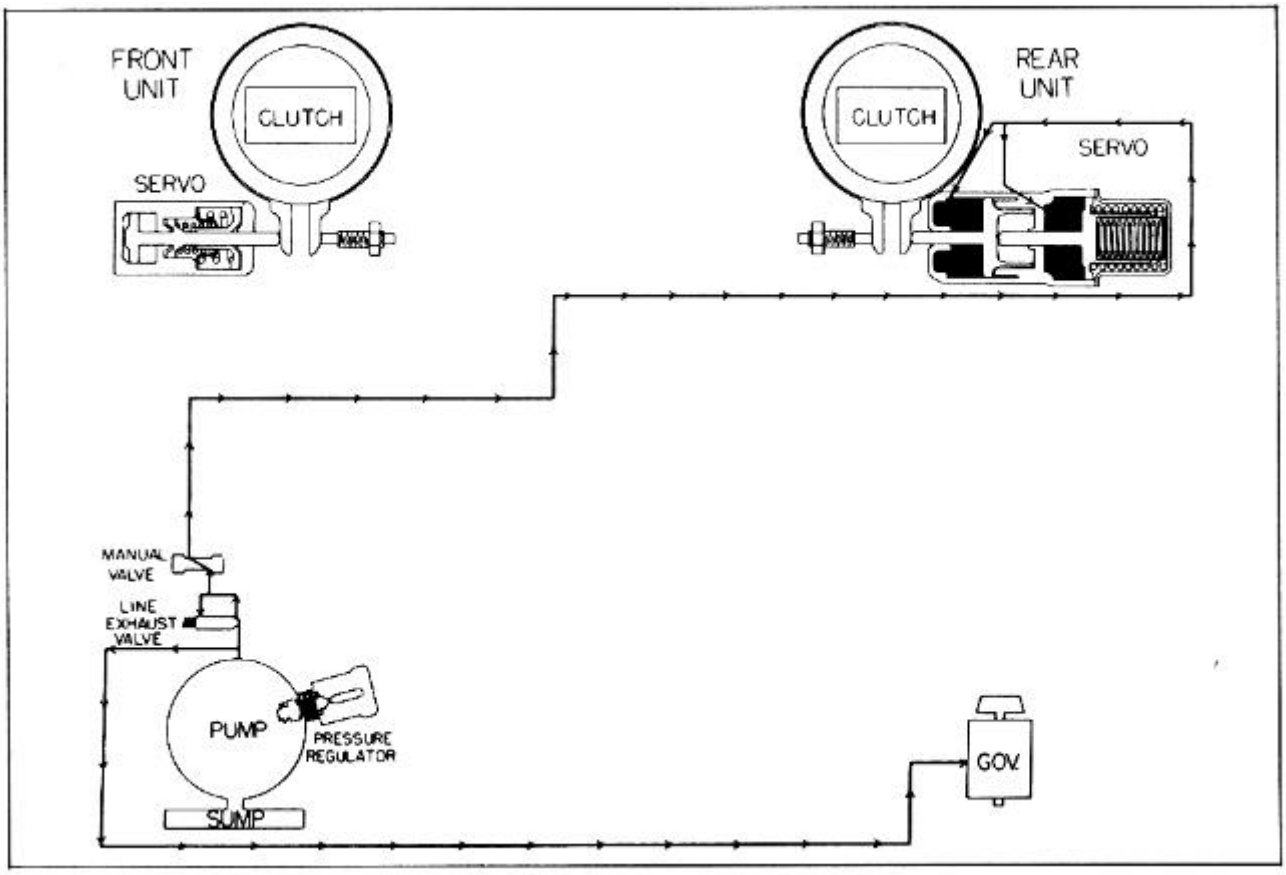


FIGURE 19—*Neutral—Engine Running*

Neutral—Engine Running

The manual valve in the neutral position with the engine running, oil is directed from the front pump to the rear servo releasing the band which was spring applied. With the manual valve remaining in neutral, no oil is supplied to the applied side of the front servo, therefore, the front band remains released. The front and rear clutches being released by spring pressure, and both bands being released, the vehicle cannot be moved while in neutral regardless of engine speed.

Oil pressure directed from the pump closes the main line exhaust valve and oil is directed to the parking blocker piston preventing the parking pawl from engaging the external teeth of the reverse internal gear. Oil is also directed to the governor closing the governor weights while the vehicle is not in motion.

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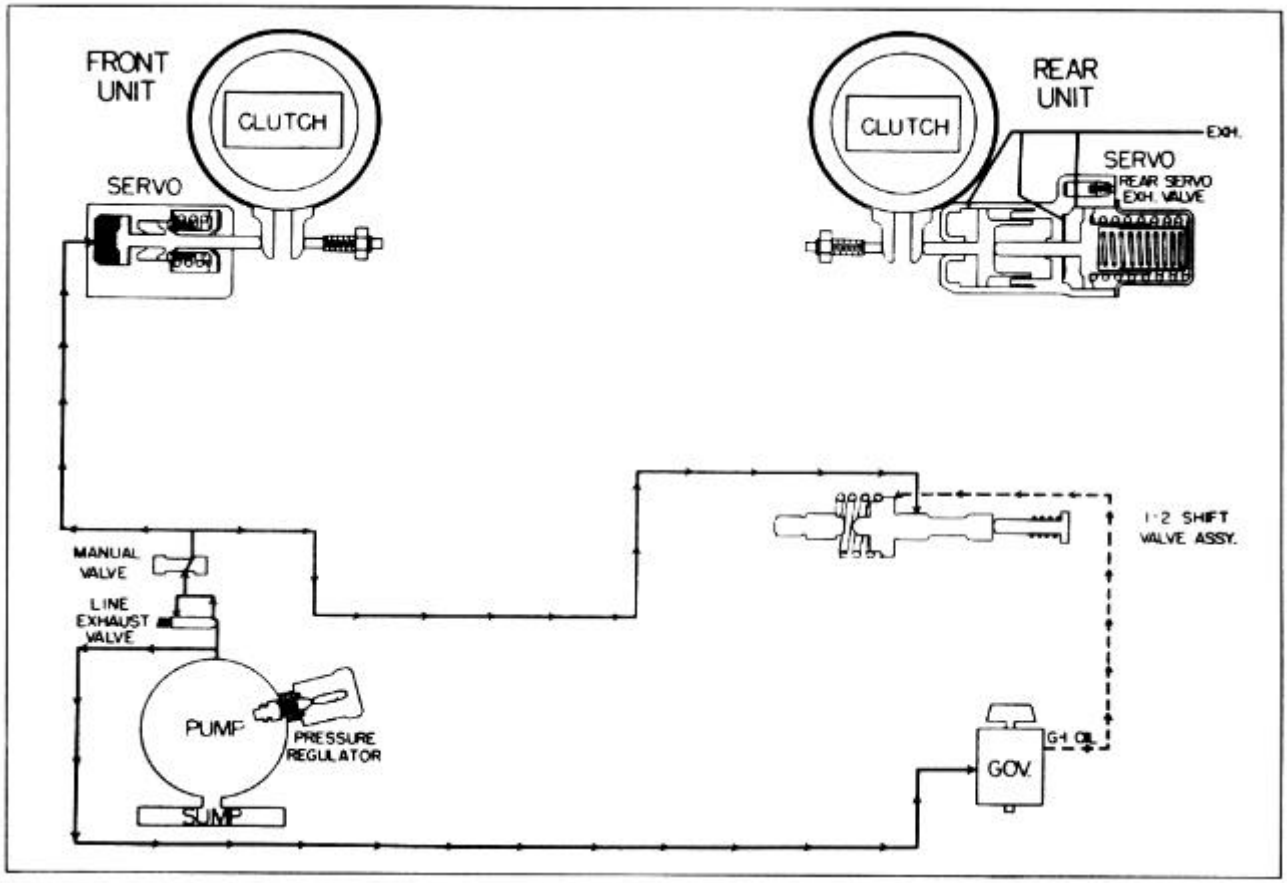


FIGURE 20—Drive Four First Speed

Drive Four First Speed

When the selector lever is moved to D—4 position, the manual valve is operated through linkage cutting off oil pressure to the rear servo allowing spring pressure to apply the band; this oil pressure is released through an exhaust port in the 2—3 shifter valve. The rear servo exhaust valve is held open by spring pressure and allows release oil in the rear servo to exhaust rapidly giving a faster application of the rear band when going from N to D and R to D range.

Oil pressure is then directed to the applied side of the front servo applying the front band. Both bands being applied places the transmission in first gear.

As the vehicle starts to move, variable G—1 oil pressure is applied to the large area of the 1—2 shifter valve. As soon as variable oil pressure overcomes the 1—2 shifter valve spring pressure, the 1—2 shifter valve will move in, directing main line pressure which was on the land of the 1—2 shifter valve, to apply the front unit clutch and release the front band placing the transmission in second speed.

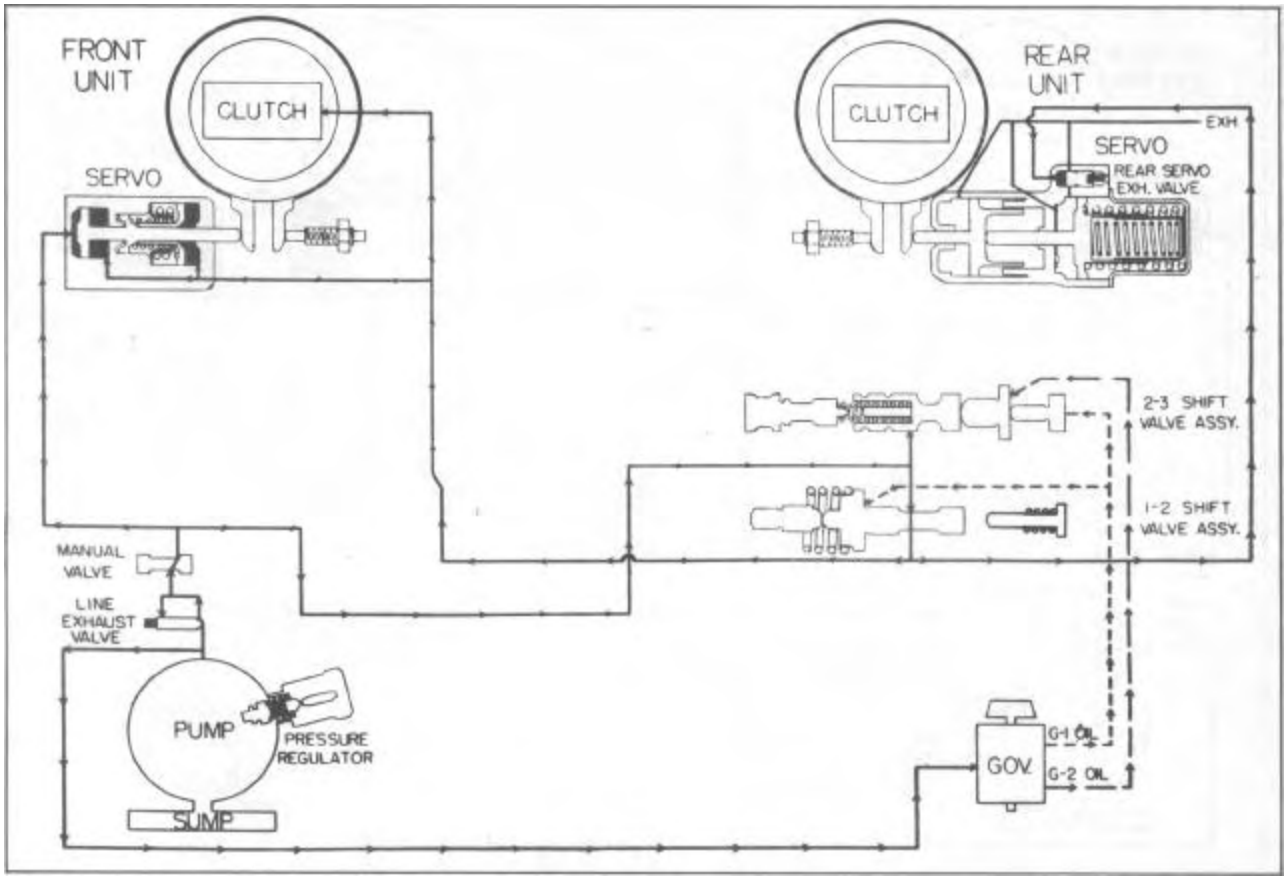


FIGURE 21—*Drive Four Second Speed*

Drive Four Second Speed

In second speed the front clutch is applied and rear band applied. The front band is released and the rear clutch released.

This change takes place when vehicle speed is increased and through centrifugal force the governor weights open further increasing variable G—1 oil pressure to move the 1—2 shifter valve. Main line pressure is then directed through the 1—2 shifter valve applying the front unit clutch, and to the two areas of the front servo releasing the band. This places the front unit in direct drive. Oil pressure from the 1—2 shifter valve closes the rear servo exhaust valve without effecting the upshift. Main line oil pressure is also directed to the land of the 2—3 shifter valve. Variable G—2 oil pressure is directed from the governor to the large area of the 2—3 auxiliary valve while G—1 oil is directed to the large area of the 2—3 governor plug.

The transmission will remain in second speed until governor pressure overcomes the 2—3 shifter valve spring pressure.

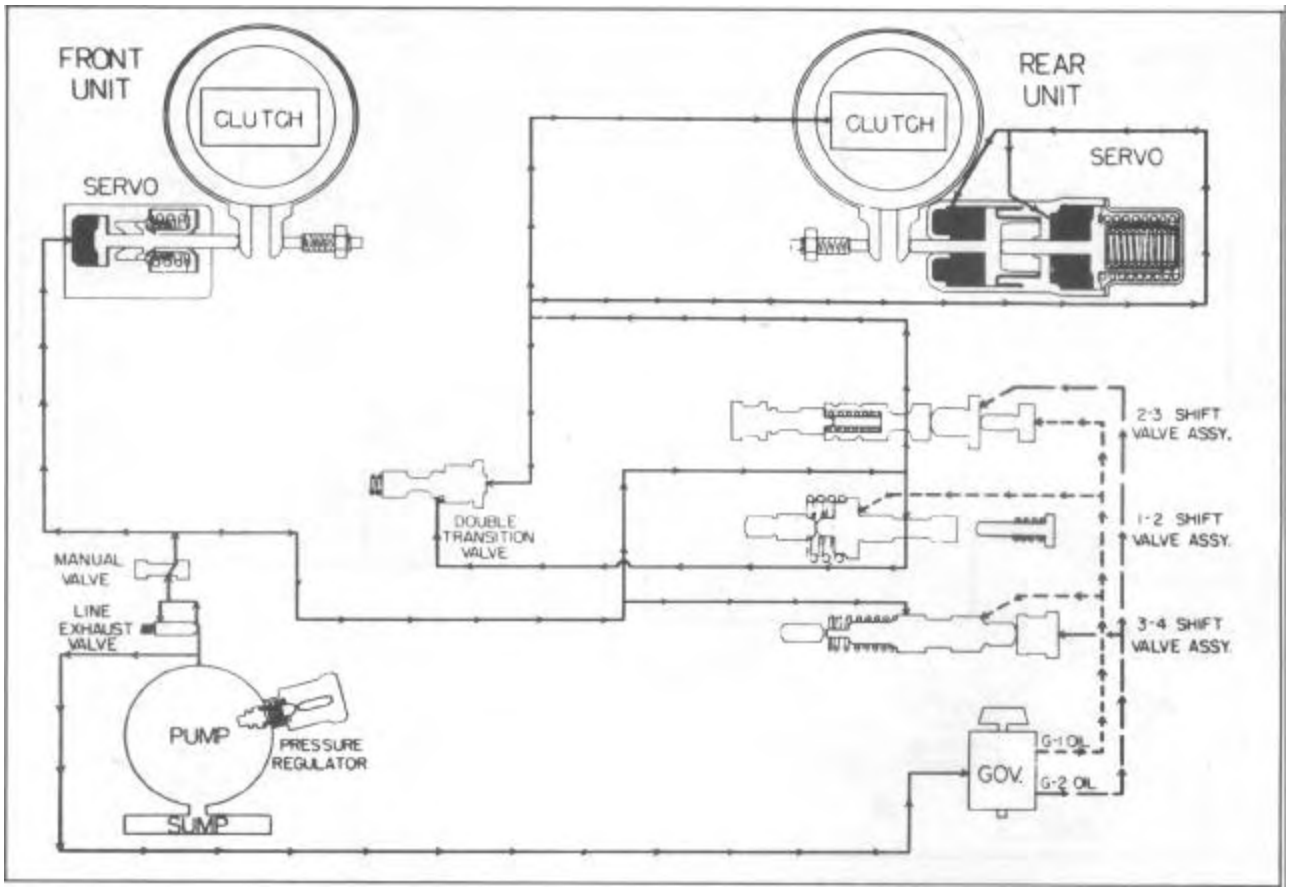


FIGURE 22—*Drive Four Third Speed*

Drive Four Third Speed

In third speed the rear clutch is applied and rear band released; the front band is applied and front clutch released.

This change takes place when vehicle speed is increased and through centrifugal force, the governor weights open still further increasing variable G—1 and G—2 oil pressure to the 2—3 governor plug and the 2—3 auxiliary valve overcoming spring pressure. Main line pressure is then directed through the 2—3 shifter valve to the rear servo releasing the band, and to the rear clutch applying the clutch. Main line pressure is also directed to the applied side of the front servo applying the band and to the double transition valve cutting off the oil pressure to the front clutch. The oil pressure that applied the front clutch exhausted out through an exhaust port in the 3—4 shifter valve.

The transmission will remain in third speed until G—1 and G—2 oil, which is being applied to the 3—4 shifter valve and 3—4 governor plug, overcome the 3—4 shifter valve spring pressure.

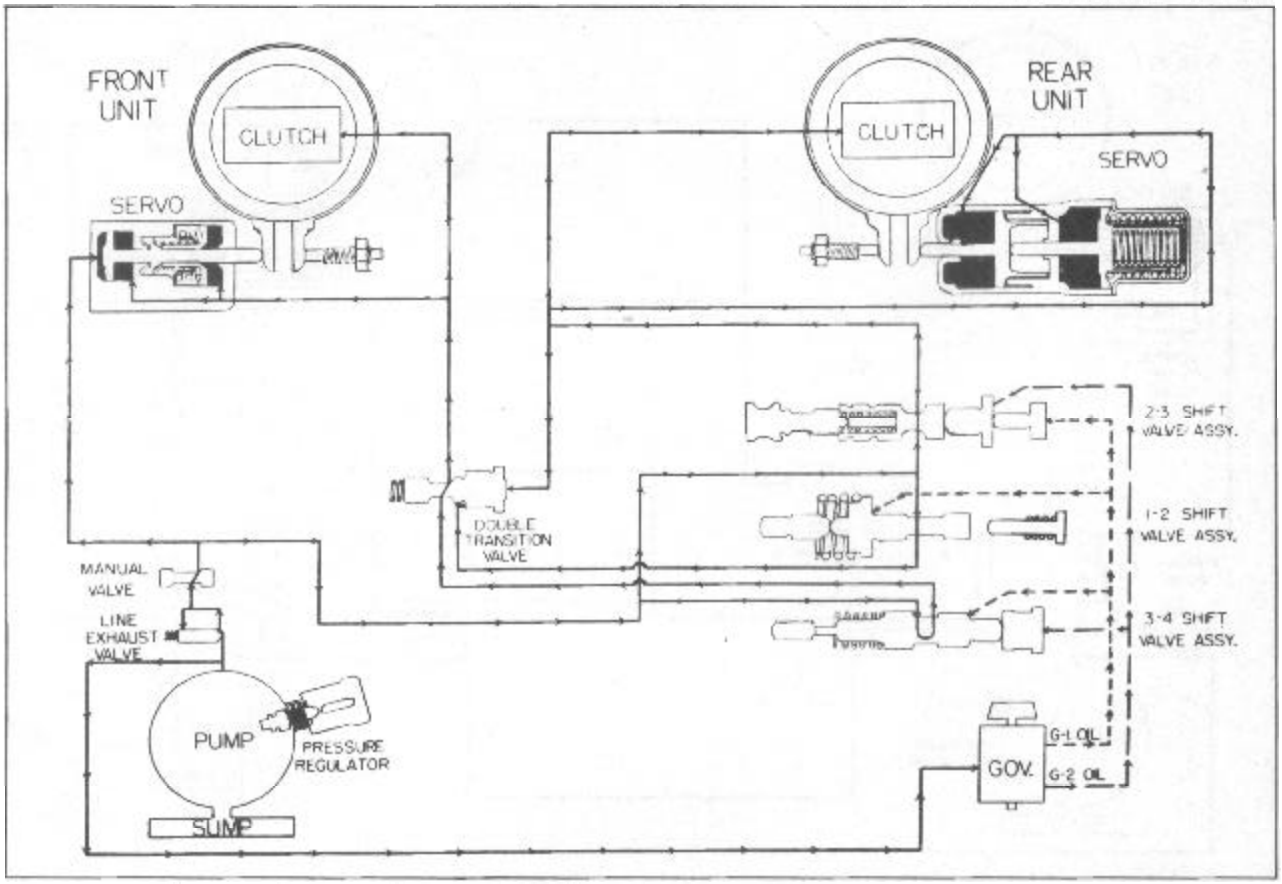


FIGURE 23—*Drive Four Fourth Speed*

Drive Four Fourth Speed

In fourth speed both clutches are applied and both bands released.

This change takes place as soon as the 3—4 shifter valve is moved in by increased governor pressure allowing main line pressure to pass through the 3—4 shifter valve and through the double transition valve to release the front band and apply the front clutch placing the transmission in fourth speed. G—1 pressure is being built up to a point where the 4—3 valve in the front servo body is positioned to block off the normal front band apply passage.

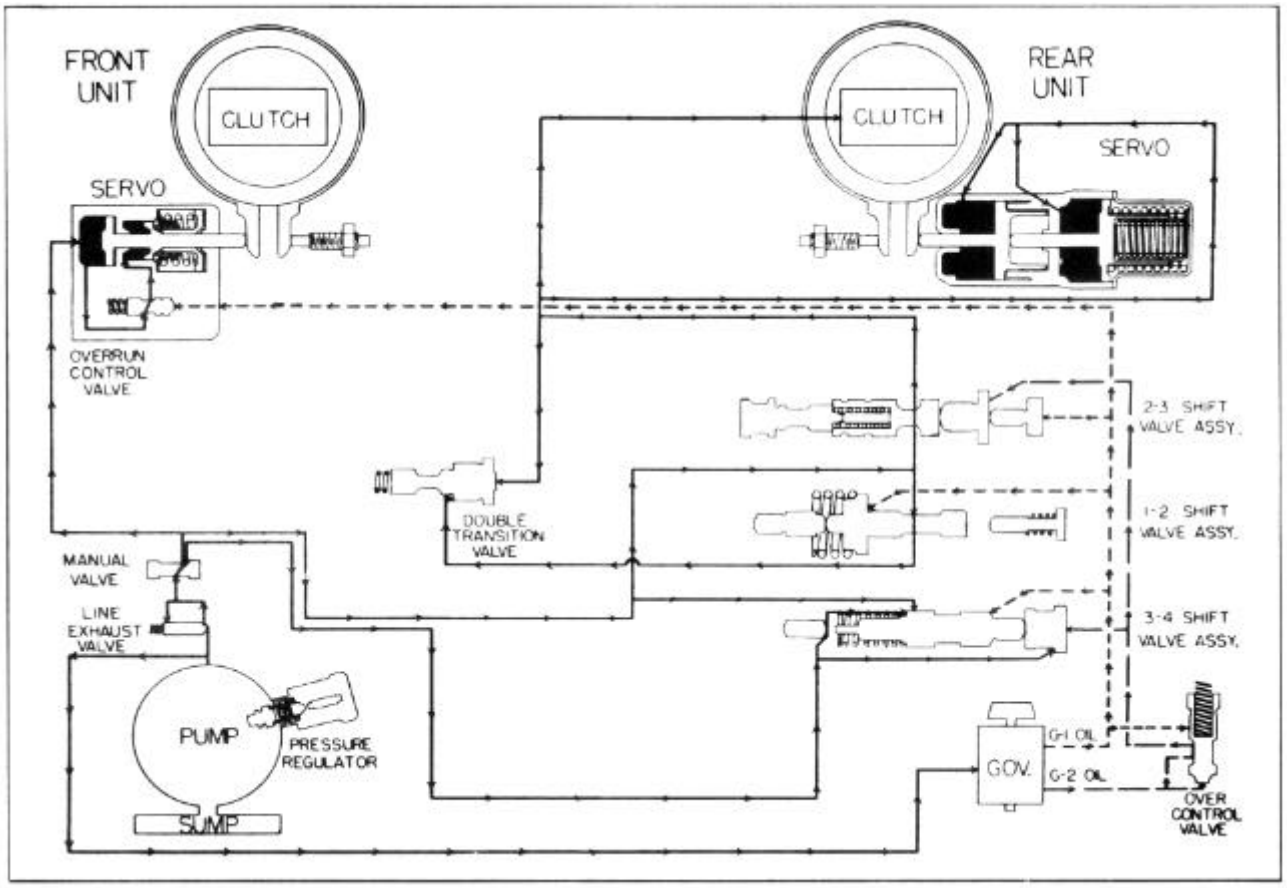


FIGURE 24—Drive Three Third Speed

Drive Three Third Speed

With the selector lever placed in the D—3 position, the front band is applied and the rear clutch applied.

Main line pressure is directed through the manual valve to the opposite end of the 3—4 shifter valve and 3—4 governor plug. Main line pressure assisted by spring pressure overcomes governor pressure holding the 3—4 shifter valve assembly in the D—3 range.

It is necessary to increase the apply force to the front band while in the D—3 range and at high vehicle speeds. With the throttle closed, compensator pressure does not exist, therefore, the over—run control valve is held in a certain position to allow main line apply pressure to take the place of compensator pressure. The over—run control valve is moved in against spring pressure by G—1 pressure directing main line pressure to the front servo compensator piston. This is desired when using D—3 range for engine braking when there is no compensator pressure to prevent the front band from slipping.

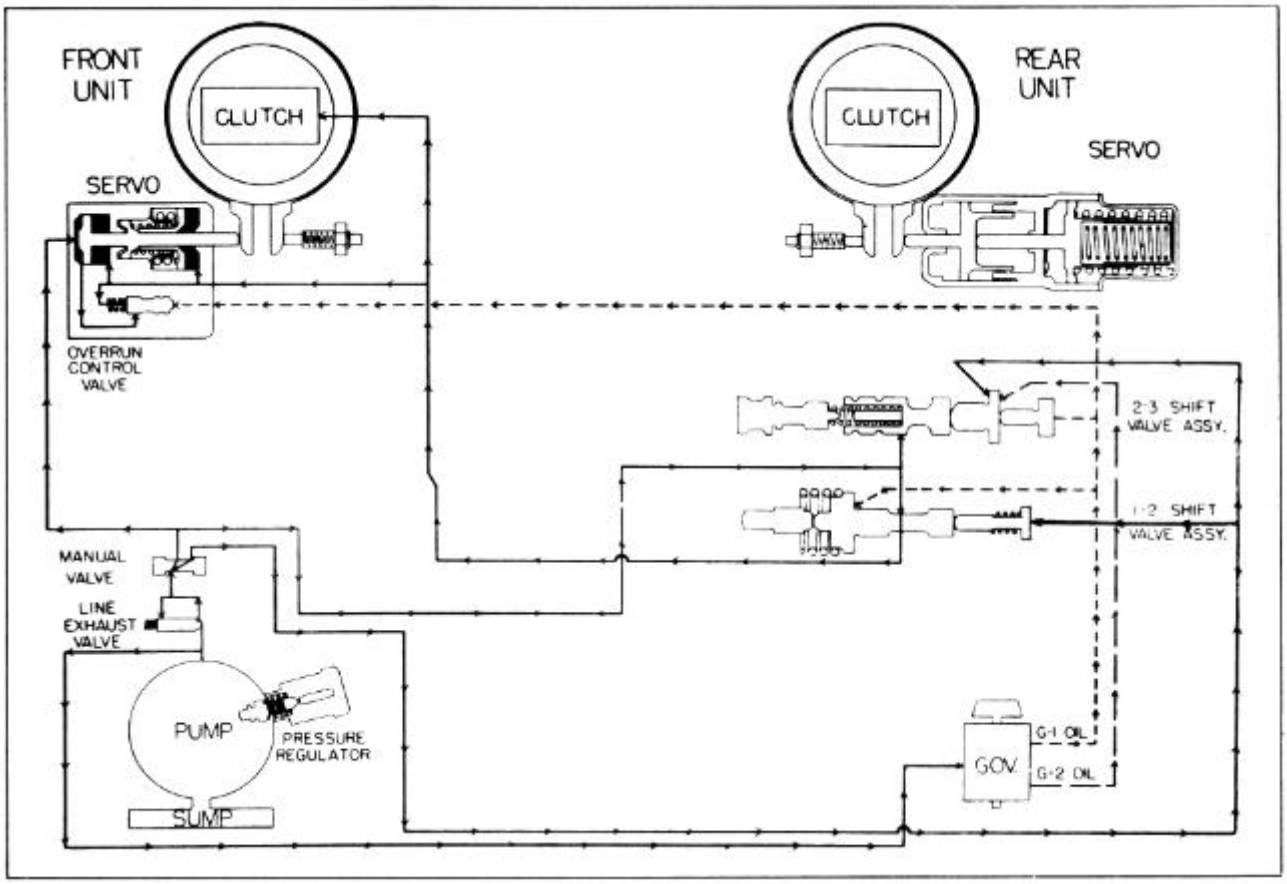


FIGURE 25—*Drive Three Fourth Speed, Overcontrol Valve*

Drive Three Fourth Speed, Overcontrol Valve

At car speeds of approximately 75 MPH, G—2 pressure will overcome spring pressure force and relocate the overcontrol valve so that G—1 pressure is directed into the G—2 passages. This is desired to give a 3—4 upshift in D—3 range to avoid excessive engine speeds.

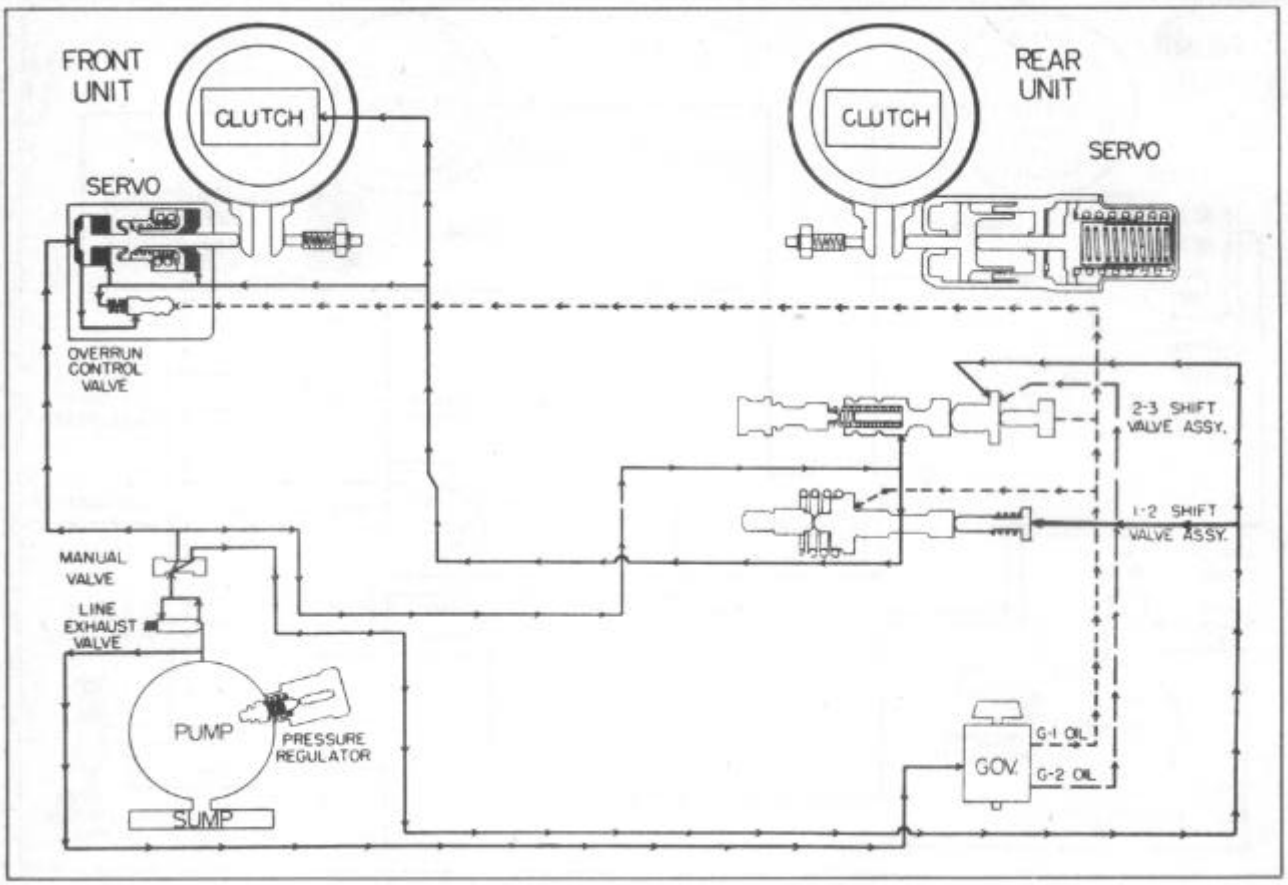


FIGURE 26—*Low Range Second Speed*

Low Range Second Speed

When the manual valve is in the low range position, main line oil is directed to the 2–1 detent plug and moves the 1–2 shift valve to the open position. This allows main line oil to pass through the 1–2 shift valve and release the front band and apply the front clutch, shifting the transmission to second speed.

At the same time, main line oil is directed behind the 2–3 auxiliary valve to hold the 2–3 shift valve closed. This prevents governor oil pressure from causing a 2–3 upshift.

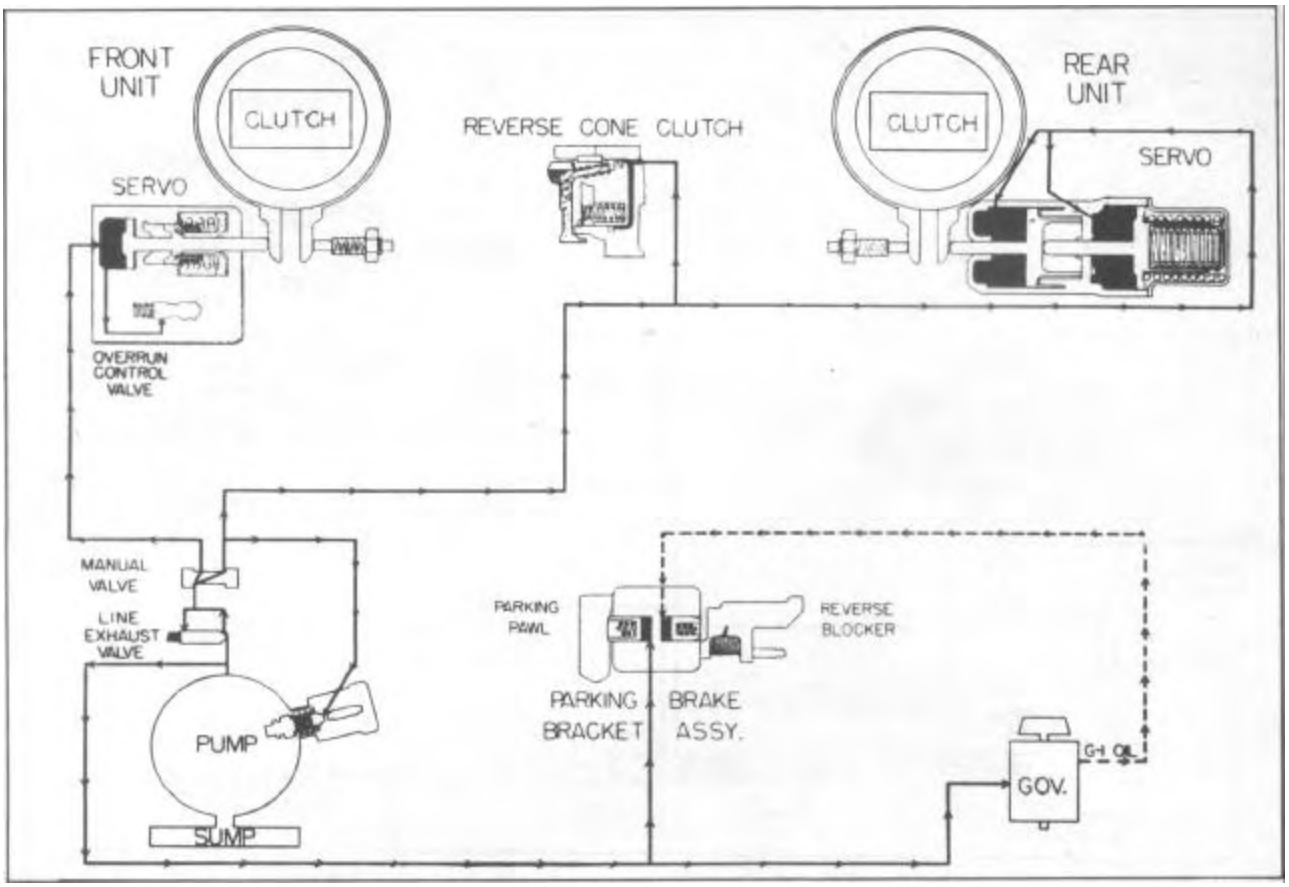


FIGURE 27—*Reverse*

Reverse

When the selector lever is moved to the R position, the manual valve directs oil to the following: Front servo to apply the band, rear servo to release the band, and reverse cone clutch to hold the reverse internal gear.

Oil is also directed through the manual valve to the reverse booster plug which is located in the pressure regulator plug assembly. With main line pressure directed against this plug the oil pump pressure is then increased to a minimum of 125 lbs. P.S.I. to prevent slippage of the front band and reverse clutch. Main line pressure is also directed to the parking blocker piston located in the parking bracket assembly to keep the parking pawl from engaging the external teeth of the reverse internal gear while the vehicle is moving in reverse.

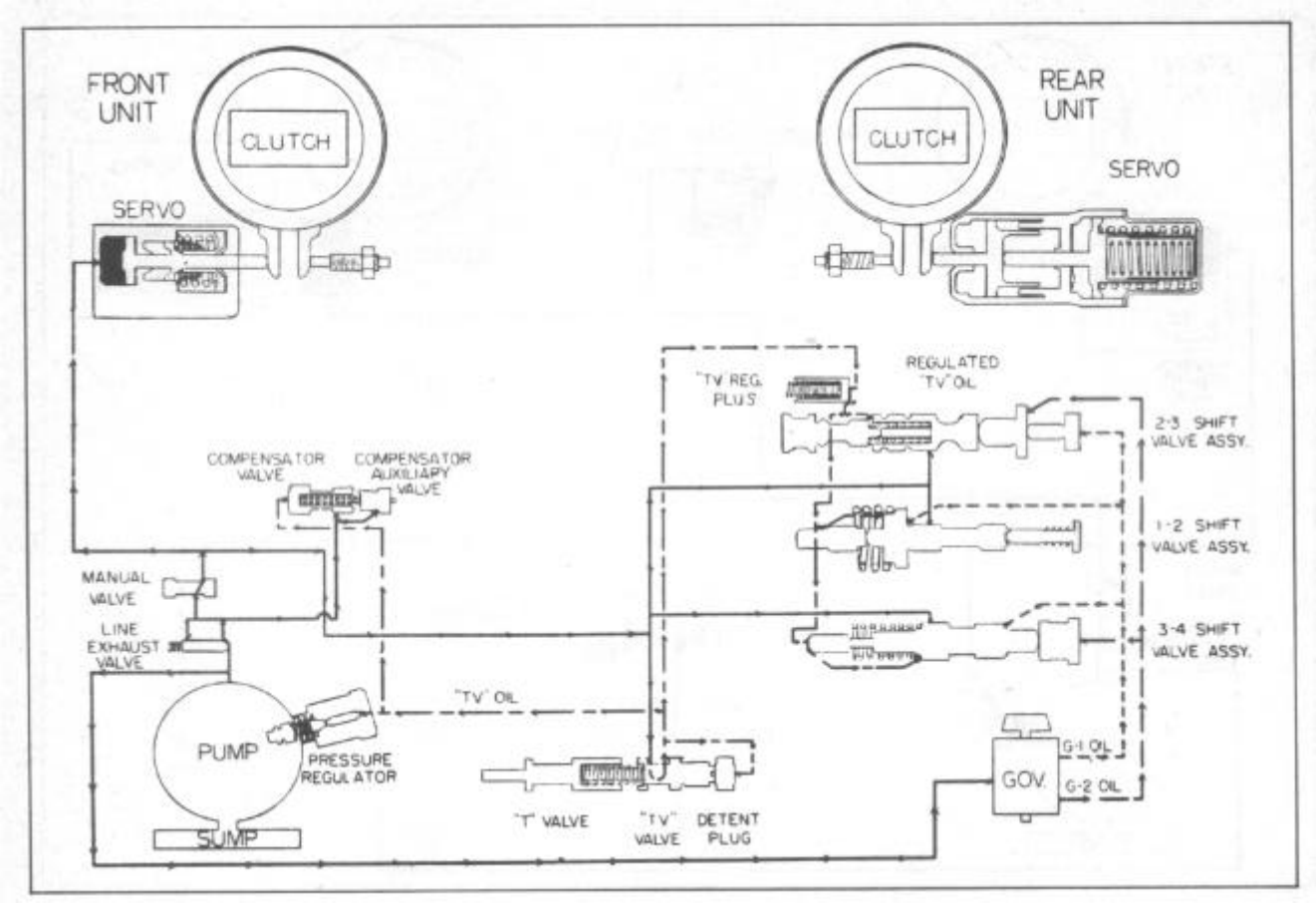


FIGURE 28—*TV and Regulated TV Modulated Line Pressure*

TV and Regulated TV Modulated Line Pressure

Throttle pressure originates at the throttle valve and varies according to carburetor throttle opening by means of linkage from the accelerator pedal. When depressing the accelerator pedal, linkage to the throttle lever on the side of the transmission accuates the inner throttle lever moving the "T" valve. The "T" valve opens the throttle valve through spring force and oil from the manual valve flows through an opening at the throttle valve. This oil under pressure acts on the area of the throttle valve to oppose spring force which opened the throttle valve. The throttle valve then becomes a balanced valve; balanced between spring force and throttle pressure on this area. As a result of this action throttle pressure varies with accelerator pedal position from zero pressure to full line pressure at full throttle.

Throttle valve pressure is not used directly on the shifter valves because the TV regulator valve located in the front valve body regulates TV pressure. Throttle pressure acting against the end of this valve is designed to regulate the pressure passing the valve. Throttle pressure assists spring force pressure to hold the shifter valves closed opposing governor pressure, which opens the valves. Governor pressure will open the shifter valve at low car speeds and the transmission will shift at low car speeds. Higher shift points are attained through greater throttle opening because governor pressure has to be built up higher to overcome throttle and spring force pressure to move the shifter valves.

Throttle pressure passes through the 3—2 detent plug and acts on the "T" ball check, 2—3 shifter valve, 1—2 shifter valve, 1—2 regulator plug, 3—4 regulator plug, and the 3—4 shifter valve when all shift valves are closed.

Throttle valve pressure is also directed to the TV plug in the pressure regulator cap as in the HydraMatic transmission, varying line pressures are required in order to hold engine torque and, at the same time, to produce smooth shifts for all throttle openings

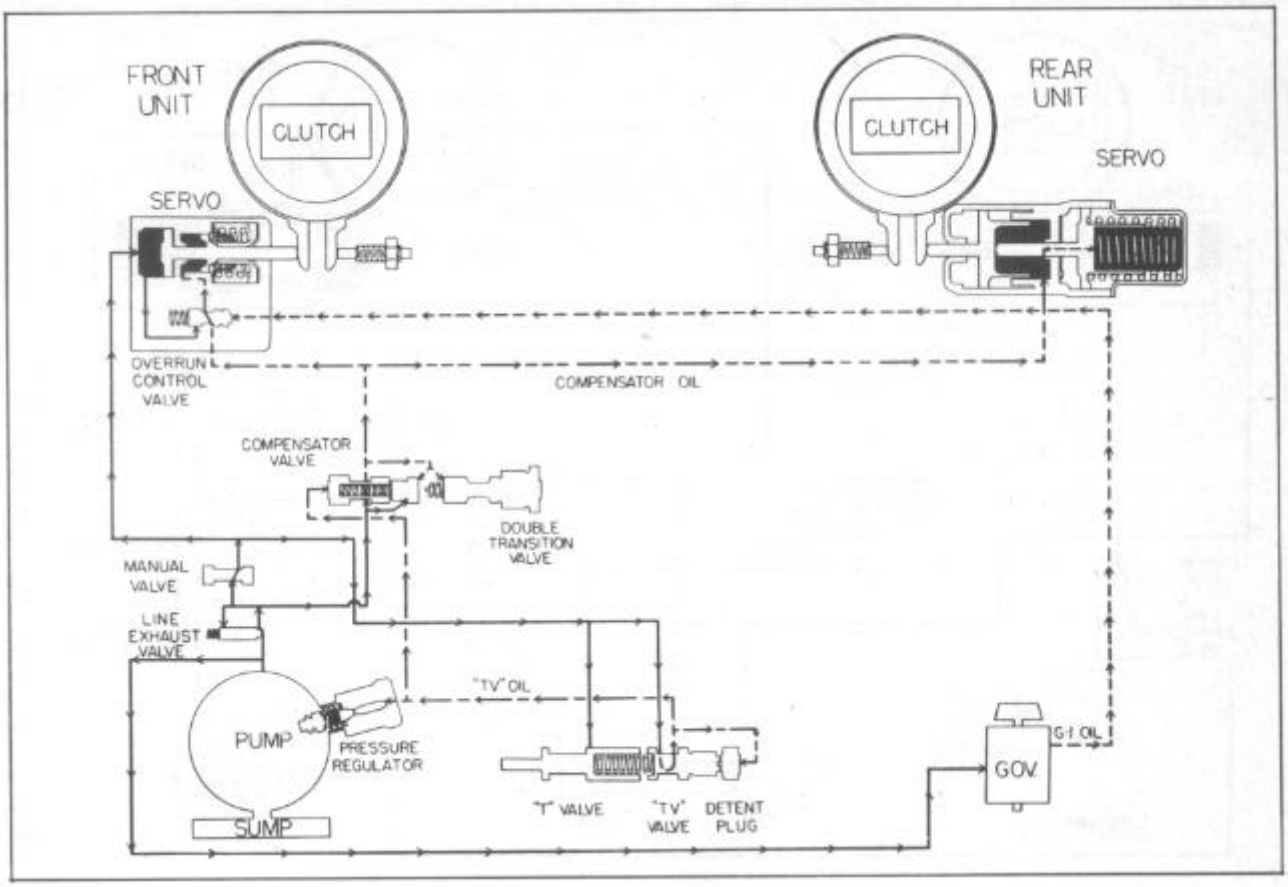


FIGURE 29—*Compensator Line Pressure*

Compensator Line Pressure

An additional pressure is required under heavy throttle and increased engine torque to prevent the bands from slipping. This pressure is obtained by the use of a compensator valve directing a variable regulated oil pressure to both the front and rear servos.

The compensator valve is opened by TV pressure and opens a port for main line pressure between the lands of the compensator valve. Compensator pressure against the large land of the compensator auxiliary plug closes the compensator valve against throttle pressure. The compensator valve then becomes a balanced valve, balanced between TV pressure plus main line and compensator pressure plus spring pressure. As a result of this action, compensator pressure varies from "0" to full main line dependent on TV pressure. Compensator pressure also assists in controlling the double transition valve on a full throttle downshift.

At speeds under 20 MPH, G—1 pressure is not great enough to overcome spring pressure and the over—run control valve is positioned to allow compensator pressure to pass through and act on the compensator piston in the front servo. At speeds above 20 MPH, G—1 pressure overcomes spring pressure and positions the over—run control valve to allow main line pressure to pass through and act upon the compensator piston.

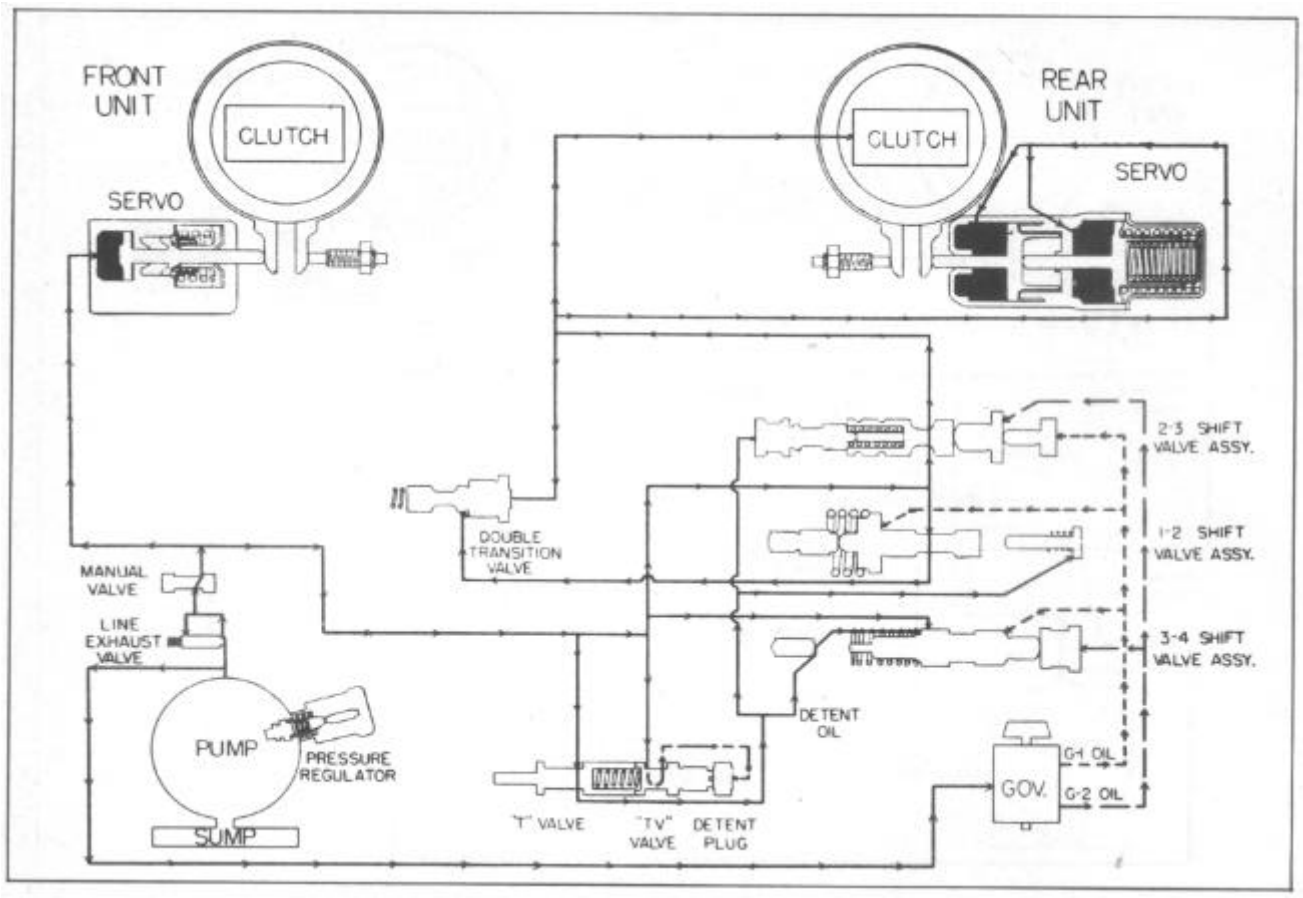


FIGURE 30—*Forced Four—Three Downshift*

Forced Four—Three Downshift

When the transmission is down shifted from fourth to third speed, the front unit is changed from direct drive to reduction, therefore, the front band is applied and the front clutch released.

It is sometimes desirable, while driving in fourth speed, to shift the transmission into third speed for rapid acceleration.

The 4—3 downshift is accomplished through the "T" valve (part of the throttle valve assembly) and a detent plug. The detent plug is located at the end of the throttle valve assembly.

When the accelerator pedal is depressed to wide open throttle position the throttle valve comes into contact with the detent plug where resistance can be felt in the pedal. Depressing further will overcome the resistance and move the detent plug.

The "T" valve then reaches a position where it opens a port directing main line pressure back of the 3—4 shifter valve, forcing it closed. This cuts off the pressure to the front unit clutch and it is disengaged by spring pressure. Pressure is also cut off from the release side of the front servo and pressure on the apply side of the servo applies the band. The transmission is then in third speed. Holding the accelerator pedal fully depressed, main line pressure with spring pressure is sufficient to hold the valve closed until a high vehicle speed is reached. If the accelerator pedal is released the shift from third to fourth will occur when governor pressure overcomes throttle pressure.

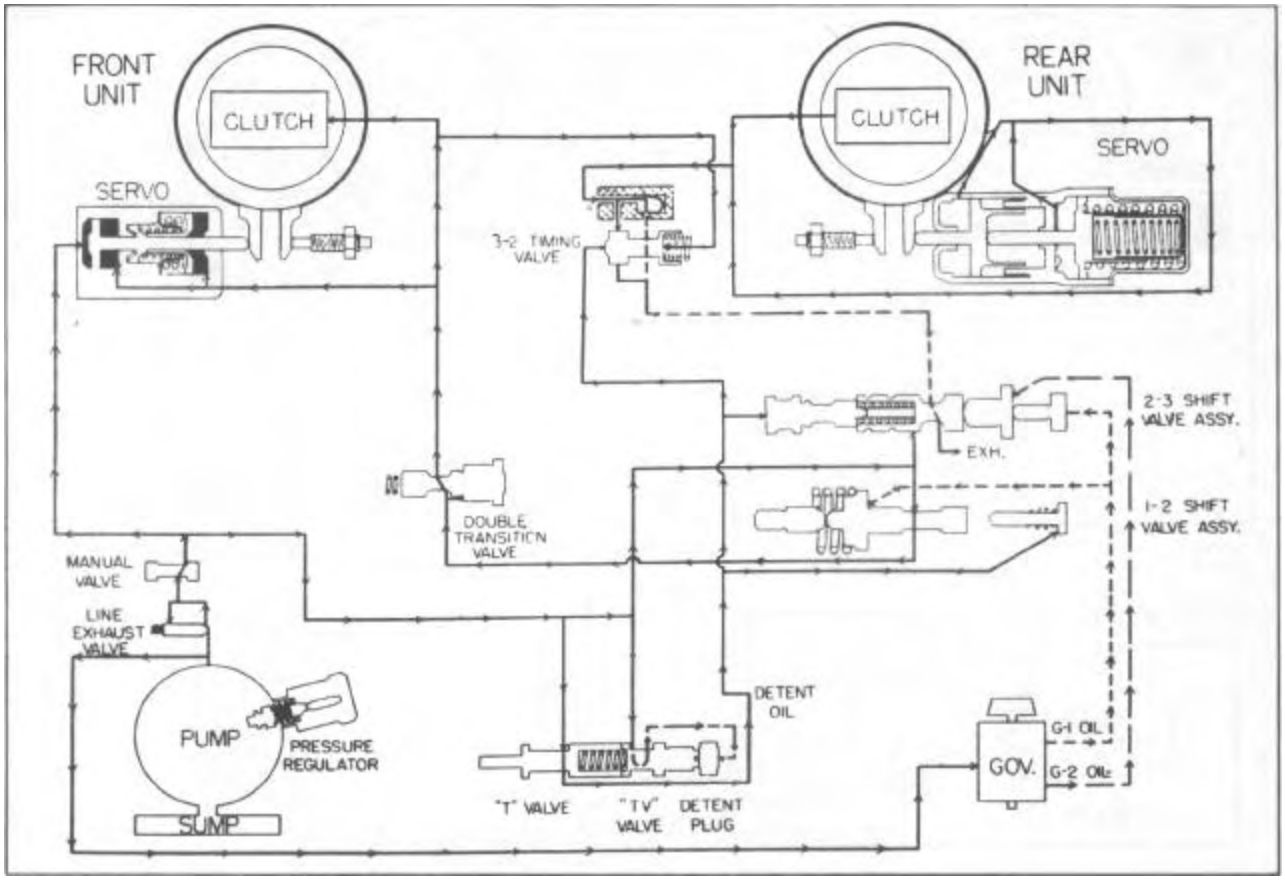


FIGURE 31—Forced Three—Two Downshift

Forced Three—Two Downshift

Approximately below 19 MPH a forced 3–2 downshift may be obtained. Pressing the accelerator to the floor will open the "T" valve and the following operation will occur:

"T" pressure acting on the 3–2 detent plug plus 2–3 shifter valve spring force overcomes governor pressure and closes the 2–3 shifter valve. "T" pressure also relocates the 3–2 timing valve which causes the exhaust of rear band release and rear clutch apply pressure to he metered through the .057" orifice of the bypass valve. Note that this exhaust still takes place at the 2–3 shifter valve. Metering the exhaust of these pressures (RBR–RCA) delays the application of the rear band until front clutch apply oil is obtained. This prevents a rough 3–2 downshift.

The 3–2 downshift is the same in both D–4 and D–3 drive ranges.

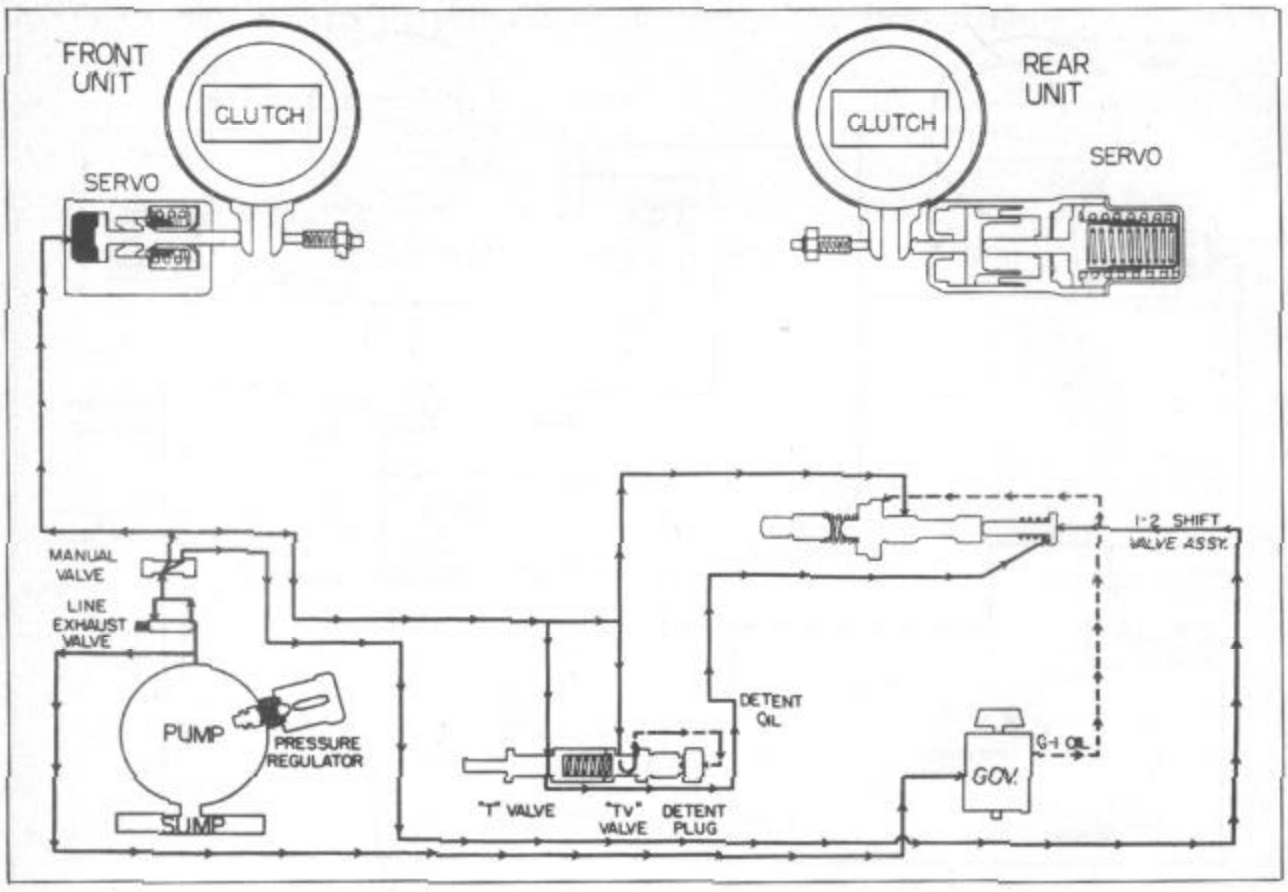


FIGURE 32— *Forced Two—One Downshift*

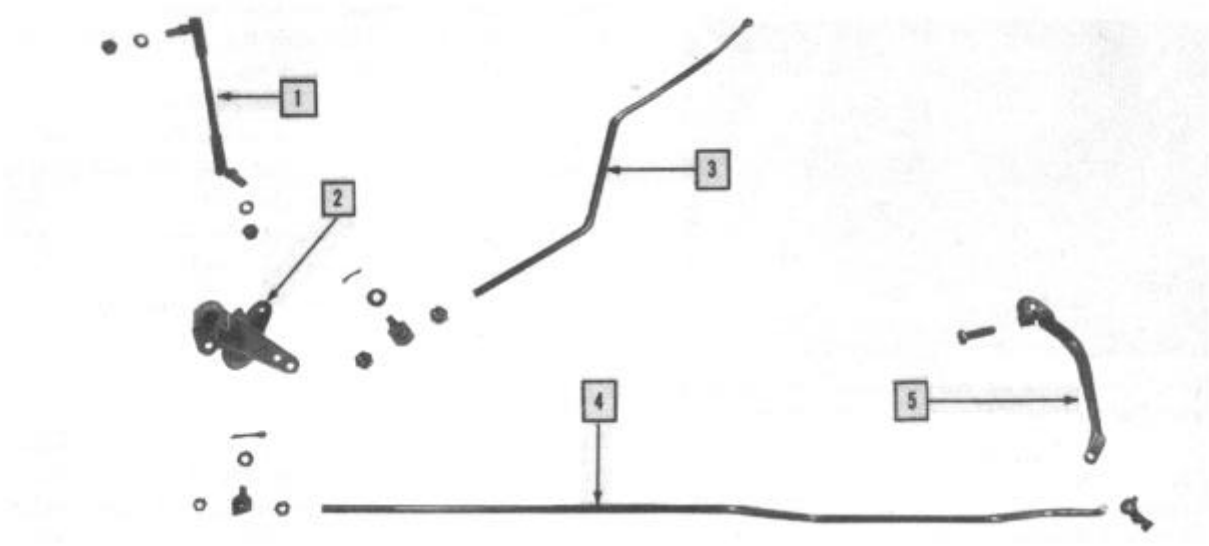
Forced Two—One Downshift

In second speed, the front clutch is applied and the rear band is applied. When making a forced 2–1 downshift pressing the accelerator pedal all the way down, main line pressure is directed from the "T" valve to the 2–1 detent plug where assisted by spring pressure overcoming main line pressure from the manual valve moving the 2–1 detent plug to a closed position.

The front unit is where the change takes place by releasing the clutch and applying the band, therefore, the transmission having both bands applied is in 100% reduction or first speed.

When the vehicle speed is under 10 MPH, governor pressure can be overcome by full TV pressure on the 1–2 shift valve closing the 1–2 shift valve placing the transmission in first speed.

ADJUSTMENTS WITH TRANSMISSION IN CAR



1. Intermediate Control Rod
2. Bell Crank
3. Accelerator Control Rod
4. Throttle Control Rod
5. T.V. Lever

FIGURE 33—*Throttle Control Linkage—"Hornet" Series Shown*

THROTTLE CONTROL LINKAGE

CAUTION: Linkage operation will not be satisfactory if binding or excessive wear exists.

Adjust engine idle speed at 490 to 510 RPM ("Rambler" 450) (with air conditioning have compressor running) with engine at normal operating temperature, transmission warm and selector lever in neutral position.

"Hornet" Series

With the carburetor set at idle, aligning pin J–2544 should fit freely in the bell crank lever and the hole in the boss of the cylinder block. If the aligning pin does not index with the lever and hole in the boss of the cylinder block, remove the carburetor to throttle rod lever clevis pins and readjust the rods. Then recheck and adjust the carburetor idle adjusting screws.

Disconnect the throttle rod at the left side of the transmission case (Fig. 34).

Loosen the two locking nuts on the TV rod trunnion at the bell crank. Adjust the trunnion so that the TV rod fits freely in the hole of the trunnion. Then shorten the TV rod 1/16" or approximately two turns by backing off the rear nut and tightening the front nut.

1. Throttle Lever
2. Shift Control Rod Clevis
3. Shift Control Rod Lever
4. Shift Control Rod
5. Throttle Rod

FIGURE 34—*Remove Throttle Rod from Throttle Lever*

NOTE: *This adjustment is necessary to insure correct throttle control valve operation.*

Clean the machined surface at the back of the transmission case and check the lever using Tool J—2195 flush against the surface with the edge of the gauge against transmission side cover. The gauge rod should fit freely in the hole of the TV lever (Fig. 35).

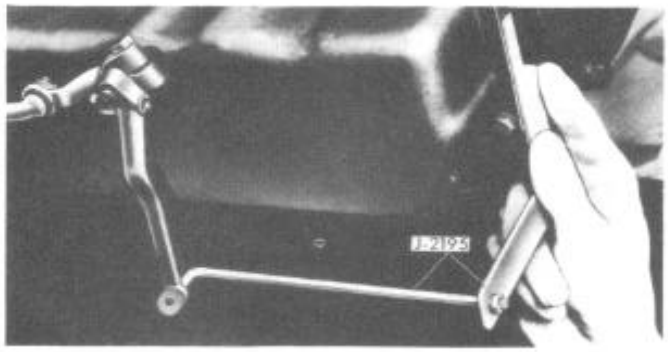


FIGURE 35—Checking Adjustment of Throttle Lever Location—"Hornet" and "Wasp" Series

If the gauge does not pass through the hole in the lever freely, use Bending Tool J—3310 (Fig. 36) and bend to proper location and connect the rod to the lever.

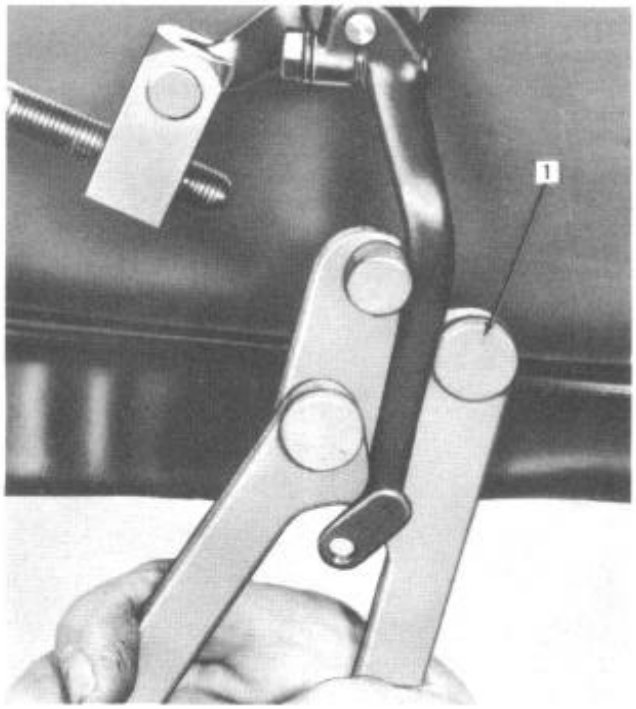


FIGURE 36—Bending Throttle Lever "Wasp" Series

With the carburetor set at idle, use aligning pins J—2544 at the rear upper throttle lever and lower bell crank. One pin is used to adjust the carburetor rods to the rear upper throttle lever, and one pin is used to adjust the vertical rod between the upper carburetor control lever and the lower bell crank. Adjust rods so that both pins index at the rear upper throttle lever and lower bell crank, and hole in the boss on the cylinder block.

Disconnect the throttle rod at the left side of transmission case as shown in Figure 34.

Clean the machined surface at the back of the transmission case and check the lever using Tool J—2195 flush against the surface with the edge of the gauge against the transmission side cover. The gauge rod should fit freely in the hole of the TV lever (Fig. 35).

Loosen the two locking nuts on the TV rod trunnion at the transmission. Then adjust the trunnion so that the TV rod fits freely in the hole of the trunnion. Then shorten the TV rod IA 6" or approximately two turns by backing off the front nut and then tighten the rear nut.

NOTE: *This adjustment is necessary to insure correct throttle control valve operation.*

"Rambler" Series

With the carburetor set at idle, disconnect transmission throttle rod at throttle lever at side of transmission.

Clean the machined surface at back of transmission case and place throttle lever checking gauge J—2545—C flush against surface with edge of gauge against transmission side cover. The throttle lever must align with the notch in the gauge (Fig. 37).

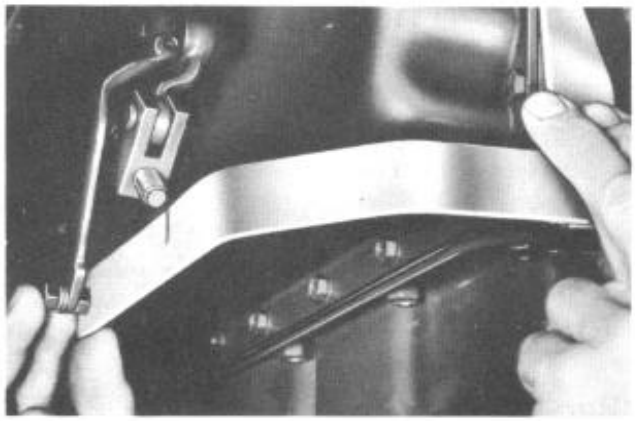


FIGURE *37—Checking Adjustment of Throttle Lever Location—"Rambler" Series*

If gauge does not align with throttle lever, use Bending Tool J—3310 and bend to proper location (Fig. 36).

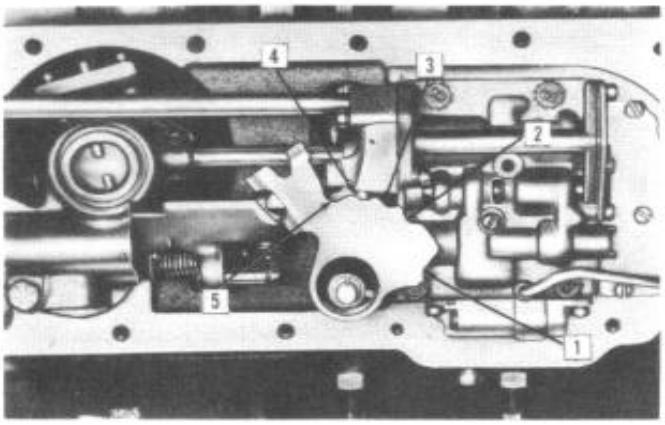
Adjust transmission throttle rod to fit freely on throttle lever; then shorten the rod approximately three turns.

NOTE: *This adjustment is necessary to insure correct throttle control valve operation.*

SELECTOR LEVER LINKAGE ADJUSTMENT

CAUTION: *Linkage operation will not be*

satisfactory if binding or excessive wear exists.
Place selector lever in the D—3 position and set the operating lever against the stop on the housing bracket.
Remove the clevis pin from the gear shift control rod at side of transmission case and remove clevis from shift lever (Fig. 35).
Place the transmission outer shift lever in the D—3 range position (Fig. 38).



1. Reverse
2. Low
3. D—3
4. D—4
5. Neutral

FIGURE 38—Location of Shift Positions

Adjust the clevis so that the clevis pin passes freely through hole in lever.

NOTE: *Be sure that the operating lever is against the stop on the housing bracket.*

After the adjustment has been completed, lengthen the control rod two full turns and replace the clevis pin and cotter key.

NOTE: *This adjustment will insure proper detent location in the transmission together with a full reverse engagement.*

BAND ADJUSTMENTS IN CAR

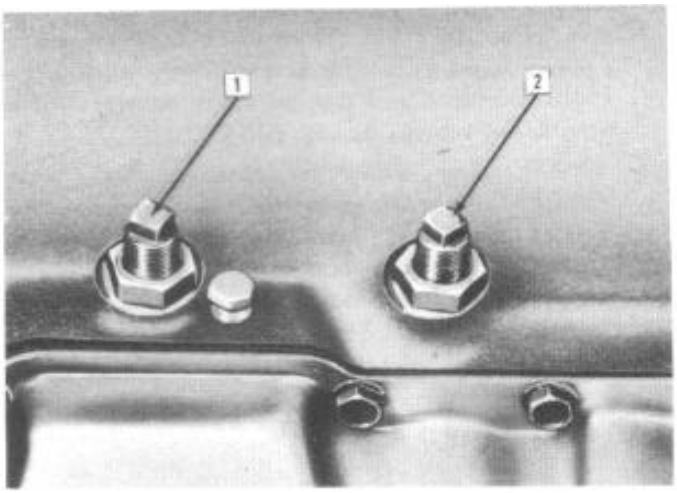
Procedure for Adjusting Hydra—Matic Bands Externally

CAUTION: *If tool No. J—2681 and tachometer are not available, adjust bands by removing oil pan. Do not attempt to adjust bands externally without tool No. J—2681 and tachometer.*

Set hand brake firmly and block front wheels with wheel blocks to prevent car running forward during adjustment.
Remove accelerator pedal, floor mat, and adjusting hole cover.
Start engine and allow it to run until temperature is normal (choke and fast idle off) before proceeding.
Connect electrical tachometer to engine.
Position selector lever in "D" range.
Adjust carburetor idle speed to 700 RPM.

Front Band

1. Use band adjusting tool No. J—2681 and loosen front band adjusting screw lock nut (Figs. 39 and 40).



1. Front Band Adjusting Screw
2. Rear Band Adjusting Screw

FIGURE 39—Band Adjusting Screws

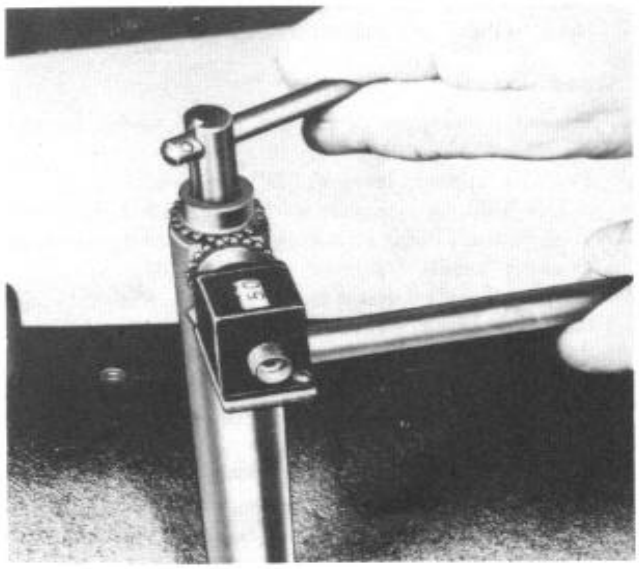


FIGURE 40—*Adjusting Front Band Using Tool 1—2681*

2. Loosen band adjusting screw until engine speed increases to 900—1,000 RPM (front drum now spinning freely).

NOTE: *If engine fails to increase speed to 900—1,000 RPM, this indicates that the band is slipping badly under normal driving conditions. The bottom pan should be removed and the bands and drums inspected*

for damage. If no apparent damage is evident, adjust both bands using tools 1—1693 and 1—5071 as outlined under Front and Rear Band Adjustment—Oil Pan Removed. Then it will not be necessary to reset the bands externally after the pan is installed.

3. Tighten band adjusting screw slowly until engine returns to 700 RPM (front drum now stopped).
4. Loosen band adjusting screw slowly until engine speed increases and tighten again slowly until engine speed returns to 700 RPM.

NOTE: *The object in loosening and retightening the screw is to locate the exact point at which the band stops the drum from spinning. At this point, wait 30 seconds. I f engine speed increases, tighten screw 1/10 of a turn. Wait 30 seconds and if engine speed again increases, tighten screw 1/10 of a turn more. Repeat this procedure until engine speed remains at 700 RPM for at least 30 seconds.*

5. Set counter on tool to 00.
6. While holding the lock nut stationary with long handle of tool, tighten adjusting screw exactly 7.7 turns with short handle (counter will read 7.7).
7. Hold adjusting screw stationary with short handle and tighten lock nut with long handle.

Rear Band

Repeat operations 1, 2, 3, 4 and 5 under heading Front Band.

Position selector lever in "N" position.

While holding lock nut stationary with long handle of tool, tighten band adjusting screw exactly two turns with short handle (counter will read 2.0).

Position selector lever in "D" range.

Hold adjusting screw stationary with short handle and tighten lock nut with long handle.

Reset engine idle speed at 490 to 510 (Rambler 450) RPM (air conditioning compressor running) (selector lever in "N" position).

Turn off ignition. Install adjusting hole cover, floor mat, and accelerator pedal.

NOTE: Although external band adjustments are outlined, internal band adjustment is recommended.

Front and Rear Band Adjustment (Transmission Oil Pan Removed)

Place front end of car on car jacks.

Remove oil drain plug and drain transmission fluid.

Remove engine support cross member.

Remove oil pan.

Remove accelerator pedal and front compartment mat.

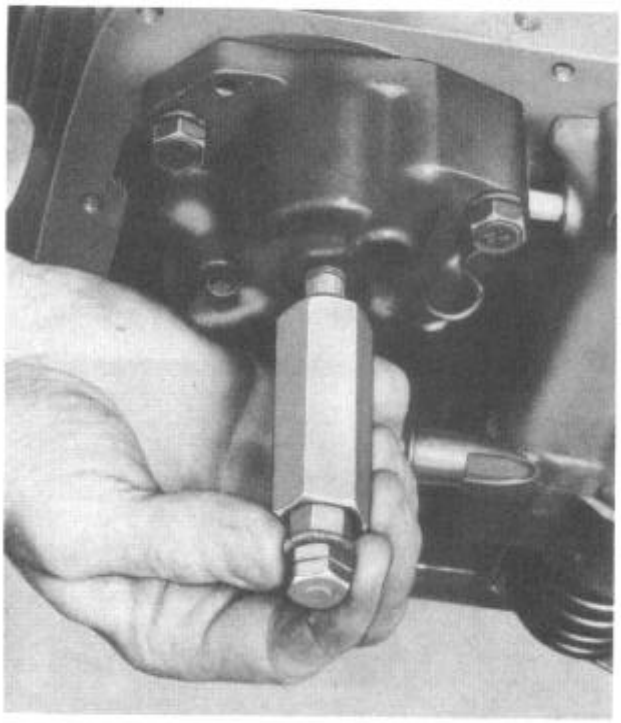


FIGURE 41—*Adjusting Front Band With Tool 1—1693*

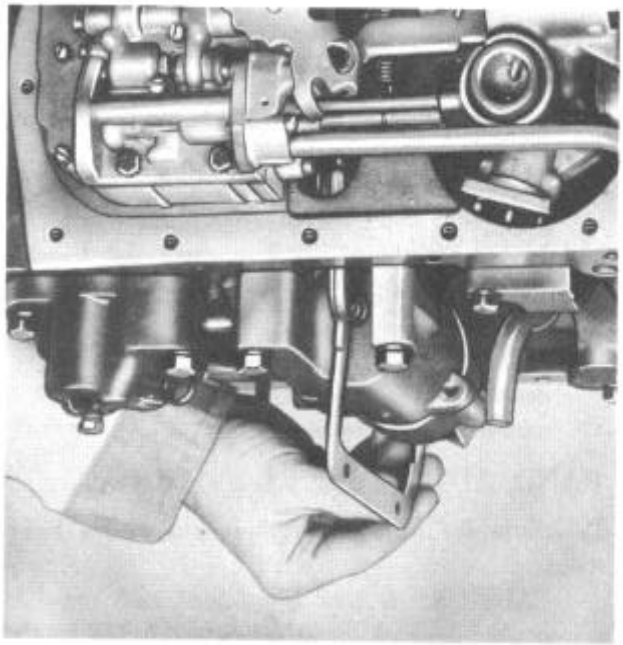


FIGURE 42—Adjusting Rear Band

Remove band adjusting floor hole cover.

Loosen both servo band adjusting screw lock nuts.

To Adjust Front Band

Loosen front band adjusting screw approximately five (5) turns.

Remove pipe plug from front servo.

Loosen "hex" adjusting screw of gauge J—1693 until approximately 1/8" of threads are exposed above gauge body (Fig. 41).
Screw gauge into front servo, tightening by HAND only.

Tighten the "hex" adjusting screw with fingers until the stem of gauge is felt to JUST touch the piston in front servo.

With a wrench continue tightening the adjusting screw five full turns from the point where it was felt that stem of gauge JUST touched the piston.

Tighten the band adjusting screw until knurled washer on gauge is just free to turn.

NOTE: *While tightening screw, be sure band is lined up over drum.*

Tighten band adjusting screw lock nut securely while holding adjusting screw.

Loosen "hex" adjusting screw at least five turns and then remove gauge from servo. Install pipe plug in servo.

To Adjust Rear Band

Place servo gauge J—5071 on finished surface of accumulator body having leg of gauge resting on servo stem (Fig. 42).

Back off adjusting screw until face of actuating lever is well away from face of gauge.

Tighten band adjusting screw until face of band actuating lever just touches gauge.

CAUTION: *Do not go beyond adjustment. If adjusting screw is accidentally turned beyond adjustment, loosen two or three turns and repeat adjustment.*

Tighten band adjusting screw lock nut securely while holding adjusting screw.

MINOR SERVICES AND REPAIRS

FLUID CAPACITY, DRAINING AND REFILLING

Capacity

Eleven (11) quarts of fluid are required to refill the "Hornet" Series transmission after draining the torus cover and oil pan. Twelve (12) quarts of fluid are required to refill after the transmission has been disassembled and overhauled. The "Wasp" and "Rambler" Series require eight and one—half (8—1/2) and nine and one—half (9—1/2) quarts. Use approved HydraMatic fluid "AQ—ATF."

Draining and Refilling

The fluid must be drained from both the fluid coupling and the transmission case, after operation, before the fluid has a chance to cool.

Drive car on lift or over pit.

Remove the inspecton hole cover in the lower flywheel housing.

Rotate the flywheel until the drain plug is lined up with inspection hole cover. The fluid coupling drain is a hex head pipe plug located near the outer diameter of the torus cover and a 7/16" six (6) point socket wrench should be used to remove it.

Remove the hex head drain plug at rear of the transmission oil pan.
Inspect the oil pan drain plug gasket to ascertain that it will not leak.

When fluid coupling and transmission case are completely drained, replace and tighten both drain plugs. (The oil pan drain plug should be torque tightened 35 to 45 ft. lbs. The fluid coupling drain plug should be tightened 6 to 7 ft. lbs.).

Pour five (5) to seven (7) quarts of "AQ—ATF" approved Hydra—Matic Fluid into the transmission. Be sure container, spout, or funnel is clean.

Set the selector lever in "N" (neutral) position and apply the hand brake. Run the engine at a speed equivalent of 20 MPH for several minutes. This will fill the fluid coupling.

Reduce the engine speed to slow idle (carburetor off fast idle step).

Add sufficient "AQ—ATF" approved fluid to bring the fluid level up to below the "L" mark on the fluid level indicator. Again, run the engine at a speed equiva—

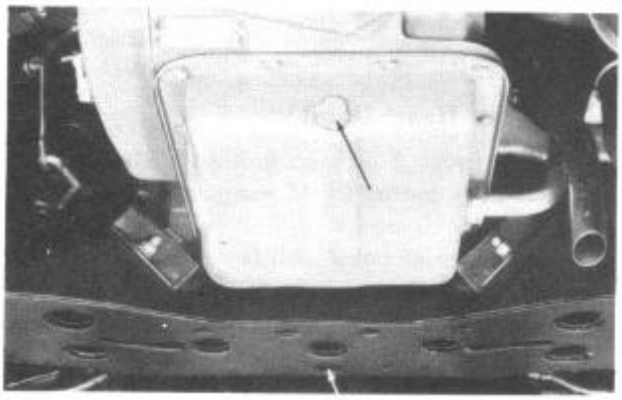


FIGURE 43—*Hydra—Matic Transmission Drain Plugs*

lent to 20 MPH for three minutes to heat the transmission fluid to near its normal operating temperature, which is indicated by a rise in fluid level to near the "F" mark due to expansion. With engine idling and transmission warm (approximately 150°F), make a final check to be certain the transmission is not overfilled.

CAUTION: *Do not overfill, foaming will result.*

Stop the engine. Replace the fluid level indicator.

Flushing of the Hydra—Matic transmission with anything other than "AQ—ATF" approved fluid is not recommended.

TRANSMISSION OIL PAN DRAIN PLUG GASKET

Remove drain plug gasket and inspect oil pan and drain plug for nicks and burrs.

Soak new gasket in water until it is sufficiently pliable to install on drain plug.

CAUTION: *Do not enlarge hole of gasket.*

Install gasket on drain plug and allow it to dry; then replace drain plug in transmission oil pan.

REAR BEARING RETAINER OIL SEAL REPLACEMENT

Place car on stands supporting body at rear of side sills.

Drain Hydra—Matic fluid.

Disconnect hand brake cable at bell crank or yoke.

Disconnect the brake hose bracket from floor pan.

On the "Hornet" and "Wasp" Series, disconnect torque tube from transmission rear bearing retainer and move rear axle assembly to the rear. Slide universal joint from output shaft.

On the "Rambler" Series, disconnect the rear spring front brackets from the floor pan and disconnect shock absorbers from rear axle tubes. Slide the universal joint from output shaft.

Remove the oil seal from the bearing retainer

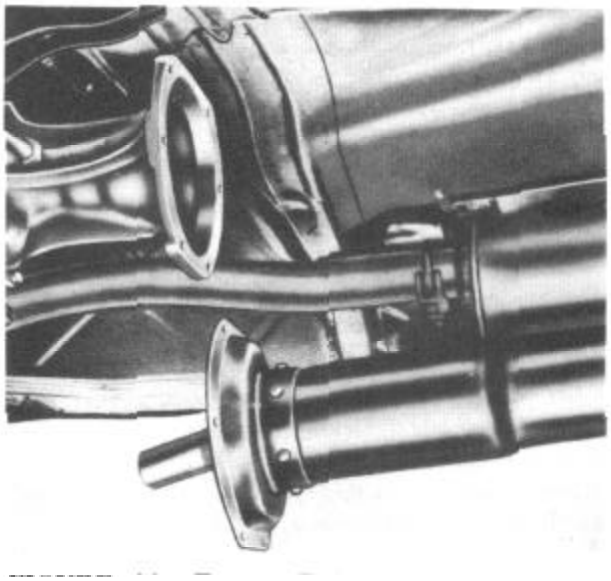


FIGURE 44—*Torque Tube Disconnected From Rear Bearing Retainer*

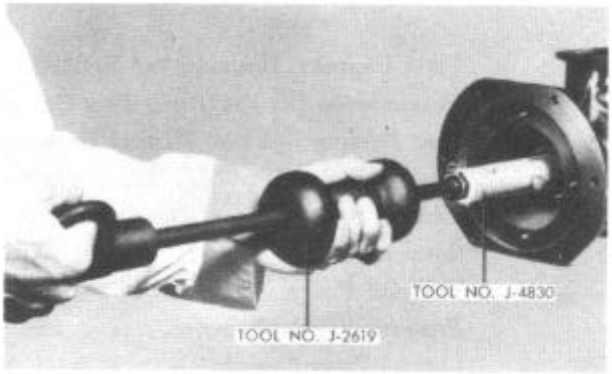


FIGURE 45—*Removing Rear Bearing Retainer Oil Seal*

with tool J—4830 oil seal remover and J—2619 slide hammer (Fig. 45).

Inspect bearing retainer seal seat and output shaft for nicks and burrs.

Apply Hydra—Matic fluid to oil seal.

Apply sealing compound (Permatex No. 3 Gasket Cement) to outside of seal.

Install rear bearing retainer oil seal with tool J—1354 (Fig. 46).

Inspect and refill the transmission to correct level with Hydra—Matic fluid.

FRONT AND REAR SERVO Removal

Fold front compartment mat back to uncover band adjusting floor hole cover and remove cover.

Loosen both adjusting band screw lock nuts.

Loosen both band adjusting screws approximately five turns to release servo spring tension.

FIGURE 46—*Installing Rear Bearing Retainer Oil Seal*

Place car on stand or hoist and drain transmission oil into clean container.

Remove oil pan and gasket and remove oil pan screen and governor oil delivery pipe (Fig. 47).

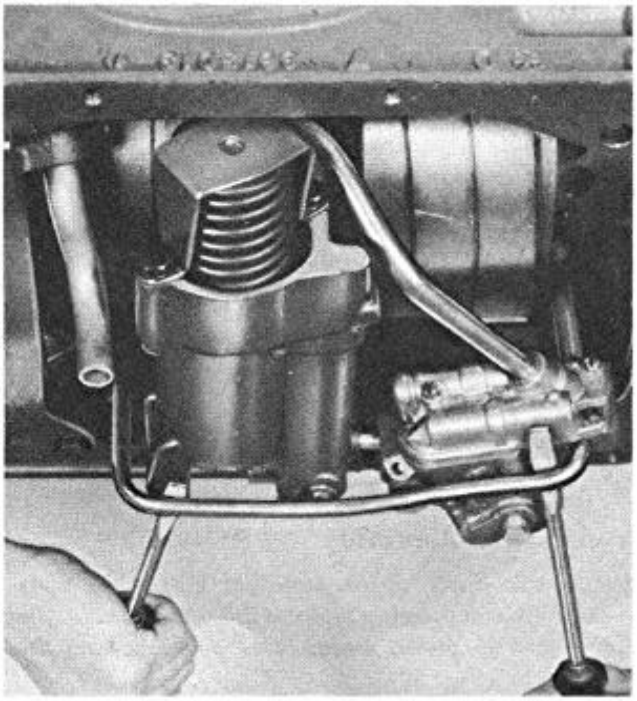


FIGURE 47—*Remove Governor Oil Delivery Pipe*

Remove front and rear servo attaching bolts; then remove rear servo oil transfer pipe and remove front servo, rear discharge pipe, and front pump delivery pipe.

Front Servo Disassembly

Remove three release cylinder to servo body cap screws and lock washers. Remove release cylinder, booster spring and retainer (Fig. 48) .

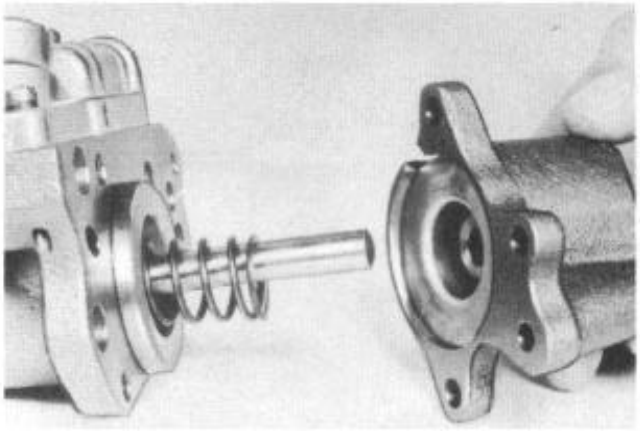


FIGURE 48—*Removing Front Servo Release Cylinder*

Remove front servo apply spring and apply piston (Fig. 49).

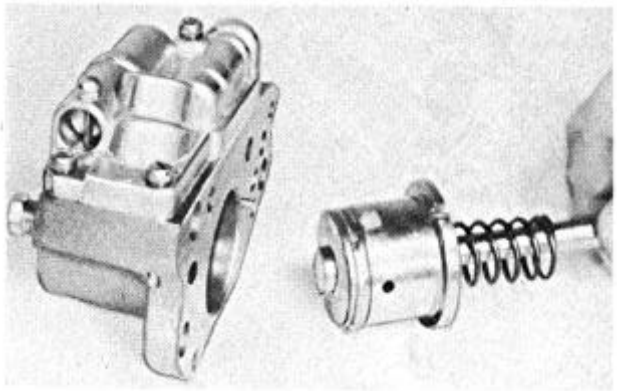


FIGURE 49—*Removing Front Servo Spring and Apply Piston*

Remove front servo valve body, rear pump check ball and spring. Remove the 4—3 shift valve from the front servo body (Fig. 50).

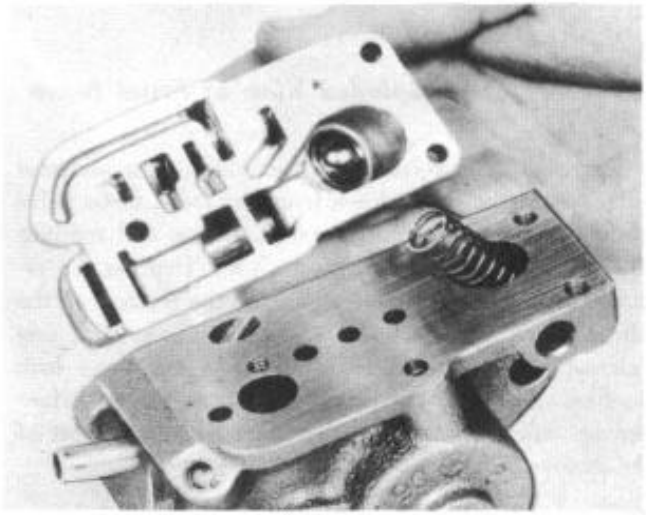


FIGURE 50—*Removing Front Servo Valve Body*

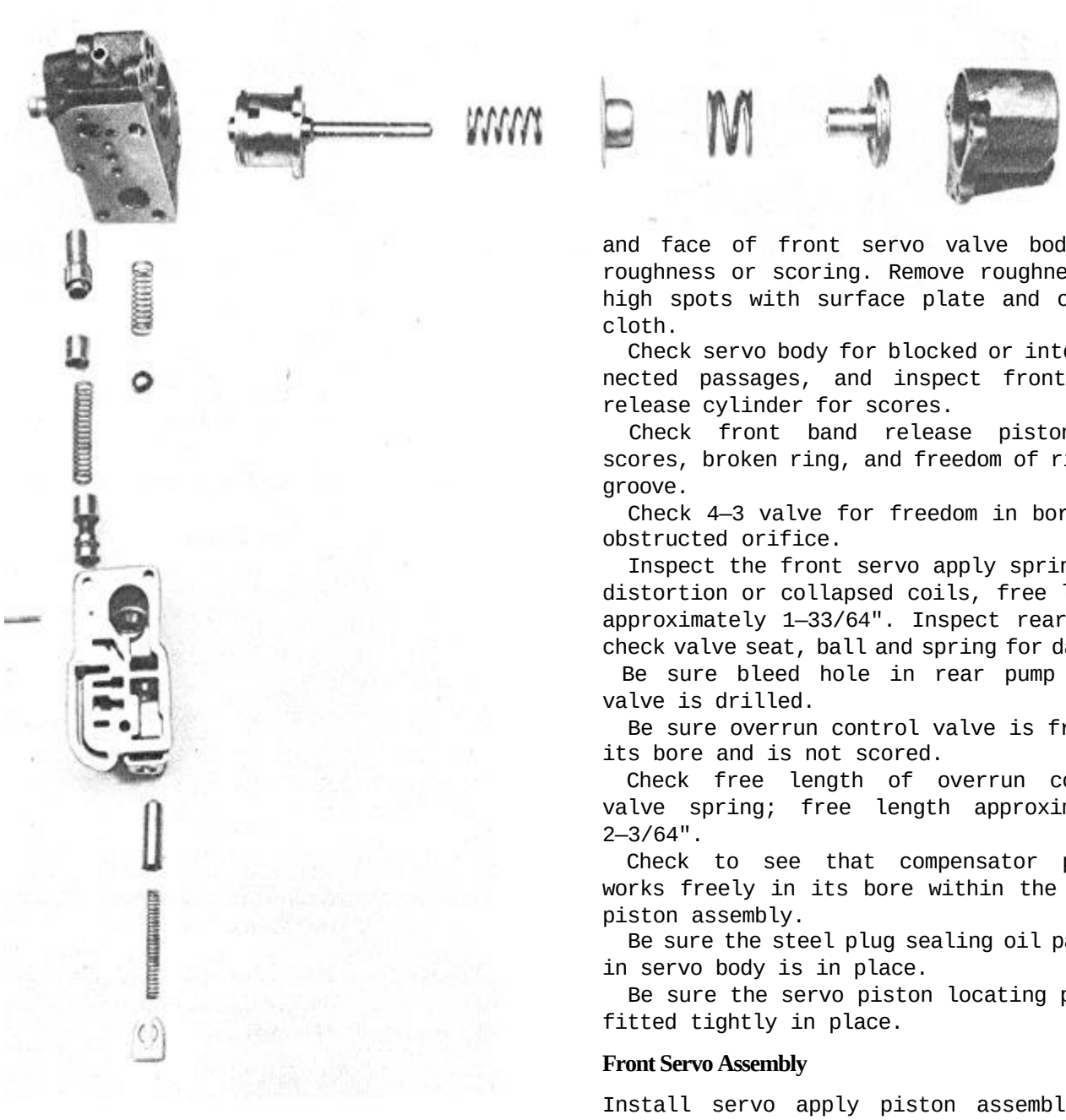


FIGURE 51—*Exploded View of Front Servo*

Remove the overrun control valve, line exhaust valve, springs and retainers from the front servo valve body. The overrun control valve, spring, and retainer are held in the valve body by a pin. Depress the retainer with a screw driver to release the tension on the pin and remove pin with long nose pliers. The line exhaust valve is held in place by a retaining lock washer. Depress the spring with a screw driver through the slot in the washer, and lift washer out of the groove in the valve body.

Front Servo Inspection

Check both machined surfaces of front servo and face of front servo valve body for roughness or scoring. Remove roughness or high spots with surface plate and crocus cloth.

Check servo body for blocked or interconnected passages, and inspect front band release cylinder for scores.

Check front band release piston for scores, broken ring, and freedom of ring in groove.

Check 4—3 valve for freedom in bore and obstructed orifice.

Inspect the front servo apply spring for distortion or collapsed coils, free length approximately 1—33/64". Inspect rear pump check valve seat, ball and spring for damage. Be sure bleed hole in rear pump check valve is drilled.

Be sure overrun control valve is free in its bore and is not scored.

Check free length of overrun control valve spring; free length approximately 2—3/64".

Check to see that compensator piston works freely in its bore within the servo piston assembly.

Be sure the steel plug sealing oil passage in servo body is in place.

Be sure the servo piston locating pin is fitted tightly in place.

Front Servo Assembly

Install servo apply piston assembly into servo body by carefully compressing and starting oil seal ring. Be sure groove in piston assembly is positioned on the locating pin (Fig. 52).

Install servo apply spring.

Install release piston, booster spring, and retainer in release cylinder.

Install release cylinder assembly to apply piston stem and fasten release cylinder with the three cap screws tightening to 6—8 foot lbs. torque (Fig. 53).

Install the overrun control valve, spring, retainer, and pin in servo valve body.

Install line exhaust valve, spring, and washer retainer in valve body.

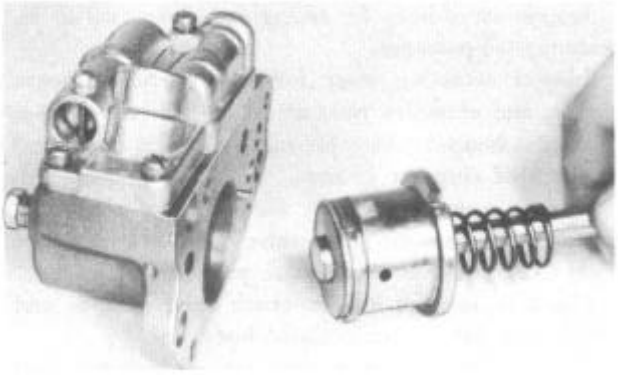


FIGURE 52—*Installing Apply Piston Assembly*

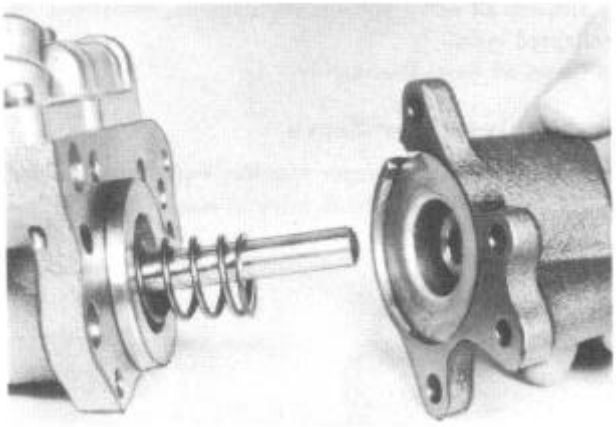


FIGURE 53—*Install Release Cylinder to Servo Body*

Install the 4—3 valve in front servo body. Place the rear pump release check ball and spring in place and assemble valve body to servo body tightening the three filister head screws securely.

Rear Servo Disassembly

Place rear servo assembly in a press and lower ram to rest on servo spring retainer. Then remove the two retainer to body bolts using 1/2" end wrench while keeping ram of press against retainer (Fig. 54).

Release press slowly until springs are free; then remove retainer, servo spring, compensator piston, and spring. Remove accumulator body and piston assembly from servo body (Fig. 55).

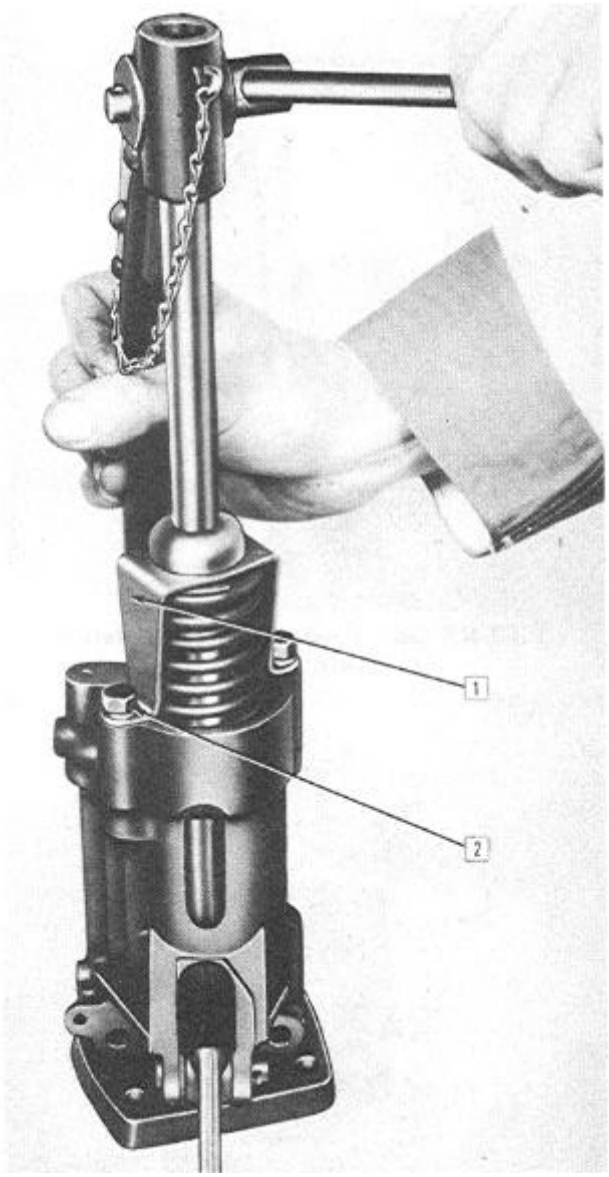
Place accumulator body on a vise, protecting body on the vise jaws, and tap accumulator piston through accumulator, apply spring and body (Fig. 56).

Remove booster spring and booster piston from servo body being careful not to "cock" the piston in bore while removing (Fig. 57).

Rear Servo Inspection

Inspect exhaust valve and bore for scores and freeness of valve in bore.

Be sure gasket is not damaged.



1. Servo Spring Retainer
2. Retainer Bolts

FIGURE 54—*Removing Servo Spring Retainer*

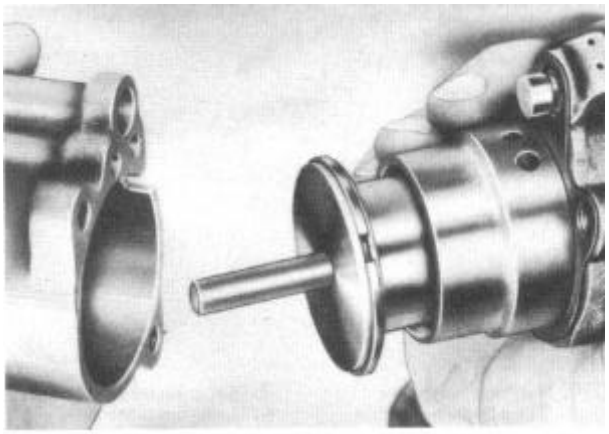


FIGURE 55—*Removing Accumulator Body and Piston Assembly*

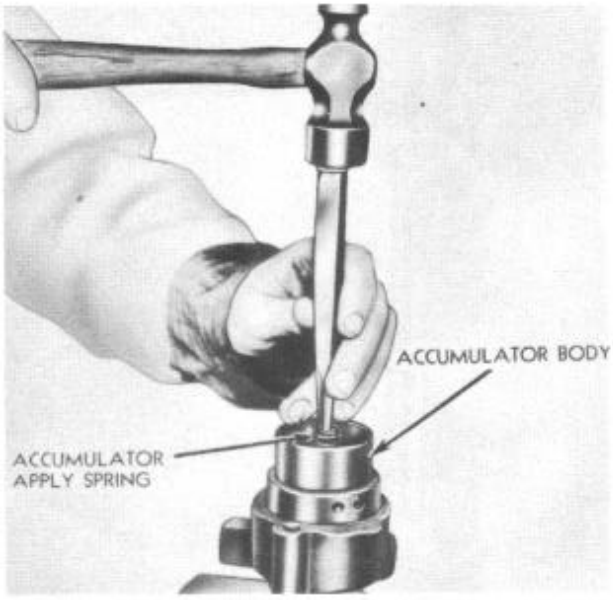


FIGURE 56—*Removing Accumulator Apply Spring*

FIGURE 57—*Removing Booster Piston*

Inspect servo body for scores and obstructed or interconnected passages.

Inspect actuating lever for free operation, worn socket, and excessive wear at actuating lever pin.

Inspect booster piston for scores, broken rings, and freedom of rings in grooves.

Inspect accumulator body for scores or obstructed passages. Be sure the check valve is not broken or the rivet loose and that check valve plunger is free.

Check to see that hole in check valve is open and valve seats flat on accumulator body.

Inspect accumulator piston for scores, damaged ring, freedom of ring in groove, or obstructed passage in stem.

Inspect all servo springs for damage, distortion, or collapsed coils.

Clean all parts thoroughly.

Assembly—Rear Servo

If check valve and plunger requires replacement, drive out the rivet holding check valve in place (Fig. 59).

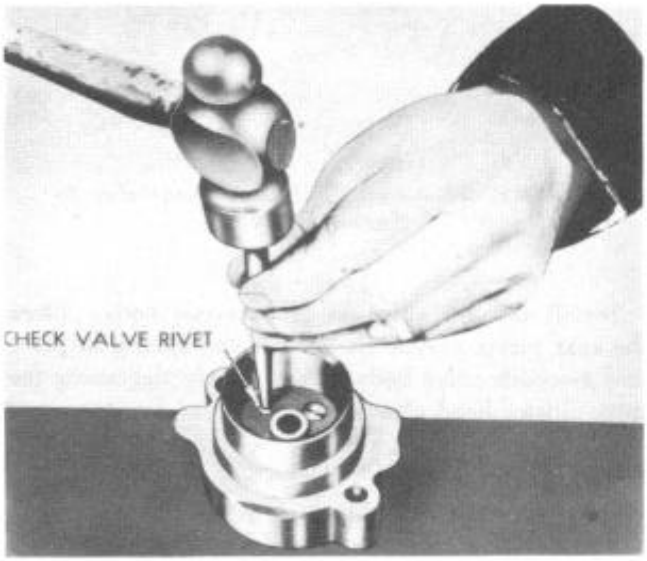
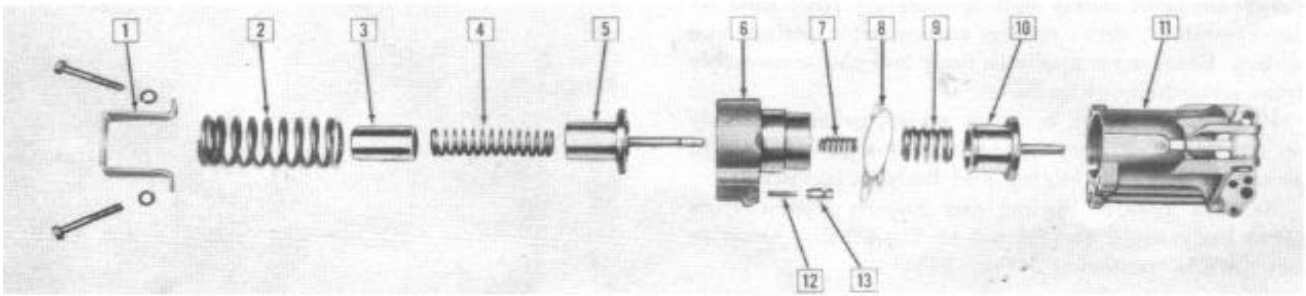


FIGURE 59—*Removing Check Valve Rivet*



1. Spring Retainer
2. Rear Servo Spring
3. Compensator Piston
4. Compensator Spring
5. Accumulator Piston
6. Accumulator Body
7. Accumulator Apply Spring
8. Gasket
9. Booster Snoring
10. Booster Piston
11. Servo Body
12. Exhaust Valve Spring
13. Exhaust Valve

FIGURE 58—*Exploded View of Rear Servo*

Remove check valve and plunger and clean and inspect body (Fig. 60).

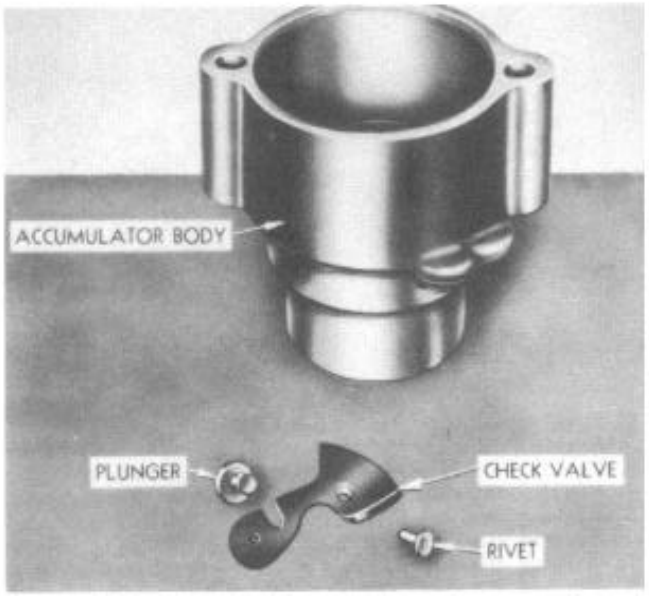


FIGURE 60—*Check Valve, Plunger, and Rivet*

Install plunger and check valve placing notch in groove in plunger. Insert rivet through valve and body then peen rivet (Fig. 61). Be sure plunger and valve are free.

NOTE: *Small bleed hole in valve should be over hole in body.*

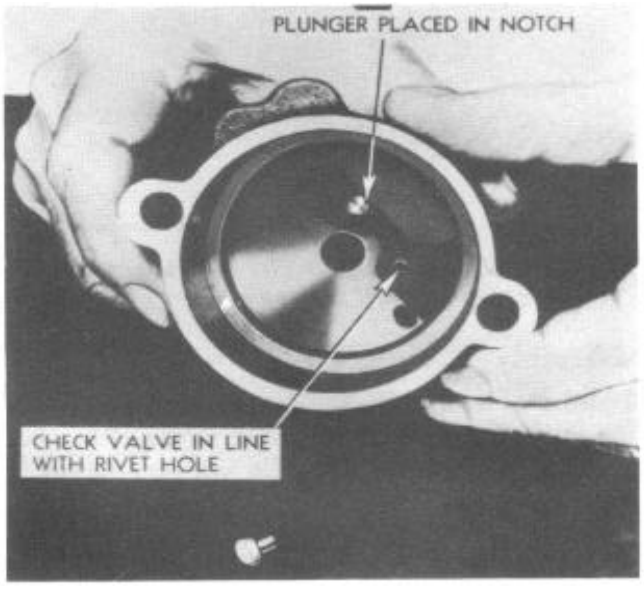


FIGURE 61—*Check Valve and Plunger in Body*

Install accumulator piston in accumulator body using care not to damage piston ring. Install accumulator apply spring over rod with small tapered end seating against shoulder (Fig. 62).

Install booster spring in booster piston making sure that spring fits snugly in recess of bottom of booster piston. Install booster piston into accumulator body (Fig. 63).

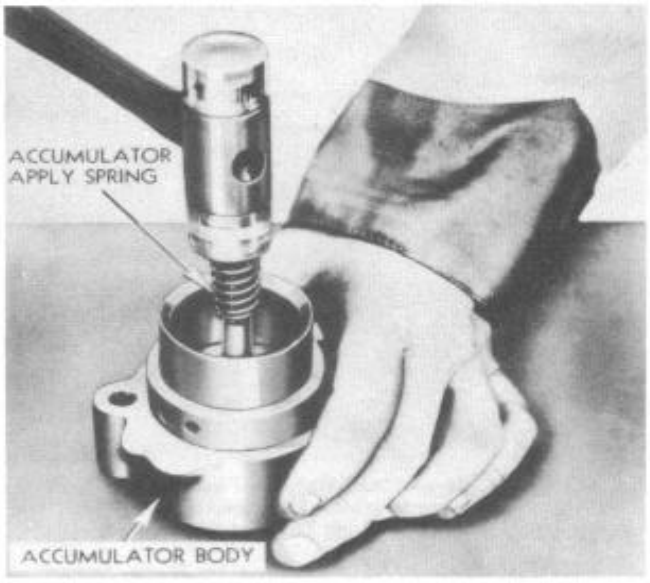
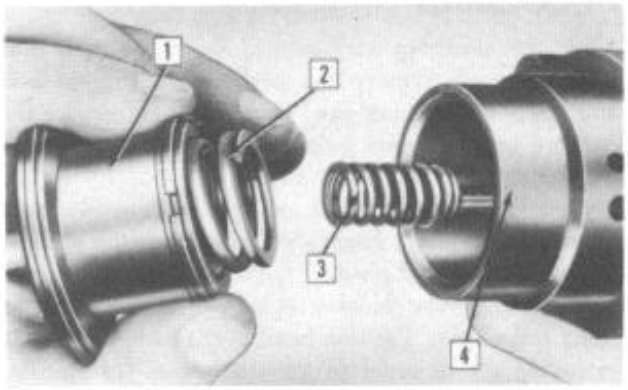


FIGURE 62—*Installing Accumulator Apply Spring*



1. **Booster Piston**
2. **Booster Spring**
3. **Accumulator Apply Spring**
4. **Accumulator Body**

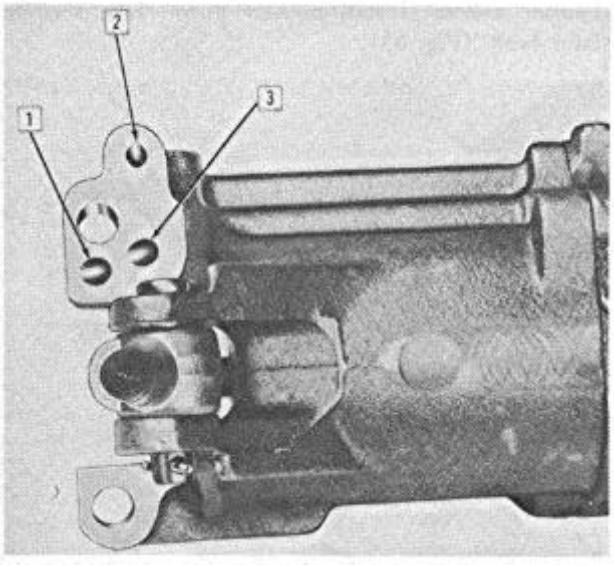
FIGURE 63—*Installing Booster Piston and Spring in Accumulator Body*

Install accumulator body and piston in servo body using care not to break the ring. Match bosses on accumulator and servo bodies.

Place compensator spring in bore of accumulator piston and install compensator piston over spring. Place servo spring and retainer with the two attaching bolts in position and place complete assembly into press.

Slowly compress spring and align compensator piston to enter bore of accumulator piston and tighten servo spring retainer bolts.

Test operation of rear servo by applying air pressure in the rear band release passage (Fig. 64).



1. Rear Band Release Passage
2. Compensator Passage
3. Manual Low Oil Passage

FIGURE 64—*Oil Passages in Rear Servo*

PARKING BRAKE BRACKET ASSEMBLY

After the side pan and control valve assembly has been removed, remove the parking pawl pivot bolt and lower the parking pawl in case. Then remove the parking brake bracket bolts and remove the assembly by pulling it off of the governor.

Remove parking blocker stop pin with needle nose pliers while holding finger over blocker piston spring; remove spring and piston. Remove reverse blocker stop pin by chipping or filing end of pin. Position hand over piston bore while removing pin in order to prevent loss of spring. Remove reverse blocker piston and springs (Fig. 65).

Inspection

Inspect blocker piston and their bores for scores or burrs. Check freeness of pistons in bores.

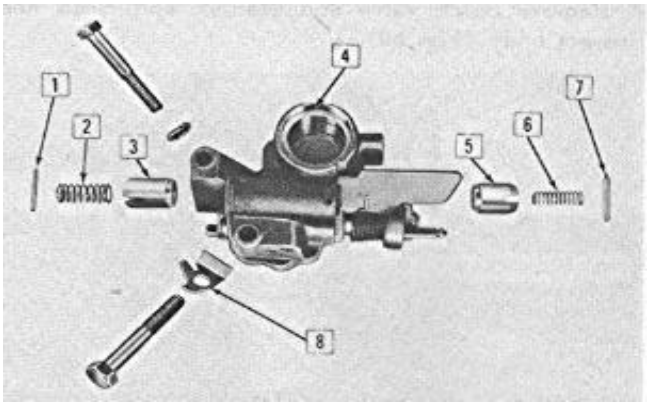
Inspect springs for distortion or collapsed coils. Check to see that both 1/4" plugs are in place in the drilled blocker piston passages. Be sure that the center hole in the governor oil delivery sleeve is plugged with a 1/4" plug.

Using a tag wire, check the feed to governor passage to be sure it is open.

Insert a tag wire through the small G—1 blocker piston passage in the governor oil delivery sleeve and look for the wire through the reverse blocker piston bore (Fig. 66).

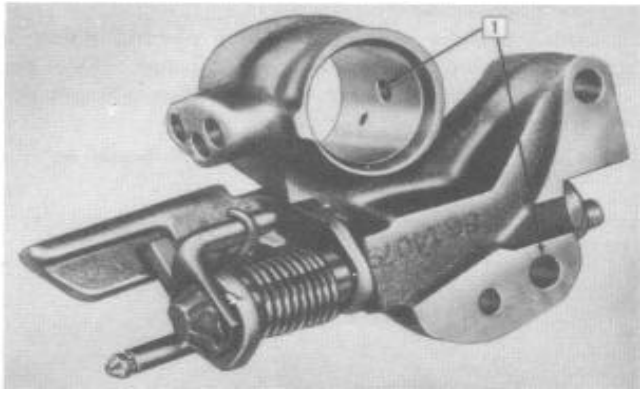
Inspect governor oil delivery sleeve for scoring or signs of extreme wear. Be sure that the parking brake pawl crank is securely welded in place.

Check to see that the reverse lever return spring dowel is securely fastened to the reverse lever.



1. Parking Blocker Piston Stop Pin
2. Parking Blocker Piston Spring
3. Parking Blocker Piston
4. Parking Blocker Bracket
5. Reverse Blocker Piston
6. Reverse Blocker Piston Spring
7. Reverse Blocker Piston Pin
8. Reverse Blocker Stop Pin Retainer

FIGURE 65—*Parking Brake Bracket Assembly*



1. Location of Governor Oil Feed Passage

FIGURE 66—*Parking Brake Bracket Assembly Oil Passage*

Assembly

Install the reverse blocker piston, spring, and stop pin. Compress spring with a blunt screw driver while installing the pin. Use a new pin and peen the end in order to keep it in place.

Install parking blocker piston, spring, and stop pin. Compress this spring while installing it; the pin is held in place by the pin retainer on the lower attaching bolt. The parking blocker piston pin retainer also seals against oil pressure that may come through the bolt hole and locks the bracket to case bolt in place.

GOVERNOR ASSEMBLY

Removal

Place car on stands or hoist.

Remove oil pan drain plug; drain fluid into a clean container. Remove throttle lever, shift control lever, and side cover and gaskets. Remove oil pan, oil screen, and front intake pipe.

Position inner detent control lever in "L" range position and remove the four bolts from the control valve assembly. Move the assembly toward the front lifting it clear of the governor and reverse oil delivery pipes. Wrap control valve assembly in a clean rag and set aside to prevent damage.

Bend the lip on the parking blocker piston pin retainer on the lower bolt (Fig. 67).

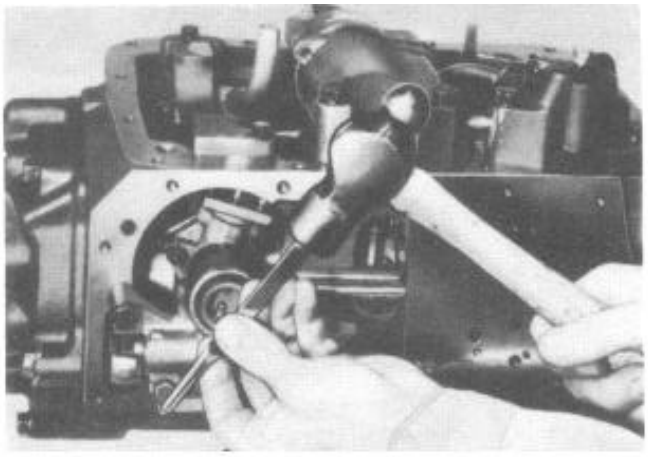


FIGURE 67—Parking Blocker Piston Pin Retainer

Remove parking pawl pivot bolt and lower parking pawl in case, as it cannot be removed at this time (Fig. 68).

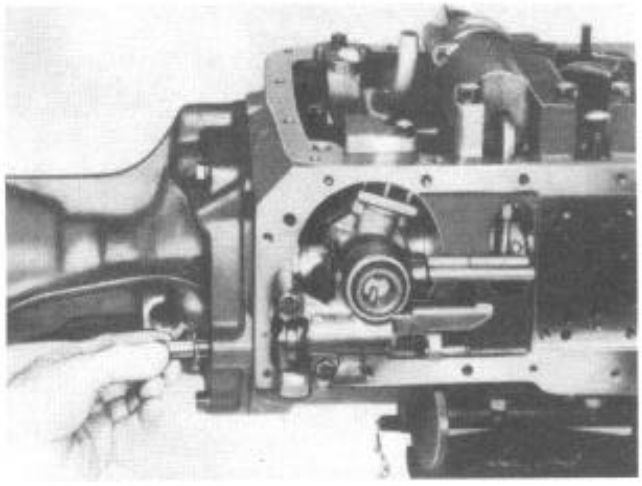


FIGURE 68—Remove Parking Pawl Pivot Bolt

Remove parking brake bracket bolts and remove the assembly by pulling it off of the governor (Fig. 69).

Mount dial indicator on side of transmission and check governor runout at tower about 1/4" from the end of the governor (Fig. 70)

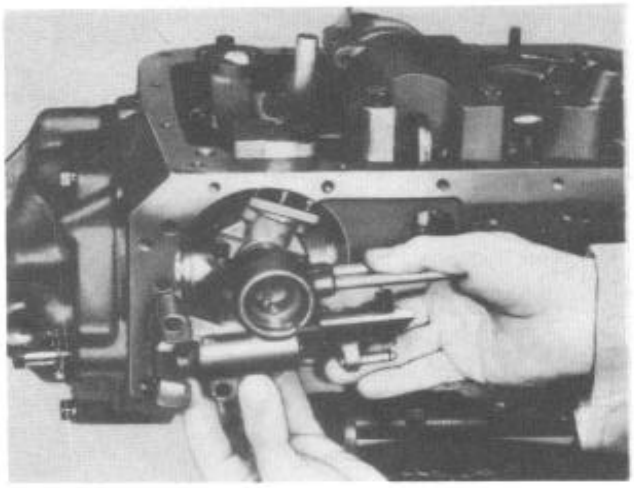


FIGURE 69—*Remove Parking Brake Bracket Assembly*

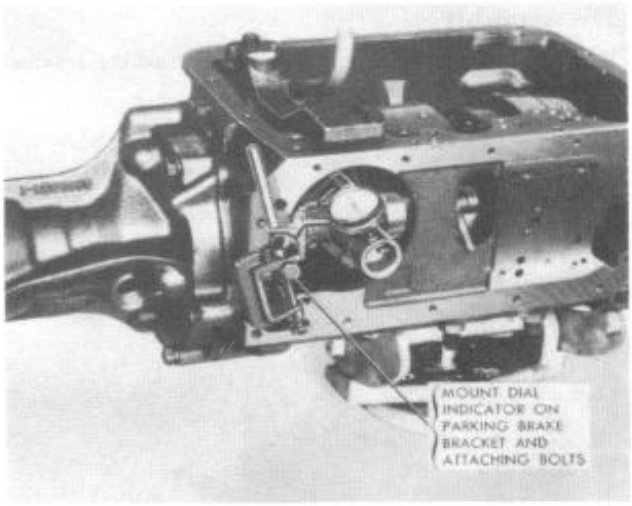


FIGURE 70—*Checking Governor Runout*

Rotate the shaft several revolutions and note runout which should not exceed .005" limit. If limit is within .005", no further check is required.

If governor runout exceeds .005", mark position of governor body on rear oil pump drive flange.

Remove two bolts and lock washers holding governor body to drive flange and remove governor.

After governor is removed, relocate dial indicator and check runout of drive flange. Drive flange runout should not exceed .002" (Fig. 71).

If the runout exceeds .002", correct the condition by replacing one or all of the following parts; governor drive flange, gear set, or complete rear oil pump assembly.

If runout of governor drive flange is less than .002", rotate governor body 180° from original position and recheck governor again. If governor runout still exceeds .005", replace governor.

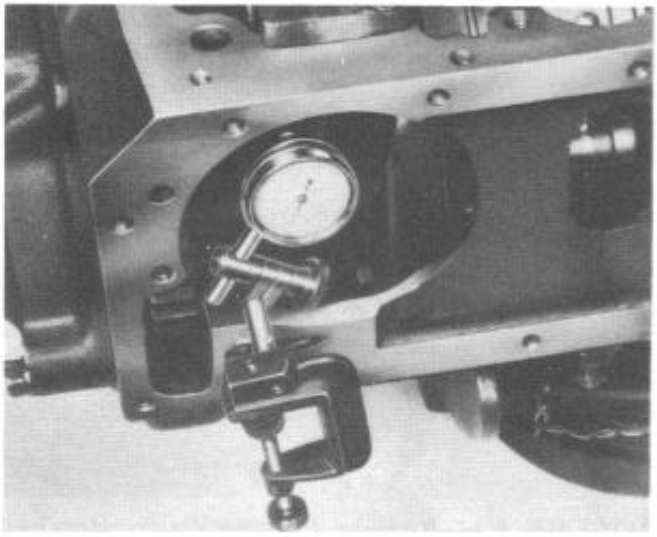


FIGURE ***71—Checking Drive Flange Runout***

Disassembly

Remove two screws holding governor bushing retainer to governor body (Fig. 72).

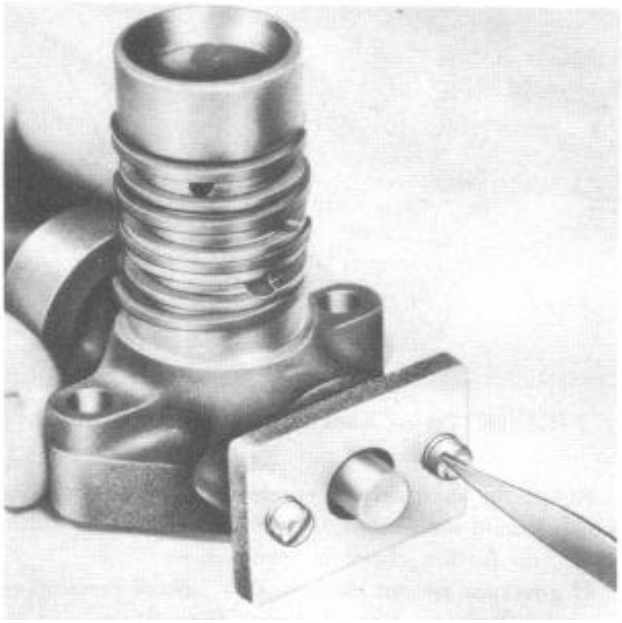


FIGURE 72—Remove Governor Bushing Retainer

Remove governor bushing and G—2 valve from governor body and remove G—2 valve from governor bushing (Fig. 73).

NOTE: *If the G—2 valve cannot be freed up without disassembly, a new governor assembly should be installed.*

Remove the four governor oil seal rings from governor body (Fig. 74).

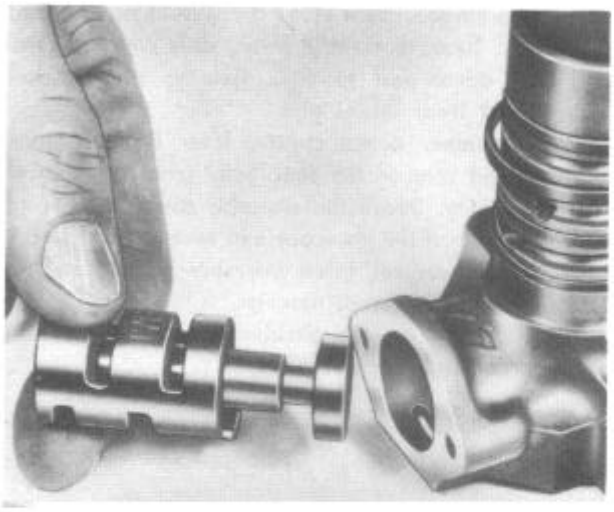


FIGURE 73—Remove Governor G—2 Valve and Bushing

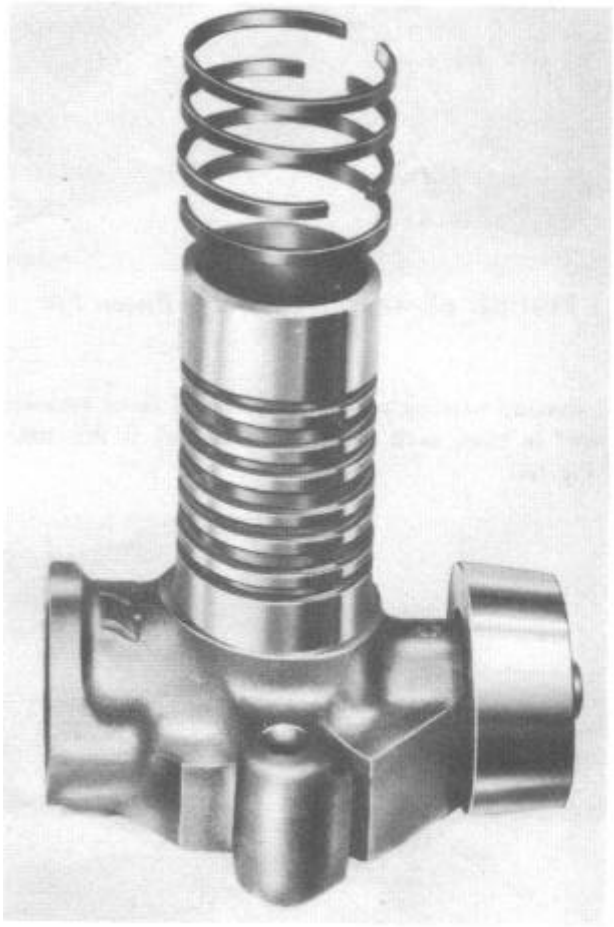


FIGURE 74—Remove Oil Seal Rings From Governor Body

Inspection

Inspect governor rings for freedom in grooves. If lands are damaged or worn thin, replace the complete governor assembly.

Check governor valves for freedom in their respective bores.

The valves or bores must not be nicked or scored. Check governor body for sand holes or blocked passages.

Assembly

Install G—2 valve in governor bushing and install bushing into governor body. Index tongue on bushing with recess in casting bore.

Install governor bushing retainer plate with two attaching screws and lock washers. After installation, shake governor body to be sure valves are free.

Install oil rings on governor body and assemble governor assembly to drive flange.

REAR OIL PUMP

To remove the rear oil pump with the governor installed, position the governor so that the large round governor weight is toward the front of the transmission. Remove the two bolts holding governor and rear oil pump to the transmission case.

Remove assembly by moving toward the rear to release the rear oil pump delivery pipe and lift out of case (Fig. 75).

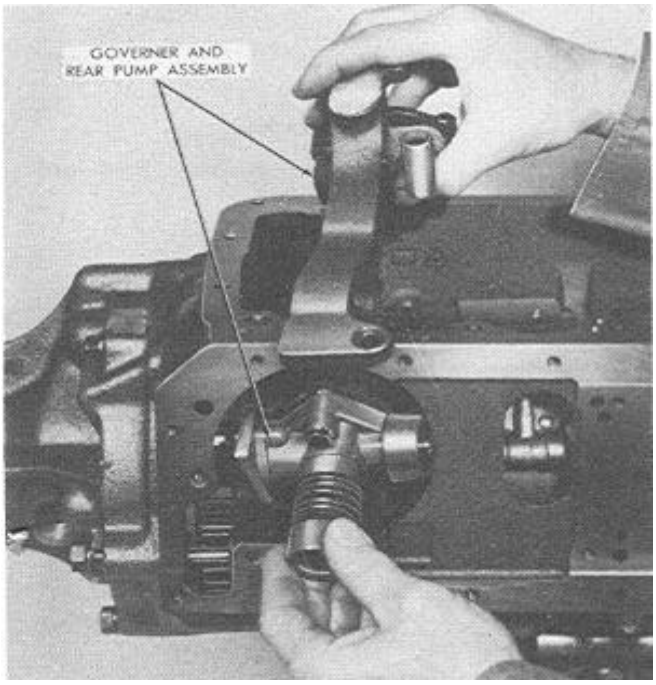


FIGURE 75—*Removing Rear Oil Pump Assembly*

Remove four bolts holding rear pump lever to pump body and remove cover. Remove internal tooth oil pump gear.

Check oil pump gears for pitted or scored surfaces. If they are, the complete rear oil pump assembly has to be replaced.

PRESSURE REGULATOR VALVE

Disassembly

Disconnect the T.V. rod from throttle lever and disconnect shift control rod at transmission shift lever.

Loosen pressure regulator valve plug in transmission case.

CAUTION: **Pressure regulator valve assembly is under spring pressure.**

After loosening, hold pressure against regulator plug while unscrewing by hand. Remove plug, spring, and valve (Fig. 76).

Inspection

Inspect reverse booster plug and T.V. plug for nicks, scores, and free movement in regulator plug.

Inspect pressure regulator valve for nicks or scores and free movement in pump body. Check drilled passages in valve to see that they are not obstructed.

Check pressure regulator spring for distortion or collapsed coils. The free length of the spring should be approximately 2—11/64"

Inspect drilled passages in pressure regulator plug and remove any foreign matter.

Inspect neoprene seal and gasket on pressure regulator plug. The neoprene seal should be replaced if there is the slightest doubt regarding its condition.

Assembly

Install new plug gasket and neoprene seal.

CAUTION: *BE SURE TO INSTALL THE PLUG GASKET ON THE PRESSURE REGULATOR PLUG WITH THE SEAM SIDE TOWARD THE THREADED END.*

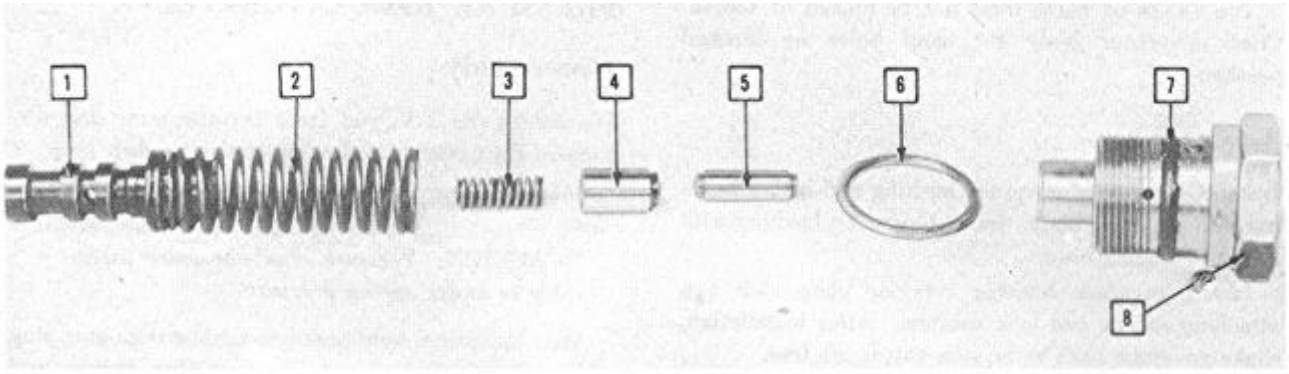
Install the pressure regulator valve and spring in the case, indexing the valve with the bore in the front oil pump.

Install the T.V. pressure plug and reverse booster plug, and spring in the pressure plug. Use petrolatum to maintain parts in position and install in case. Torque to 40 foot pounds.

Fold floor mat back, remove floor hole cover. Remove pipe plug (located between band adjusting screws) and install gauge J—2540 and test oil pressure.

To test oil pressure, start engine and operate until temperature reaches 140° to 160°F. Set hand brake. Block wheels for safety and set selector lever in D range. Main line pressure should read 45 to 72 pounds.

Place selector lever in neutral, turn off engine, and remove gauge. Install pipe plug securely and replace front hole cover and floor mat.



1. Pressure Regulator Valve
2. Pressure Regulator Spring
3. Reverse Booster Plug Spring
4. Reverse Booster Plug
5. T.V. Pressure Plug
6. Pressure Regulator Plug Gasket
7. Pressure Regulator Plug Seal
8. Pressure Regulator Plug

FIGURE 76—*Pressure Regulator Assembly*

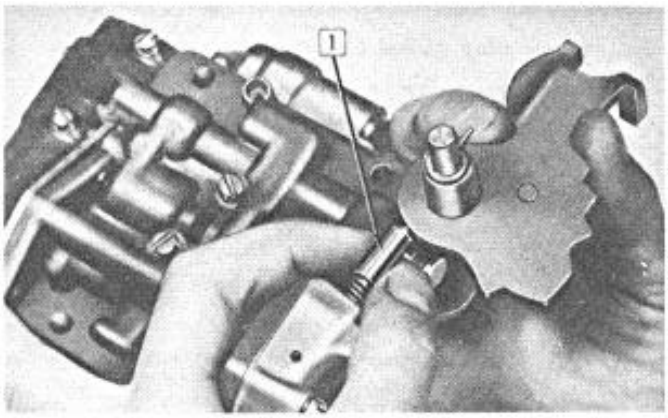
CONTROL VALVE ASSEMBLY

Disassembly

Remove throttle and shift control levers and side pan.

NOTE: *Extreme care must be taken in handling the Hydra—Matic transmission control valve assembly. Never grip the bodies in a vise or use force in removing or installing the valves or plugs. The control valve assembly should be laid on a clean piece of paper for disassembly and assembly.*

Move inside detent control lever slowly counterclockwise to remove detent tension spring and plunger (Fig. 77).

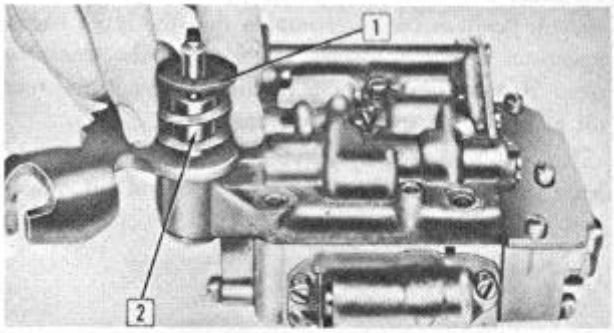


1. Detent Plunger and Spring

FIGURE 77—*Removing Detent Plunger and Spring*

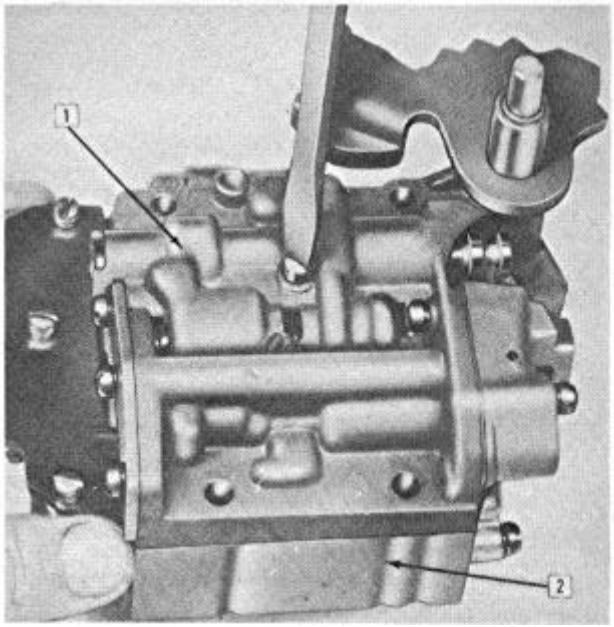
Remove manual shaft rubber seal and outer and inner shaft seal washers (Fig. 78). Remove two screws holding inner and outer valve bodies together and separate inner and outer valve bodies and spacer plate (Fig. 79).

Remove two screws and timing valve body assembly. Remove timing valve plug retainer pin, timing plug, spring, and valve (Fig. 80).



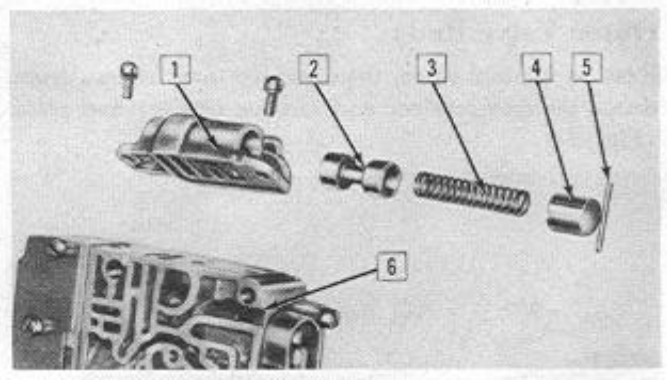
1. Rubber Seal
2. Seal Washers

FIGURE 78—*Removing Rubber Seal and Washers*



1. Outer Valve Body
2. Inner Valve Body

FIGURE 79—*Separate Outer and Inner Valve Bodies*



1. Timing Valve Body
2. 3–2 Timing Valve
3. 3–2 Timing Valve Spring
4. 3–2 Timing Valve Plug
5. Plug Retaining Pin
6. Inner Valve Body

FIGURE 80—*Disassembly of Timing Valve Body Assemblies*

Remove three screws holding rear valve body assembly to inner valve body, and remove rear valve body and spacer plate (Fig. 81).

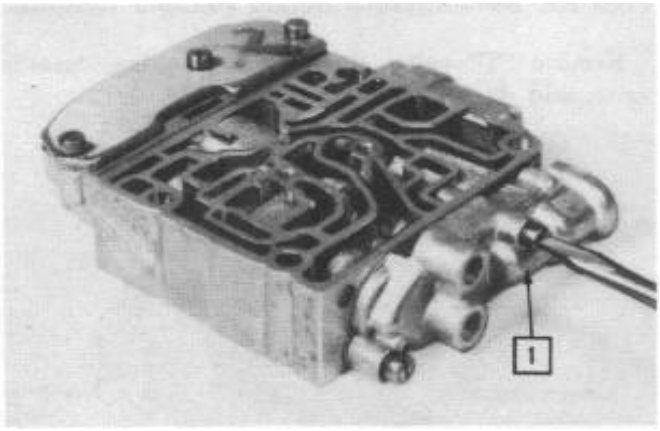


FIGURE 81—Remove Rear Valve Body

Remove 3–4 governor plug, 2–1 detent plug, 2–1 detent plug spring, and 2–3 governor plug (Fig. 82).

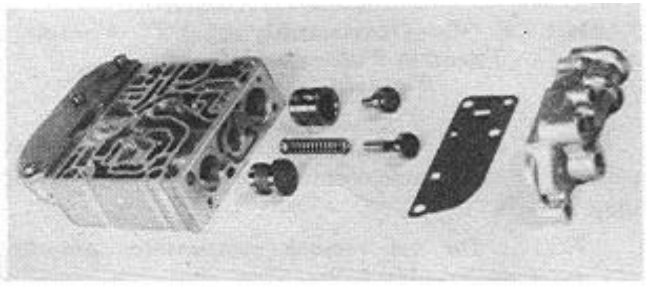
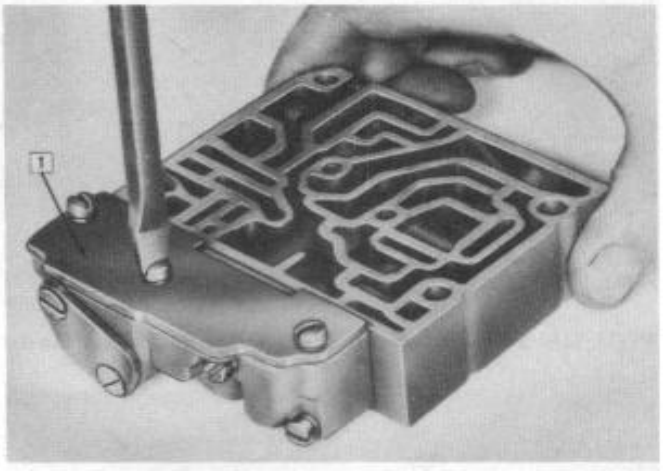


FIGURE 82—*Disassembling Rear Valve Body*

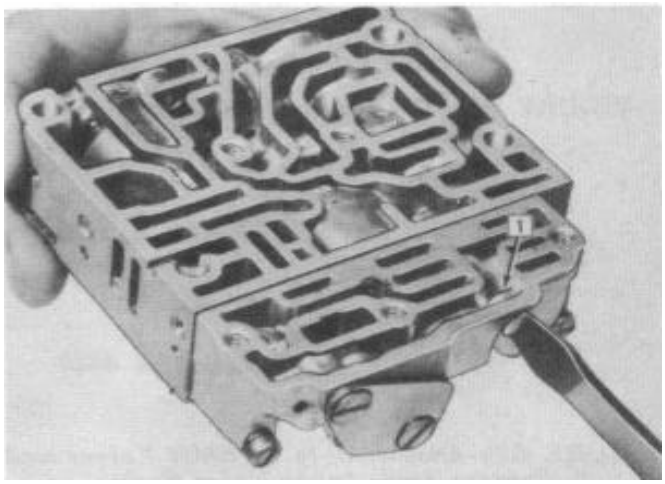
Remove three screws holding front valve body plate to front valve body and remove plate and "T" oil ball check valve and spring (Fig. 83).



1. Front Valve Body Plate

FIGURE 83—*Remove Front Valve Body Plate*

Remove three screws holding front valve body assembly to inner valve body assembly and remove front valve body assembly and separator plate (Fig. 84).



1. Front Valve Body

FIGURE 84—*Removing Front Valve Body Assembly*

Remove 3–4 regulator plug, 1–2 regulator plug, T.V. regulator valve, and spring from front body (Fig. 85).

Remove two screws and 3–2 detent plug plate and remove 3–2 detent plug from front valve body (Fig. 86).

Remove 3–4 shift valve spring, 3–4 shift valve, 1–2 regulator plug spring, 1–2 shift valve, 2–3 shift valve spring, 2–3 spring guide pin, and 2–3 shift valve (Fig. 87).

Remove 2–3 governor sleeve and 2–3 auxiliary valve by pushing out with a pencil or small rod (Fig. 88).

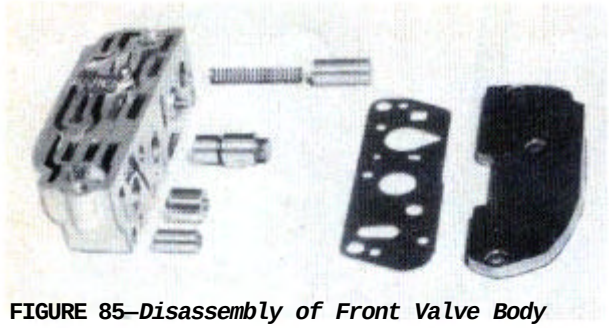
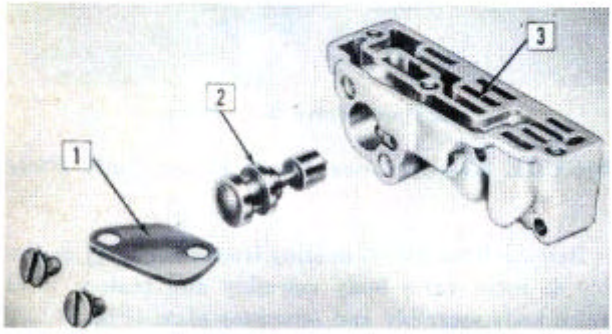


FIGURE 85—*Disassembly of Front Valve Body*



1. 3—2 Detent Plug Plate
2. 3—2 Detent Plug
3. Front Valve Body

FIGURE 86 — *location of 3—2 detent Plug*

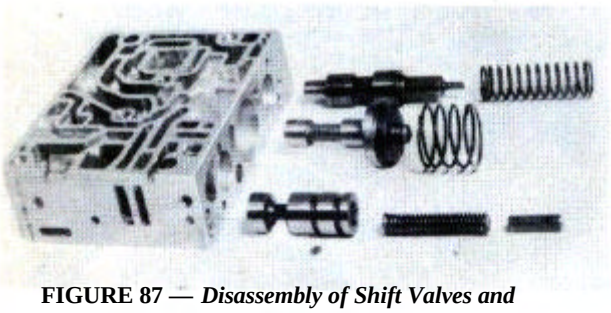
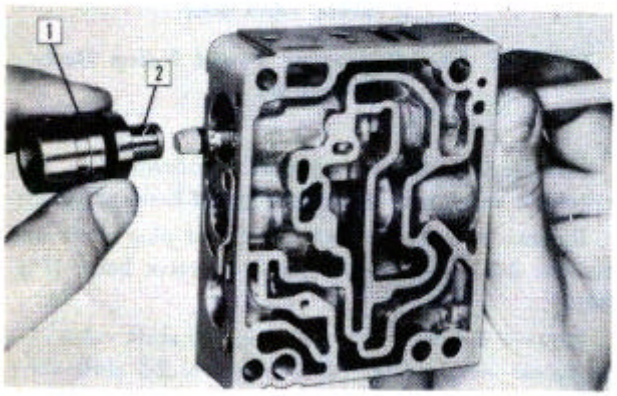


FIGURE 87 — *Disassembly of Shift Valves and Springs from Inner Valve Body*

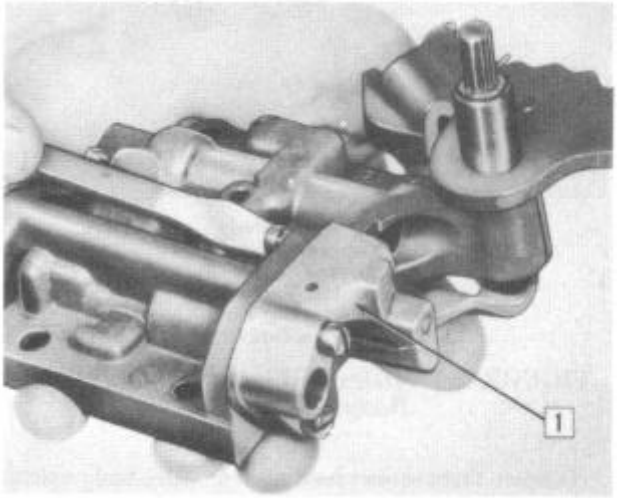


1. 2—3 Governor Sleeve
2. 2—3 Auxilliary Valve

FIGURE 88 — Removing 2—3 Governor Sleeve and Auxiliary Valve

Outer Valve Body

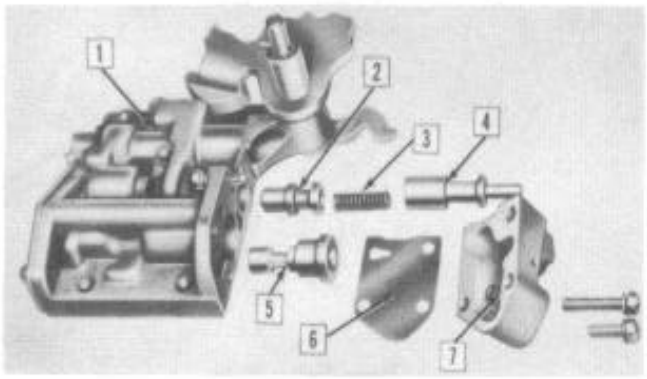
Remove manual valve, then remove three screws from detent plunger retainer and remove retainer and plate (Fig. 89).



1. Detent Plunger Retainer

FIGURE 89—Remove Detent Plunger Retainer

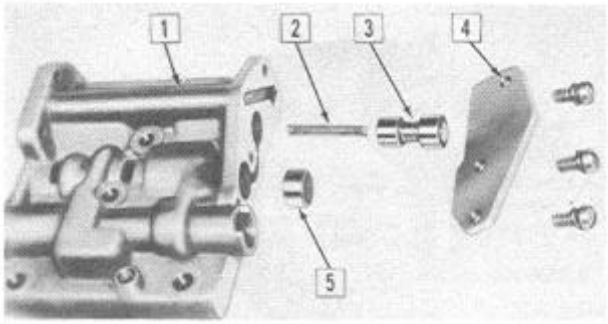
Remove "T" valve, throttle valve spring, throttle valve, and double transition valve (Fig. 90).



1. Outer Valve Body
2. Throttle Valve
3. Throttle Valve Spring
4. "T" Valve
5. Double Transition Valve
6. Detent Plunger Retainer Plate
7. Detent Plunger Retainer

FIGURE 90—*Disassembly of "T" Valve, Throttle Valve, and Double Transition Valve*

Remove three screws and outer valve body front plate and remove compensator valve spring and detent plug (Fig. 91).
NOTE: Do not remove compensator pin from outer valve body.



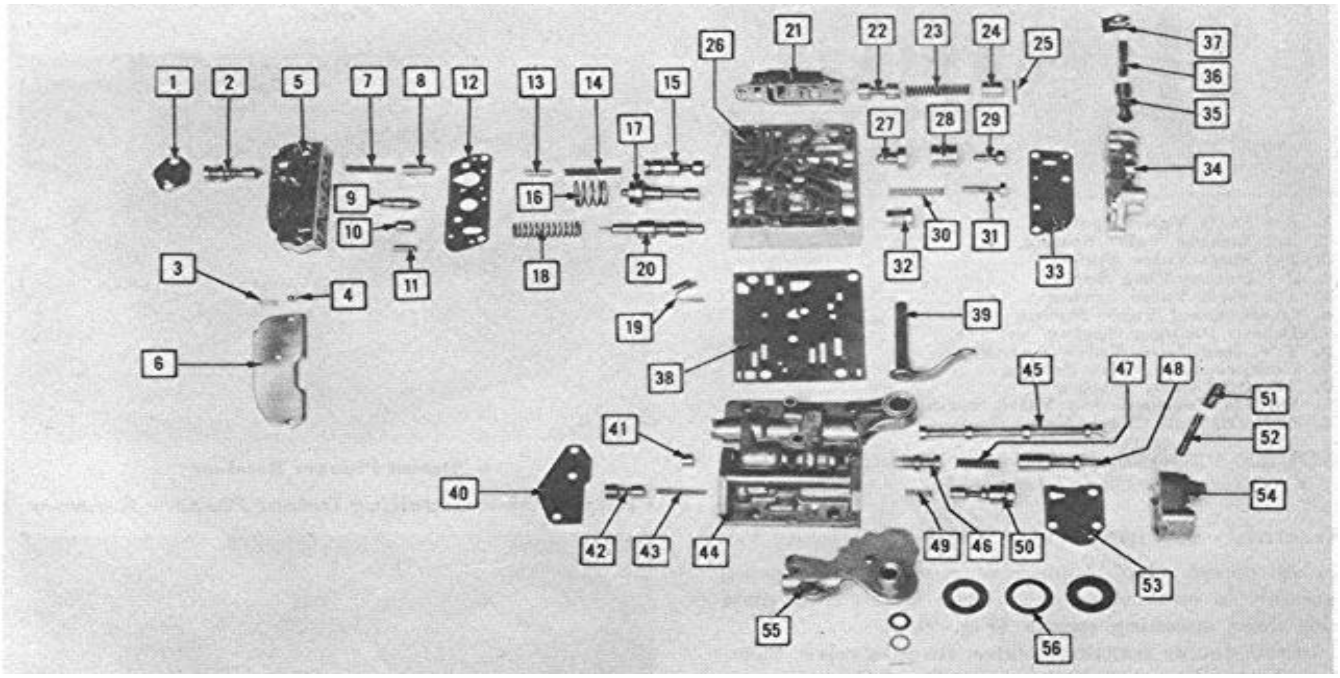
1. Outer Valve Body
2. Compensator Valve Spring
3. Compensator Valve
4. Outer Valve Body Front Plate
5. Detent Plug

FIGURE 91—*Remove Outer Valve BodyPlate, Compensator Valve, and Detent Plug*

Inspect all valves carefully to see that they are free from burrs and not damaged (scored) in any way. Burrs can be removed by carefully using fine crocus cloth. This type of valve has sharp corners to prevent dirt from wedging between valve and body, therefore, when removing burrs, do not round off square edges.

With the valves and valve bodies clean and dry, check each shifter valve, governor plug, and regulator plug for free movement in their respective bores and operation positions.

NOTE: Valves can be assumed to be free in their operating position if they will fall of their own weight in their respective bores when valve body is shaken slightly. Do not drop valves.



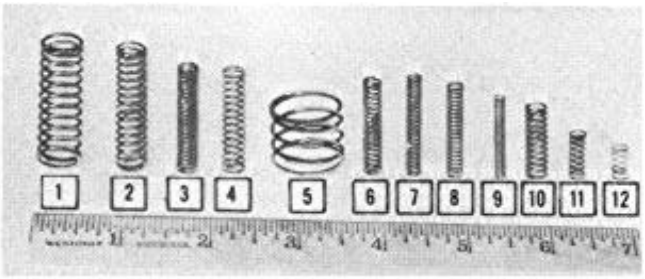
1. 3—2 Detent Plug Plate
2. 3—2 Detent Plug
3. "T" Oil Ball Check Valve Spring
4. "T" Oil Ball Check Valve
5. Front Valve Body
6. Front Valve Body Plate
7. T.V. Regulator Valve Spring
8. T.V. Regulator Valve
9. 1—2 Regulator Plug
10. 3—4 Regulator
11. Shuttle Valve
12. Front Valve Body Separator Plate
13. 2—3 Shift Valve Spring Guide Pin
14. 2—3 Shift Valve Spring
15. 2—3 Shift Valve
16. 1—2 Regulator Plug Spring
17. 1—2 Shift Valve
18. 3—4 Shift Valve Spring
19. By—Pass Check Valve
20. 3—4 Shift Valve
21. 3—2 Timing Valve Body
22. 3—2 Timing Valve
23. 3—2 Timing Valve Spring
24. 3—2 Timing Valve Plug
25. 3—2 Timing Valve Plug Retainer Pin
26. Inner Valve Body
27. 2—3 Auxiliary Valve
28. 2—3 Governor Sleeve
29. 2—3 Governor Plug
30. 2—1 Detent Plug Spring
31. 2—1 Detent Plug
32. 3—4 Governor Plug
33. Rear Valve Body Spacer Plate
34. Rear Valve Body
35. Overcontrol Valve
36. Overcontrol Valve Spring
37. Overcontrol Valve Retainer
38. Valve Body Spacer Plate
39. Inner Throttle Lever
40. Outer Valve Body Front Plate
41. Detent Plug
42. Compensator —Valve
43. Compensator Valve Spring
44. Outer Valve Body
45. Manual Control Valve
46. Throttle Valve
47. Throttle Valve Spring
48. "T" Valve
49. Double Transition Valve Spring
50. Double Transition Valve
51. Detent Plunger
52. Detent Plunger Spring
53. Detent Plunger Retainer Plate
54. Detent Plunger Retainer
55. Manual Shaft and Detent Control \ Lever
56. Rubber Seals and Washers

FIGURE 92—*Disassembled View of Control Valve Assembly*

The manual control valve is the only valve furnished separately. If it becomes necessary to replace one of the other valves or one of the bodies (inner or outer), the complete control valve assembly should be replaced. Refer to Master Parts Catalog for component parts which are replaceable on the control valve assembly.

Check the fit of the throttle valve inside lever and shaft in the hub of the inside detent control lever on the outer valve body. If the shaft binds in the hub, is excessively worn, or if the oil seal is missing or damaged, it will be necessary to replace the defective parts.

Before reassembly, make certain the springs can be accurately identified for correct assembly (Fig. 93).



1. 3–4 Shift Valve Spring
2. 3–2 Timing Valve Spring
3. 2–3 Shift Valve Spring
4. 2–1 Detent Plug Spring
5. 1–2 Shift Valve Spring
6. Overcontrol Valve Spring
7. Detent Plunger Spring
8. T.V. Regulator Valve Spring
9. Compensator Valve Spring
10. Throttle Valve Spring
11. Double Transmission Valve Spring
12. "T" Oil Ball Check Valve Spring

FIGURE 93—*Comparison of Springs in Valve Body Assembly*

Assembly—Outer Valve Body

Install detent plug, compensator valve and spring assembly in outer valve body; then install front plate with three attaching screws (Fig. 91).

Install double transition valve, throttle valve, throttle valve spring, and "T" valve (Fig. 94).

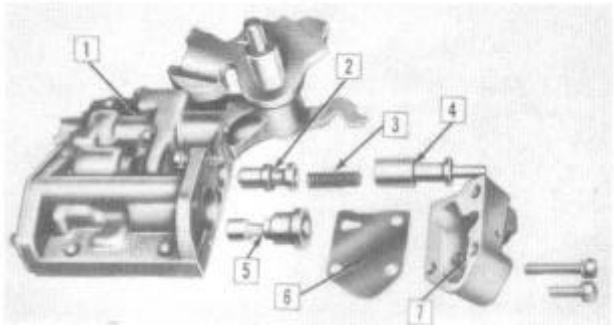
Install detent plunger retainer plate with inner throttle lever in position and tighten three attaching screws (Fig. 95).

Install manual valve, detent spring and plunger. Align manual valve with the inside detent control lever, and rotate clockwise to index inner valve body assembly to make certain that the 2–3 auxiliary valve is free in the bore (Fig. 96).

Assembly—Inner Valve Body

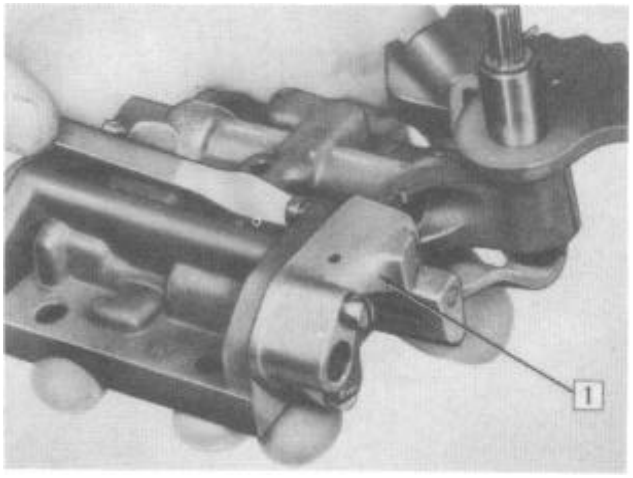
Install the 2–3 auxiliary valve and the 2–3 governor sleeve in the valve body.

Install valve and governor sleeve carefully to prevent "cocking" in counterbore.



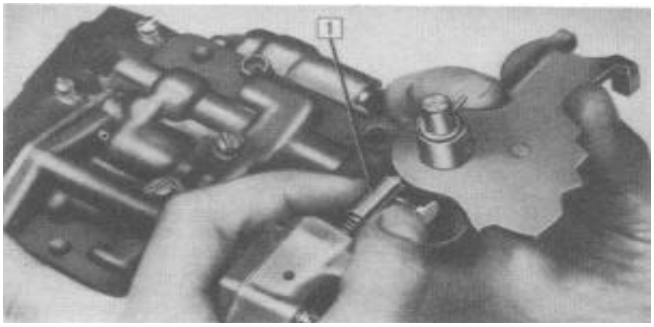
1. Outer Valve Body
2. Throttle Valve
3. Throttle Valve Spring
4. "T" Valve
5. Double Transition Valve
6. Detent Plunger Retainer Plate
7. Detent Plunger Retainer

FIGURE 94—*Install "T" Valve and Throttle Valve*



1. Detent Plunger Retainer

FIGURE 95—Installing Detent Plunger Retainer



1. Detent Plunger and Spring

FIGURE 96—*Installing Detent Plunger and Spring*

Shake inner valve body to ascertain freeness of the 2–3 auxiliary valve in the bore.

Install the 3–4 governor plug, 2–3 governor plug, 2–1 detent spring, and plug (Fig. 97).

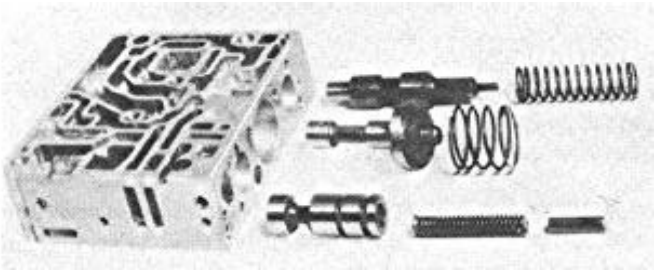


FIGURE 97—*Installing Governor Plugs, Detent Spring and Plug*

Install the rear valve body assembly and spacer plate. The detent plug can be held in position with the plate while starting the three attaching screws.

Install the 2—3 shift valve, spring, and spring guide pin, 1—2 shift valve and regulator plug spring, the 3—4 shift valve, and 3—4 shift valve spring. The spring will protrude from the bore. However, with the inner valve body assembly lying on a clean flat surface, the spring will remain in place (Fig. 98).

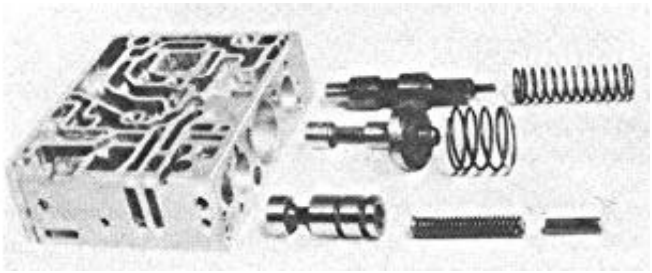
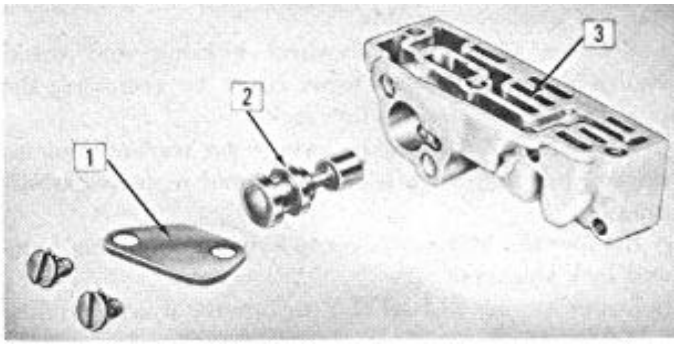


FIGURE 98—Assembly Sequence of Shift Valves and Springs

Install the 3—2 detent plug in the front valve body; then install the plate with two attaching screws. Make sure plate is installed correctly to cover bore in front valve body (Fig. 99).



1. 3—2 Detent Plug Plate
2. 3—2 Detent Plug
3. Front Valve Body

FIGURE 99—*Install Detent Plug in Front Valve Body*

Install T.V. regulator valve and spring in front valve body and install the 1—2 and 3—4 regulator plugs and shuttle valve (Fig. 100).

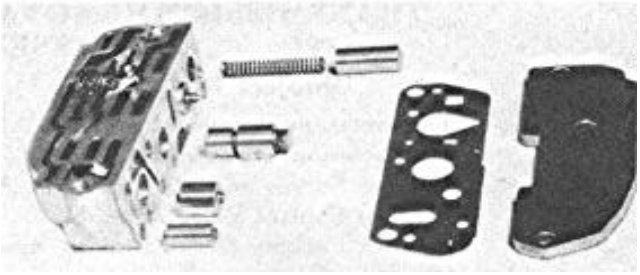
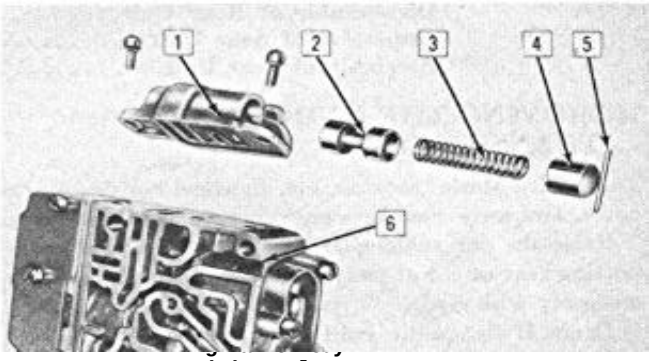


FIGURE 100—*Install Regulator Valve and Plugs in Front Valve Body*

With the front valve body and inner valve body assemblies on a clean flat surface, bring the two together. Be sure that all springs line up with the respective valves and bores. Install and tighten the three attaching screws alternately to bring the two valve bodies together evenly.

Install the 3—2 timing valve, spring, and plug into the 3—2 timing valve body. Press plug into bore to compress the spring and insert the plug retainer pin. Install timing valve assembly on inner valve body with two attaching screws (Fig. 101).



2. 3—2 Timing Valve
3. 3—2 Timing Valve Spring
4. 3—2 Timing Valve Plug
5. Plug Retainer Pin
6. Inner Valve Body

FIGURE 101—*Install Timing Valve Assembly*

Install spacer plate and outer valve body on inner valve body assembly with the four control valve to transmission case attaching bolts. Line up both inner and outer valve body assemblies before tightening and install and tighten the two attaching screws.

Install manual shaft, inner and outer washers, and rubber seal.

Install control valve assembly to transmission case. Line up the oil delivery pipes to rear valve body; then position the control valve assembly and install the four attaching bolts. Torque 6—8 foot pounds.

Install new side pan gasket and replace side pan (use new copper washers at lower bolts). Replace the outer shift and throttle levers.

TRANSMISSION REMOVAL, DISASSEMBLY, INSPECTION AND ASSEMBLY OF UNITS

REMOVING THE HYDRA—MATIC TRANSMISSION

The Hydra—Matic transmission, flywheel housing, torus cover, and torus members are removed as an assembly.

Raise the car sufficiently to set on car stands, supporting rear of car at body side sills. Support rear axle assembly with hydraulic jack.

Drain Hydra—Matic fluid from transmission. Remove oil filler tube from oil pan.

"Hornet" and "Wasp" Series

Disconnect hand brake cable at the bell crank and brake cable housing at the bell crank bracket.

Disconnect speedometer cable and housing at transmission adapter.

Disconnect throttle rod assembly from throttle lever at transmission.

Disconnect control rod from transmission shift lever. Remove rear brake hose bracket from floor pan to prevent damage to hose.

Disconnect the torque tube from the rear bearing retainer; then move the rear axle and torque tube assembly to the rear and separate by sliding the universal joint to the rear, off the splines of the output shaft.

"Rambler" Series

Support the rear of the body at the side sills.

Disconnect the rear shock absorbers at the rear axle tubes and hand brake at yoke.

Remove the rear spring front bracket attaching nuts and lower the rear axle assembly, thus lowering the rear spring front brackets from the floor pan.

Slide the rear axle and propeller shaft assembly to the rear, sliding the universal joint from the output shaft.

All Series

Support the rear end of the engine to remove weight from the rear engine support cross member.

Remove the rear engine support cross member, cushion and bracket assembly.

Remove plate from flywheel housing and drain Hydra—Matic fluid from torus cover by removing the pipe plug using a six point socket.

Remove throttle control lever from transmission to prevent bending it while removing and replacing transmission.

Remove the 30 torus cover to flywheel attaching bolts and lock washers.

Lower engine SLIGHTLY to remove flywheel housing attaching bolts.

Place hydraulic jack with tool J—2808 under transmission, handle to the rear of car, and lift transmission slightly to take strain off of flywheel housing bolts.

CAUTION: *Tool 1—2808 must be fastened securely to jack pad to prevent slipping.*

Remove flywheel housing attaching bolts, nuts, and lock washers.

Remove transmission assembly by moving the

transmission to the rear of the car and lower assembly after main shaft has been withdrawn from the crankshaft pilot bushing.

NOTE: *To prevent end of mainshaft striking the flywheel to crankshaft bolts when lowering the transmission, turn flywheel so end of mainshaft will pass between two bolts.*

TRANSMISSION DISASSEMBLY

Place transmission and fluid coupling assembly in holding fixture J—2541 on bench.

Move shift lever on side of transmission toward rear to reverse position.

Straighten the main shaft nut lock washer. Remove main shaft nut, using 1—7/16" socket. Slide driven torus off front end of transmission main shaft.

NOTE: *If torus sticks, tap end of main shaft with rawhide or similar hammer.*

Remove driving torus snap ring (Fig. 102).

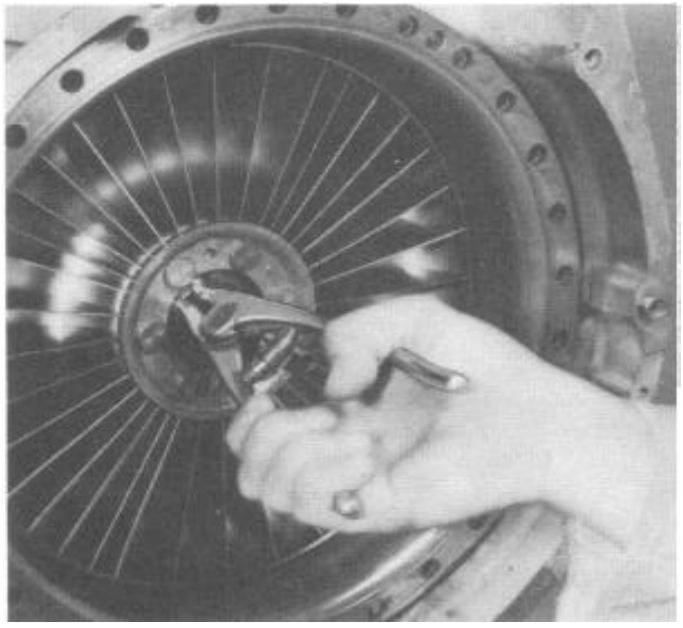


FIGURE 102—*Removing Driving Torus Snap Ring*

Remove driving torus assembly (Fig. 103).

CAUTION: *Do not attempt to remove torus cover and driving torus together.*

Remove torus cover. Do not attempt to remove torus cover by pulling and pushing on cover in a rough manner as this may result in a broken oil seal ring. Work hub of torus cover back through oil seals gently, and then pull torus cover forward with a quick jerk.

Remove bolts and lock washers holding flywheel housing to front of transmission case; remove flywheel housing (Fig. 104).

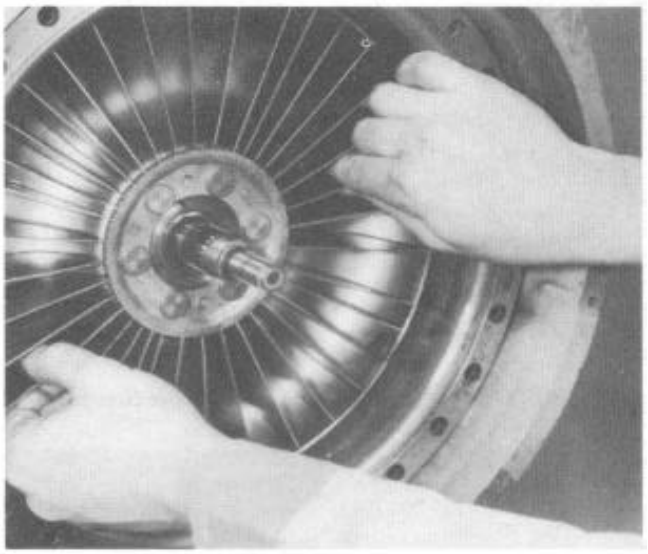


FIGURE 103—*Removing Driving Torus*

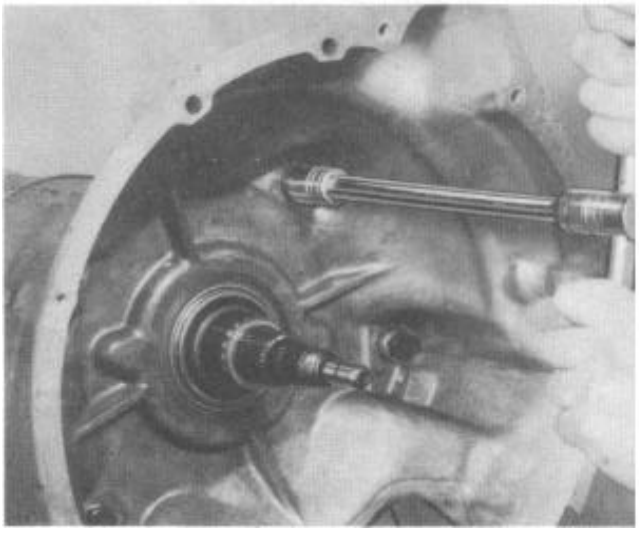


FIGURE 104—*Removing Flywheel Housing*

Move shift lever on side of transmission to "L" position.

Loosen clamp bolt holding shift lever to shaft at side of transmission and remove lever.

Remove main shaft snap ring with snap ring pliers KMO—630 (Fig. 105). Remove oil pan bolts and lock washers; remove oil pan gasket.

Remove side cover bolts and cover gasket.

Remove oil pan screen by lifting from rear oil pump intake pipe and sliding screen toward rear from the front pump intake pipe. Use care not to damage screen.

Remove front oil pump intake pipe by lifting out of front pump (Fig. 106).

Remove the governor oil delivery pipe by prying it up evenly on both ends (Fig. 107).

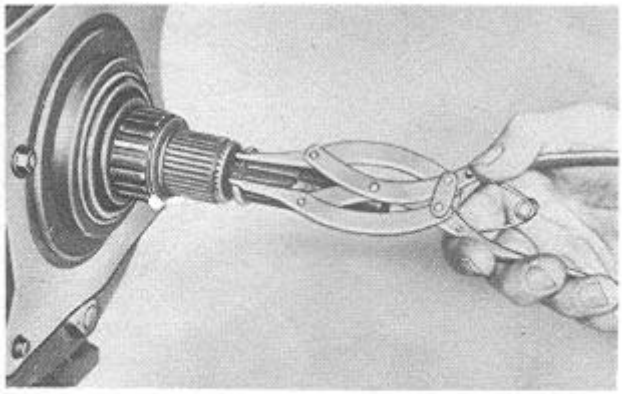
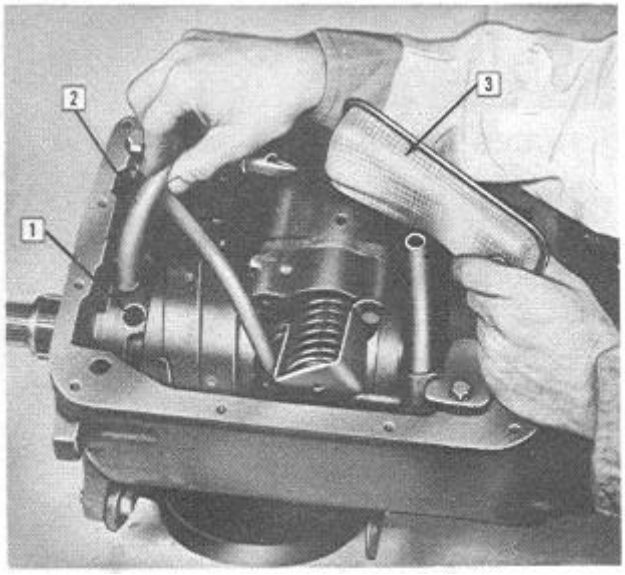


FIGURE 105—Removing Main Shaft Snap Ring



1. Oil Seal Ring in Front Pump Housing
2. Front Pump Intake Pipe
3. Oil Screen

FIGURE 106—*Removing Oil Pan Screen and Front Pump Intake Pipe*

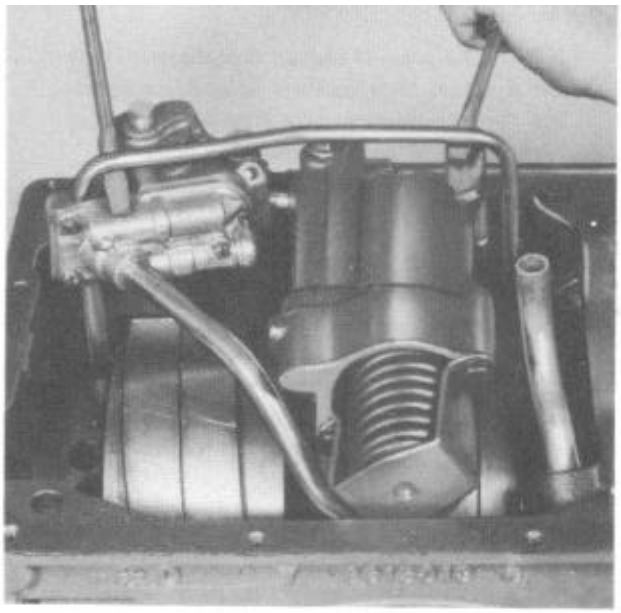
Rear Servos and Oil Pipes

NOTE: Loosen the front and rear band adjusting screw lock nuts; then loosen adjusting screws approximately five turns to release servo spring tension.

Then remove the front and rear servo attaching bolts.

Remove rear servo unit by separating front and rear servos at oil transfer pipe. Leave the pipe in servo in which it remains (Fig. 108). Remove front servo unit.

NOTE: As front servo is lifted from transmission, the rear pump discharge pipe will rotate in the front fitting and slide free (Fig. 109). Remove rear pump discharge pipe from rear pump. Remove front pump delivery pipe (Fig. 110) if it does not come out with servo.



F IGURE 107—Removing Governor Oil Delivery Pipe

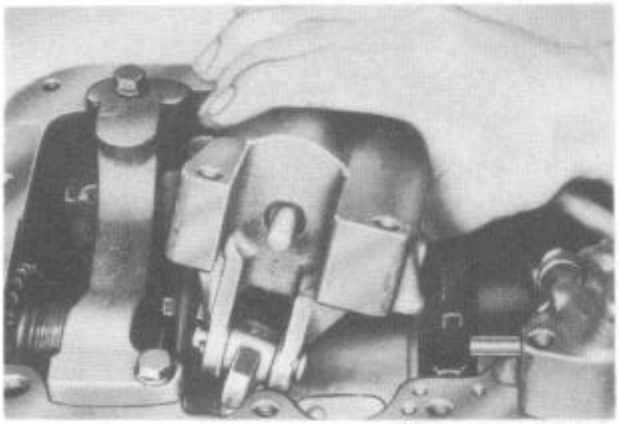


FIGURE 108—ReFIGURE 108—Removing Rear Servo-moving Rear Servo

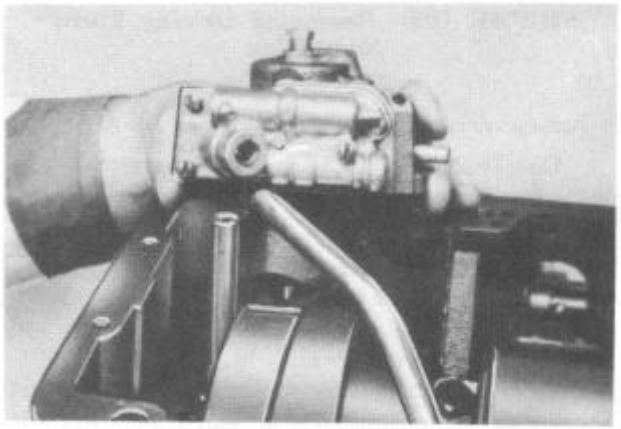


FIGURE 109—Removing Front Servo Unit

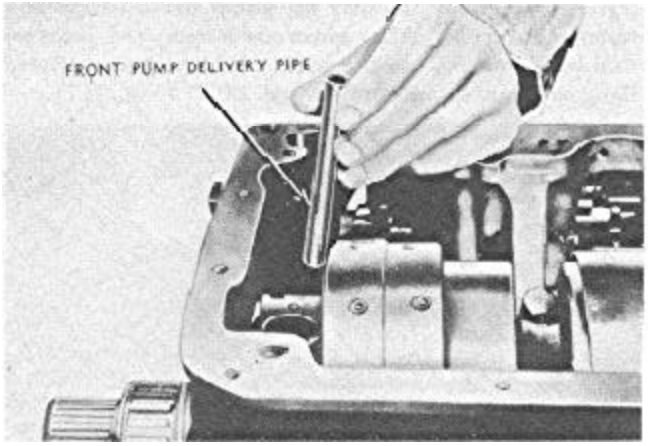


FIGURE 110—*Removing Front Pump Oil Delivery Pipe*

NOTE: *Refer to Minor Services and Repairs for disassembly, inspection, and assembly of front and rear servo.*

Remove Control Valve Assembly

Position inner detent control lever in "L" range and remove the pressure regulator reverse oil pipe from control valve and case. (Use very light pressure to avoid bending pipe.)

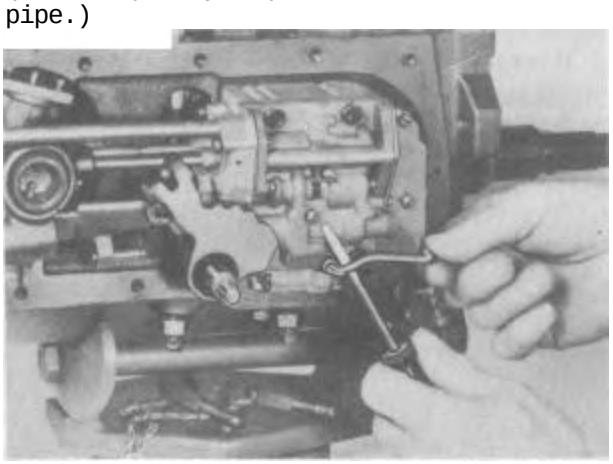


FIGURE 111—*Removing Pressure Regulator Reverse Oil Pipe*

Remove the four mounting bolts and move control valve assembly toward the rear to release assembly from oil delivery pipes (Fig. 112).

NOTE: *Oil delivery pipes may come off with control valve assembly, if so, remove them from control valve to prevent damage to pipes.*

Wrap control valve assembly in clean rag and set aside to prevent damage.

NOTE: *Refer to Minor Services and Repairs for disassembly, inspection, and assembly of the Control Valve Assembly.*

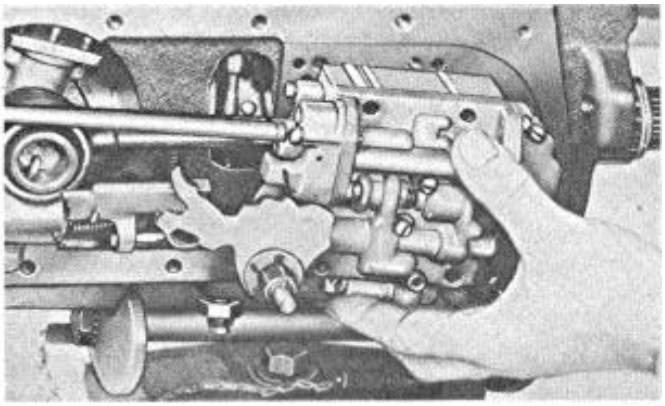


FIGURE 112—*Removing Control Valve Assembly*

Remove Parking Brake Bracket Assembly

Remove reverse cone clutch oil delivery pipe (Fig. 113).

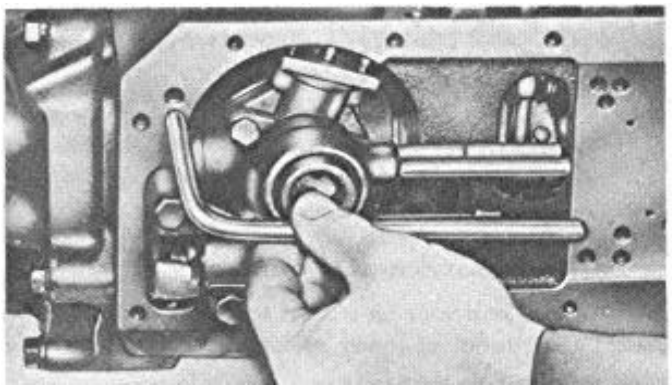


FIGURE 113—*Removing Reverse Cone Clutch Oil Delivery Pipe*

Remove parking brake pawl pivot bolt at rear of transmission and lower parking pawl in case (Fig.114).

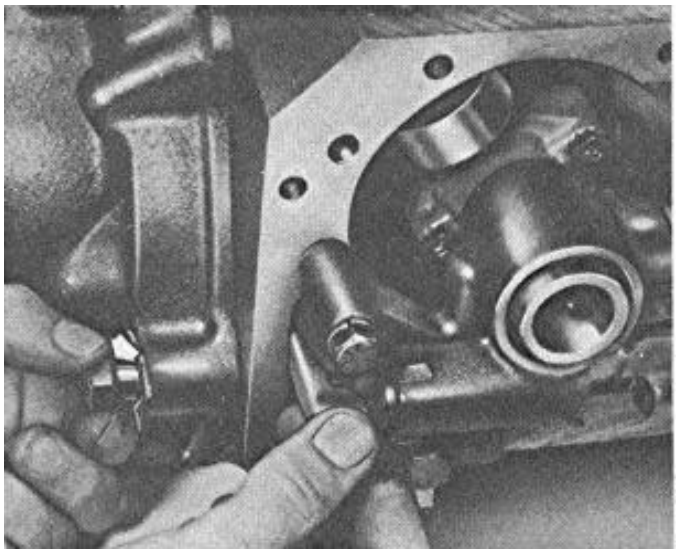


FIGURE 114—*Removing Parking Brake Pawl Pivot Bol*t

Remove two parking brake bracket to case bolts and remove parking brake bracket assembly by pulling off governor (Fig. 115).

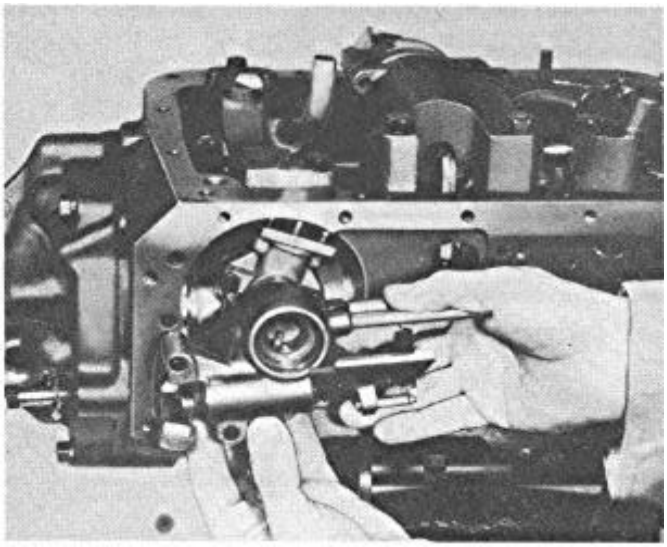


FIGURE 115—*Removing Parking Brake Bracket Assembly*

NOTE: *Refer to Minor Services and Repairs for disassembly, inspection and assembly of the parking brake assembly.*

Checking Governor Runout

Mount dial indicator on side of transmission and check governor runout at tower about 1/4" from the end of the governor (Fig. 116).

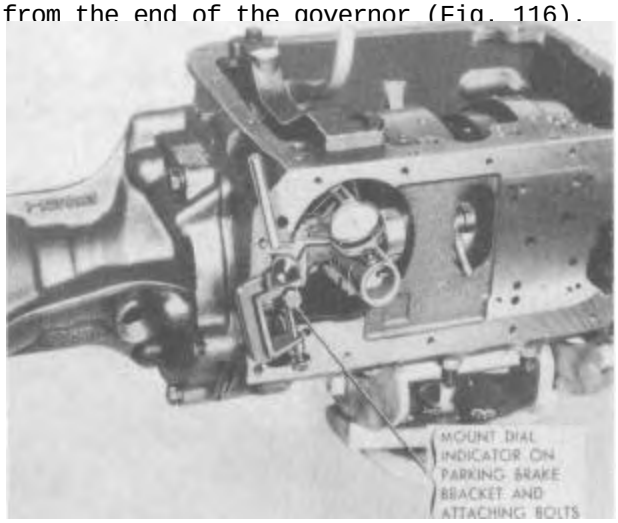


FIGURE 116—Checking Governor Runout

Rotate shaft several revolutions and note runout which should not exceed .005" limit. If limit is within .005" no further check is required.

If governor runout exceeds .005" mark position of governor or body on rear oil pump drive flange and remove governor. After governor is removed, relocate dial indicator and check runout of drive flange. Drive flange runout should not exceed .002" (Fig. 117).

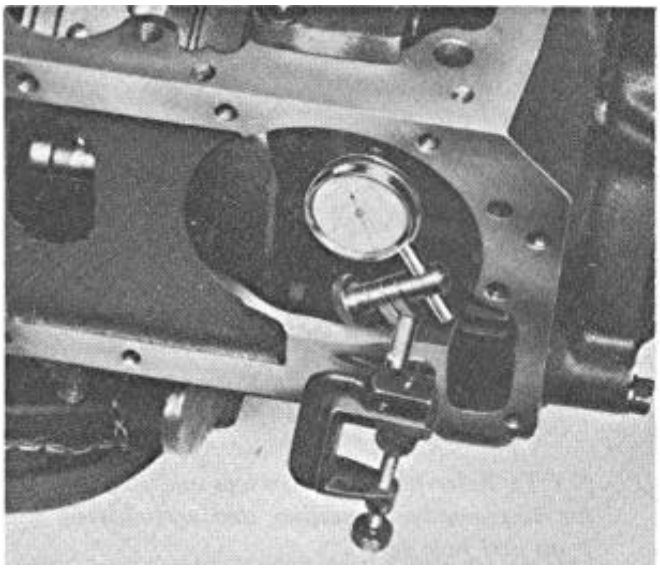


FIGURE 117—*Checking Drive Flange Runout*

If run-out of drive flange exceeds .002", correct condition by replacing one or all of the following parts— governor drive flange, gear set or complete rear oil pump assembly.

If run-out of governor di ive flange is less than .002" rotate governor body 180° from original position and recheck governor again. If governor runout still exceeds .005" replace governor.

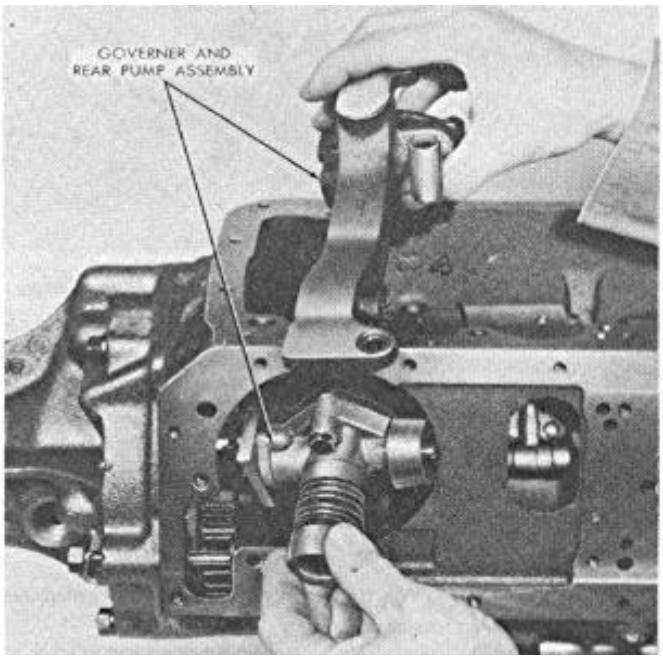


FIGURE 118—*Removing Governor and Rear Pump Assembly*

Remove Governor and Rear Pump Assembly

Position governor so that the large round governor weight is toward the front of the transmission. (Fig. 118).

To remove governor and rear pump assembly from transmission; position one reverse drive flange attaching bolt up.

Remove two bolts and lock washers holding governor and rear pump to transmission case.

Remove assembly by moving toward control valve assembly side of transmission case and raise rear of pump to clear case.

Remove Pressure Regulator Assembly

Loosen pressure regulator valve plug in transmission case using a 11/2" socket wrench.

CAUTION: *Pressure regulator valve assembly is under spring pressure. Hold pressure against regulator plug while unscrewing by hand.*

Remove plug, spring, and valve as an assembly ; the reverse booster plug and T.V. plug are located in the pressure plug (Fig. 119).

NOTE: *Refer to Minor Services and Repairs for disassembly, inspection and assembly.*

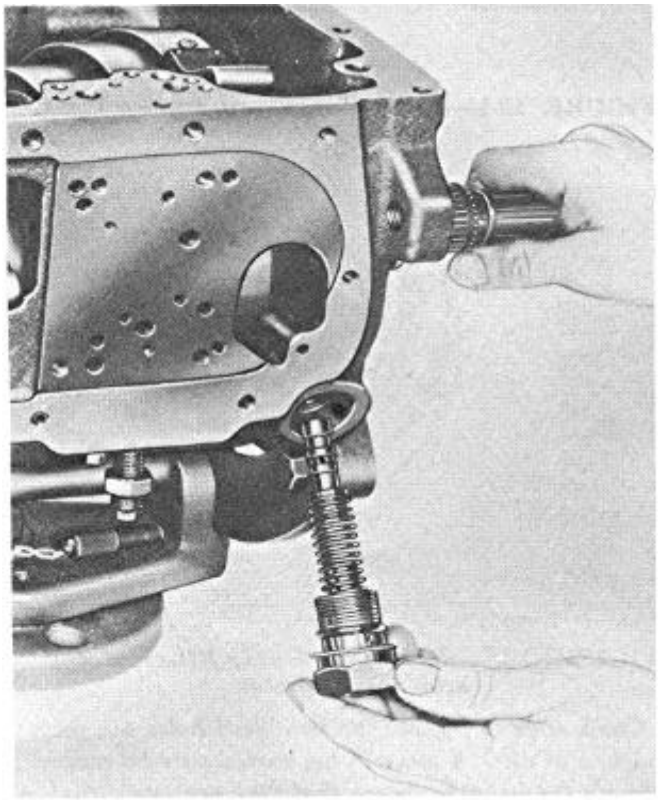


FIGURE 119—*Removing Pressure Regulator Plug Assembly*

Check End Clearance of Main Shaft

Install Main Shaft End Play Guide J-2587 over main shaft and front planet carrier.
Set up dial indicator on transmission case using tool J-1465 (Fig. 120).

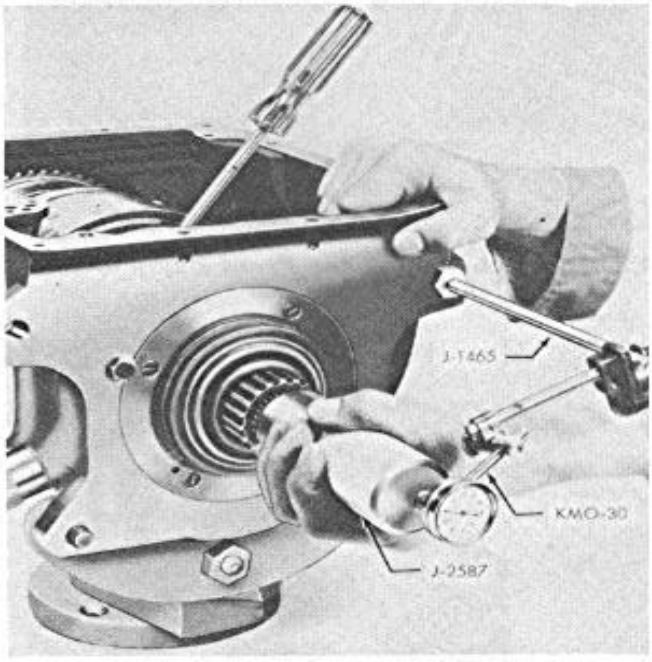


FIGURE 120—*Checking Main Shaft End Play*

Insert screw driver between the front clutch drum unit and center bearing cap holding front planet unit forward. The screw driver should be placed at an angle to prevent damage to the oil delivery sleeve.

Move main shaft back and forth (Fig. 120). End clearance should be .004" to .018" and be sure to get just float. Pulling too hard will compress clutch release springs.

Remove screw driver from between front clutch drum and center bearing cap. If the dial indicator reading is less than .004" or more than .018", correct by replacing with a new selective thrust washer; these are supplied in various thicknesses. Remove the dial indicator.

Front Oil Pump Disassembly

Remove main shaft snap ring with snap ring pliers and remove the steel and bronze thrust washers from the planet carrier shaft.

Remove the two front pump attaching bolts and locating washer. Then remove the front pump and front drive gear together from the transmission (Fig. 121). Remove bronze thrust washer from front end of planet carrier.

Remove front drive gear. Remove four oil pump cover to body attaching screws and washers. Use J-2184-A pump holder and socket set (Fig. 122)

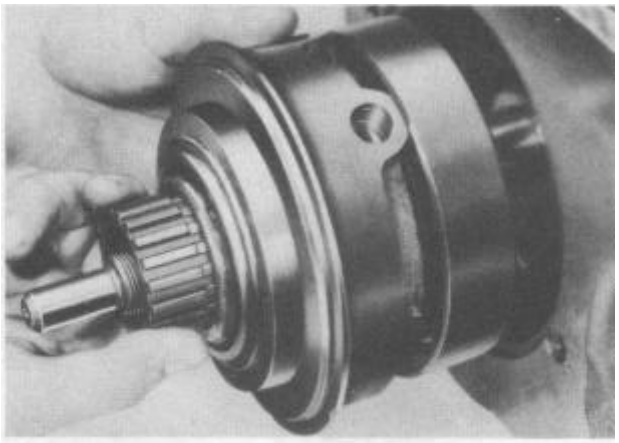


FIGURE 121—*Removing Front Pump and Front Drive Gear*

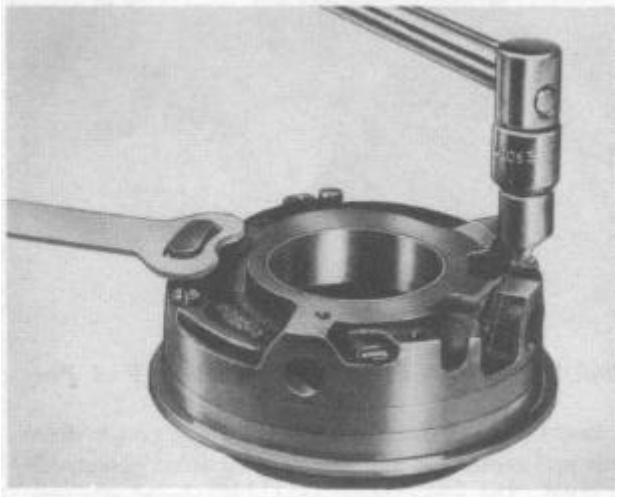


FIGURE 123—*Removing Pump Cover to Body Attaching Screws*

Lift pump body from the cover.

NOTE: *Never lift the cover from the body. This could permit the internal parts to fall from the assembly.*

Remove relief valve guide from the oil pump body by pressing on the guide with a blunt screw driver and slipping the pin from the body. Hold the guide with finger pressure to prevent it from "popping" out too fast. Remove guide, spring and valve. The valve can be removed with snap ring pliers.

Remove front pump intake seal from front pump body intake port and discard.

Mark face of rotor with pencil or prussian blue so that it will be returned to its original position.

Remove guide rings, rotor .and seven vanes (Fig. 125).

Remove slide and priming springs (Fig. 126).

Inspection of Front Oil Pump

The entire unit should be inspected for dirt, or scoring (Fig. 127).

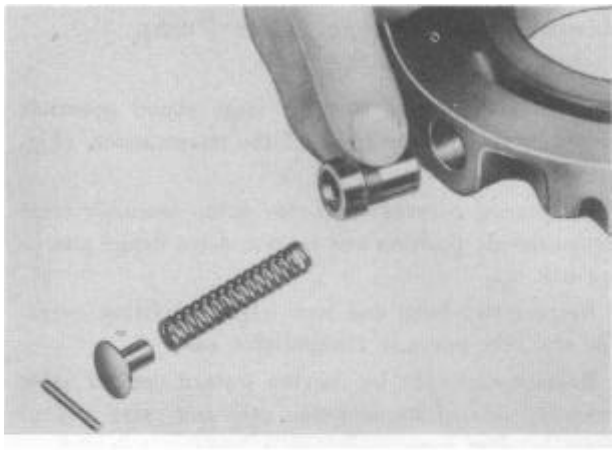


FIGURE *123—Removing Relief Valve Guide Spring and Valve*

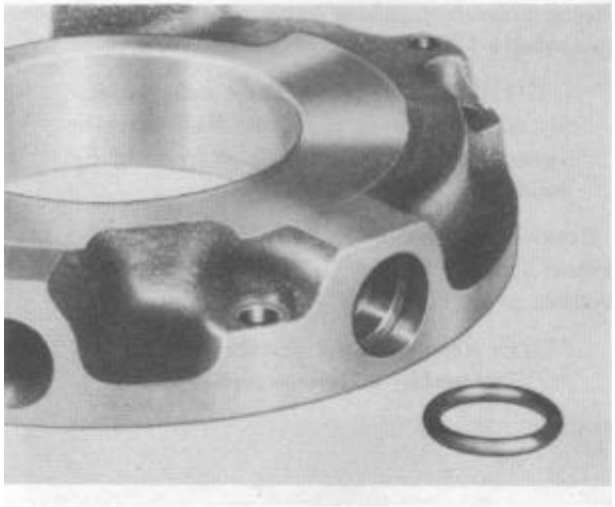


FIGURE 124—Removing Front Intake Pipe Seal

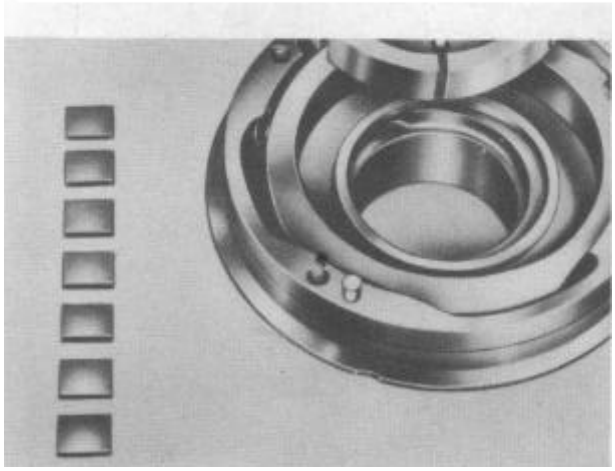


FIGURE 125—*Removing Guide Rings, Rotor and Seven Vanes*

Check slide to be sure the two bleed holes are open and free of dirt. A piece of tag wire should be pushed through the holes to insure that they are open.

Check vanes to see that they are not scored or burred.

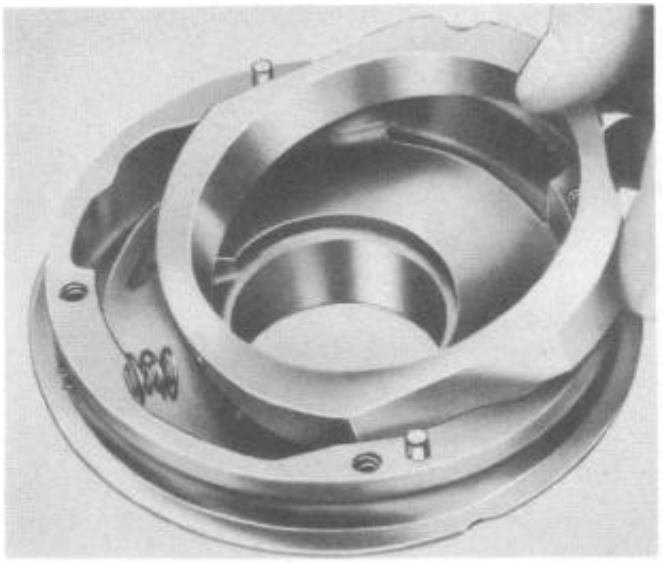


FIGURE 126—*Removing Slide and Priming Springs*

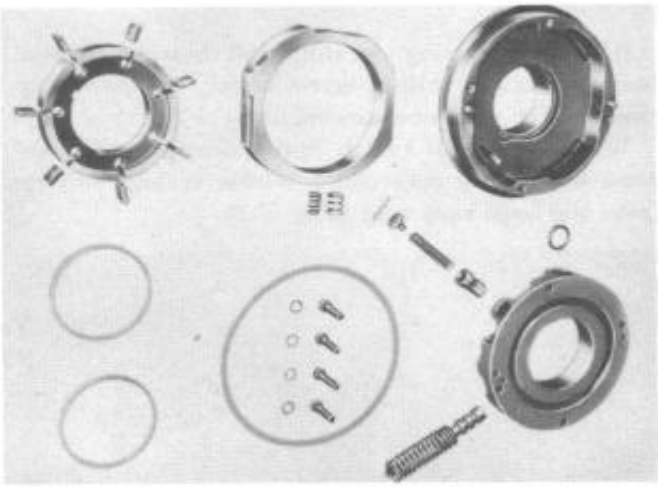


FIGURE 127—*Disassembled View of Front Pump*

Be sure slide is free in pump cover. It should not bind under any circumstances.

Check freeness of pressure regulator valve in pump body bore.

Check freeness of vanes in rotor slots.

Check to be sure oil seal ring is free and not broken. Check pump bushing for scores or flaking. However, slight wear is permissible.

Check woodruff key slot in rotor for burrs or wear. Inspect all passages for obstruction.

Check freedom of relief valve in pump body bore.

Assembly of Front Oil Pump

Install relief valve, spring, spring guide and retaining pin in pump body. Use a blunt screw driver to compress the guide and spring while installing retainer pin.

Install priming springs and slide in pump cover.

CAUTION: *Be sure springs are located properly by moving slide against it until slide bottoms against lower stop in cover.*

Install one guide ring and rotor. Be sure marked face of rotor is up.

Install seven vanes in rotor slots. Be sure vanes fit between guide ring and slide.

NOTE: *Check edges of vanes for wear pattern. One edge will be polished for its full length. This edge should face the slide.*

Install second guide ring. Guide ring can be installed easier if rotor is on dowel pins.

Install four pump cover to body screws and washers and tighten 12-15 foot pounds using a torque wrench and front pump holding tool set J-2184-A.

With pump completely assembled, move rotor by hand to be sure rotor, vanes and slide are free. Be sure priming springs will return slide after springs are compressed.

Front pump should be assembled to the front drive gear before they are installed in the transmission. Be sure pump assembles to front drive gear freely. Do not force pump onto drive gear.

Reverse Assembly and Main Shaft Removal

Remove rear bearing retainer oil seal with tool J-4380 Oil Seal Remover and J-2619 Slide Hammer (Fig. 128).

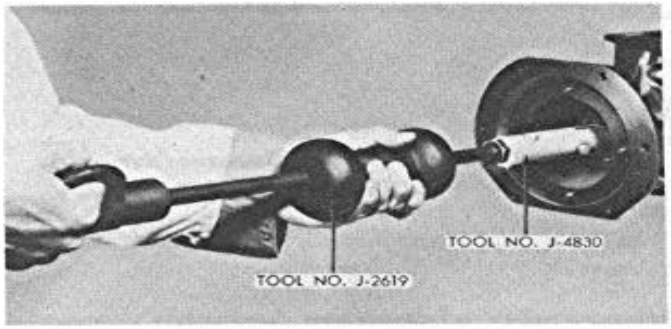


FIGURE 128—Removing Rear Bearing Retainer Oil Seal

Remove six reverse center gear and drive flange attaching bolts. Drive flange can be held from turning by bracing screw driver under drive flange bolt head (Fig. 129).

Install screw driver between the center bearing cap and rear clutch drum to prevent the drum from moving forward.

Remove five remaining rear bearing retainer to transmission case attaching bolts and lock washers.

Carefully remove reverse assembly from transmission case (if assembly sticks, tap on front end of main shaft with plastic or similar type hammer) (Fig. 130).

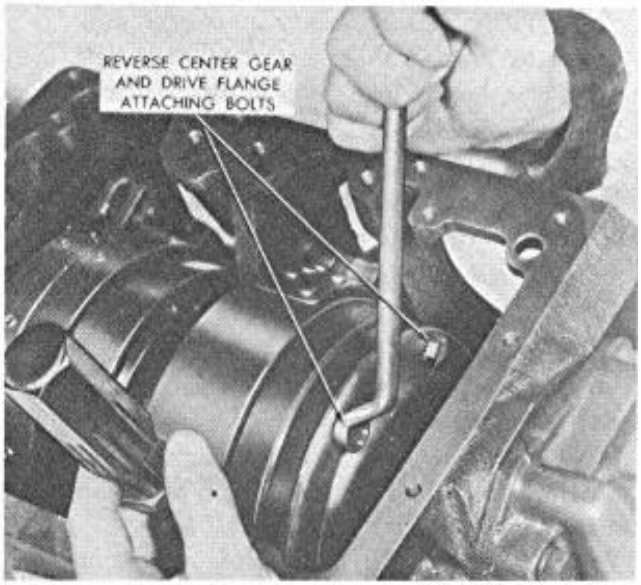


FIGURE 129—*Removing Reverse Center Gear and Drive Flange Attaching Bolts*

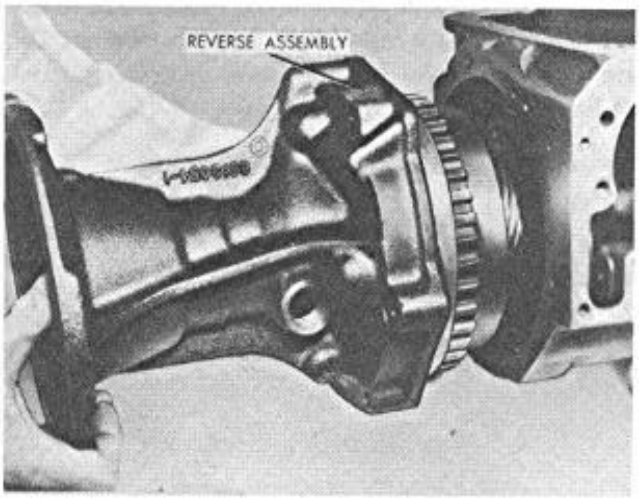


FIGURE 130—*Removing Reverse Assembly from Transmission Case*

If main shaft remained in transmission, remove main shaft.

Disassembly of Reverse Assembly

Remove the stationary cone lock key, speedometer driven gear and sleeve assembly from rear bearing retainer. Then remove gasket.

Use snap ring pliers to remove snap ring on output shaft inside the rear bearing retainer at ball bearing. This snap ring is smaller than other snap rings used in the transmission.

Lay the bearing retainer on its side and remove output shaft from bearing retainer (Fig. 131). (It may be necessary to tap output shaft with a plastic hammer while holding rear bearing retainer to separate units).

Remove reverse internal gear and stationary cone from rear bearing retainer by compressing stationary cone by hand.

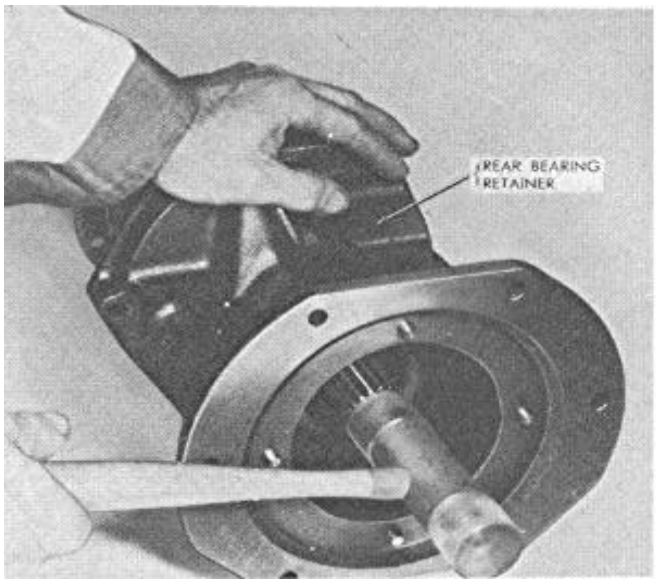


FIGURE 131—*Removing Output Shaft from Rear Bearing Retainer*

Remove snap ring, locating ball bearing in rear bearing retainer, with a screw driver. (A new snap ring must be used when assembling.)

With tool J-4670 Clutch Spring Compressor, compress the reverse cone clutch release springs and remove the large snap ring (Fig. 132).

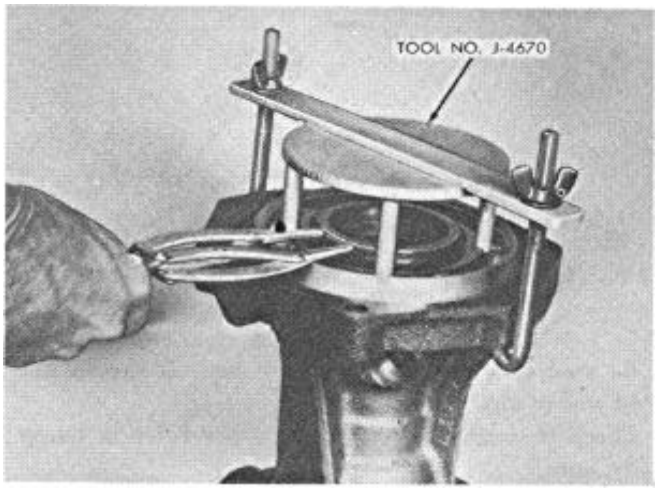


FIGURE 132—*Removing Reverse Cone Clutch Retaining Snap Ring*

Remove tool and remove coil spring retainer.

Remove the six coil release springs.

Remove reverse piston by pulling straight out. (Do not try to turn piston since it is located by two dowel pins.)

Remove outer oil seal from reverse piston.

Remove inner oil seal from the rear bearing retainer hub (Fig. 133).

Remove large bronze thrust washer from reverse internal gear.

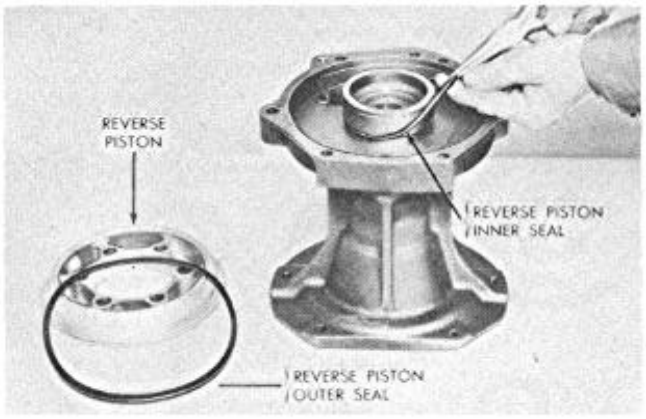


FIGURE 133—Removing Reverse Piston Inner and Outer Oil Seals

Remove reverse stationary cone from reverse internal gear cone by using large snap ring pliers KM0- 410 to expand cone (Fig. 134).

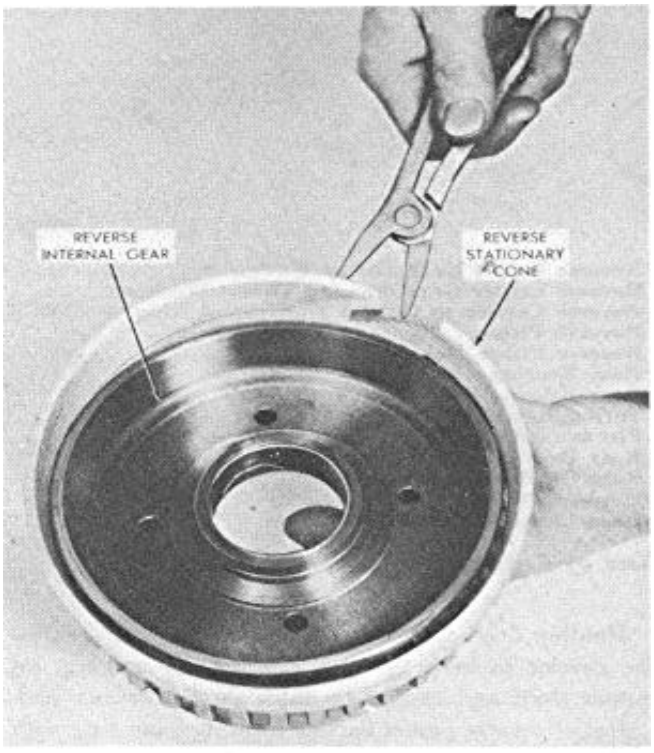


FIGURE 134—*Removing Reverse Stationary Cone*

Remove reverse clutch release wave spring and spring retainer from reverse internal gear by lifting straight out.

Remove the snap ring, that holds the reverse planet carrier, from the output shaft with snap ring pliers.

Remove reverse planet carrier from output shaft.

Remove reverse planet carrier locating snap ring from output shaft with snap ring pliers.

Remove reverse sun gear and drive flange assembly from output shaft.

Remove one steel and one bronze thrust washer from output shaft.

Inspection of Reverse Assembly and Main Shaft

Inspect ball bearing by thoroughly cleaning and oiling. Then rotate slowly by hand, feeling for roughness.

Inspect reverse internal gear for damaged teeth and scored or damaged inside bearing surface.

Inspect reverse internal gear for scored or burned cone surface.

Inspect reverse internal gear parking teeth for damage.

Inspect reverse planet carrier for worn or damaged teeth and worn roller bearings.

Inspect splines of reverse planet carrier for damage.

Inspect bronze oil pump drive gear for damage or excessive wear. See that bronze gear is tight on carrier and that pump drive gear ball is in place.

Inspect gear in reverse center gear and flange assembly for damaged teeth or worn bushing. If gear is damaged, replace entire assembly as center gear is not furnished separately.

Inspect output shaft assembly for scored thrust and bearing surfaces.

Inspect output shaft splines for nicks or burrs. Inspect output shaft speedometer drive gear surface for wear or damage.

Inspect steel and bronze thrust washers for excessive wear.

Inspect internal gear thrust washer for wear or scoring.

Inspect reverse clutch release spring and retainer for signs of damage or burning.

Inspect reverse clutch stationary cone for burning or excessive wear.

Inspect reverse piston coil release springs for distortion or collapsed coils.

Inspect reverse piston for burning on cone surface. Inspect reverse piston for scores on piston. Be sure oil seal grooves are thoroughly clean.

Inspect two reverse piston pins for scoring, looseness or distortion.

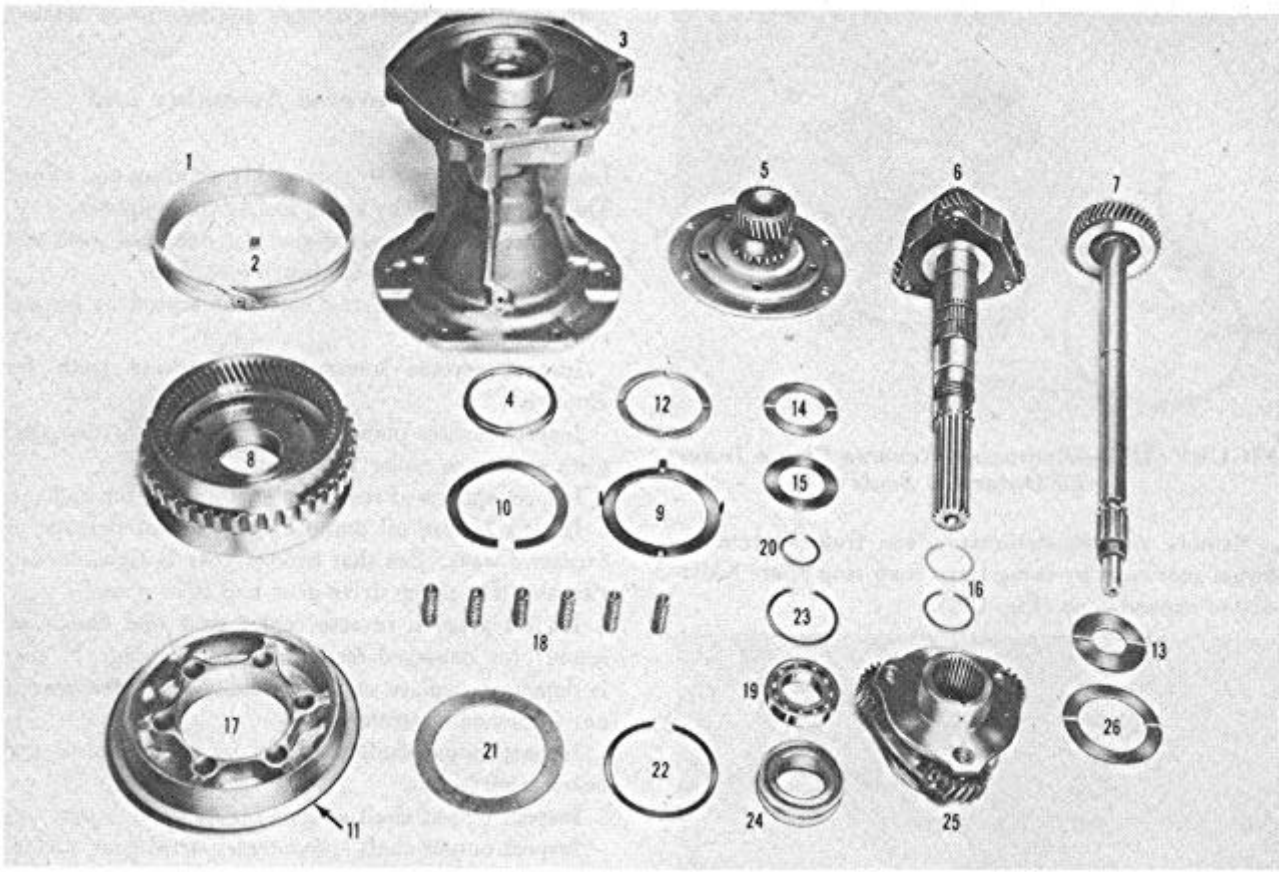
Inspect inner and outer piston seal operating surfaces for scoring or roughness.

Inspect rear bearing retainer bushing for excessive wear and see that oil holes in retainer are open. Clean all parts thoroughly.

Assembly of Reverse Unit

Hold the reverse center gear with drive flange up; install the steel thrust washer and then the bronze thrust washer in the recess of the drive flange.

Still holding the reverse center gear, insert the output shaft through the drive flange and center gear until carrier bottoms on the two thrust washers (Fig. 136).



1. Reverse Clutch Stationary Cone
2. Reverse Stationary Cone Key
3. Rear Bearing Retainer
4. Reverse Piston Inner Seal
5. Reverse Drive Flange Assembly
6. Output Shaft Assembly
7. Main Shaft
8. Reverse Internal Gear Assembly
9. Reverse Clutch Release Spring Retainer
10. Reverse Clutch Release Spring
11. Reverse Piston Outer Seal
12. Reverse Internal Gear Thrust Washer
13. Selective Thrust Washer
14. Reverse Center Gear Thrust Washer
15. Reverse Center Gear Backing Thrust Washer
16. Reverse Carrier to Output Shaft Snap Rings
17. Reverse Piston
18. Reverse Piston Release Springs
19. Rear Bearing (Ball Type)
20. Rear Bearing to Shaft Snap Ring
21. Spring Retainer Washer
22. Piston to Rear Bearing Retainer Snap Ring
23. Rear Bearing to Retainer Snap Ring
24. Rear Oil Seal
25. Reverse Planet Carrier Assembly
26. Rear Clutch Hub Thrust Washer

FIGURE 135—*Disassembled View of Reverse Assembly*

FIGURE 136—*Installing Reverse Center Gear on Output Shaft*

Holding drive flange and center gear tightly against the carrier to keep thrust washers from moving, set output shaft and carrier on table on the carrier end.

Install reverse planet carrier locating snap ring with snap ring pliers.

NOTE: Do not pick up this unit until completely assembled to prevent thrust washers from slipping out of place.

Install reverse planet carrier over output shaft with bronze drive gear down, meshing pinions with the sun gear. (Be certain unit is bottomed against reverse planet carrier locating snap ring).

Use snap ring pliers to install snap ring on output shaft to position reverse planet carrier.

Install reverse clutch release wave spring and spring retainer on internal gear side of reverse internal gear (Fig. 137).

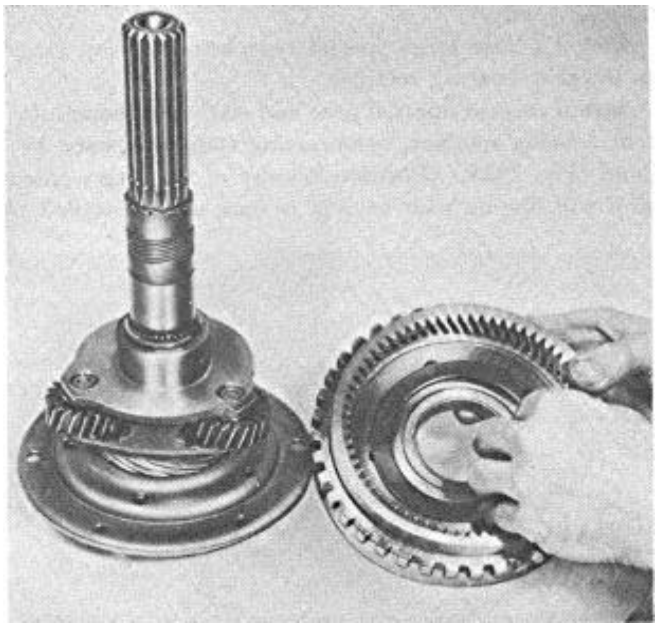


FIGURE 137—Installing Reverse Clutch Release Spring Retainer

Install reverse stationary cone on reverse internal gear cone. (Use snap ring pliers to spread stationary cone for installation) (Fig. 138).

CAUTION: *Do not spread cone more than necessary to make the installation.*

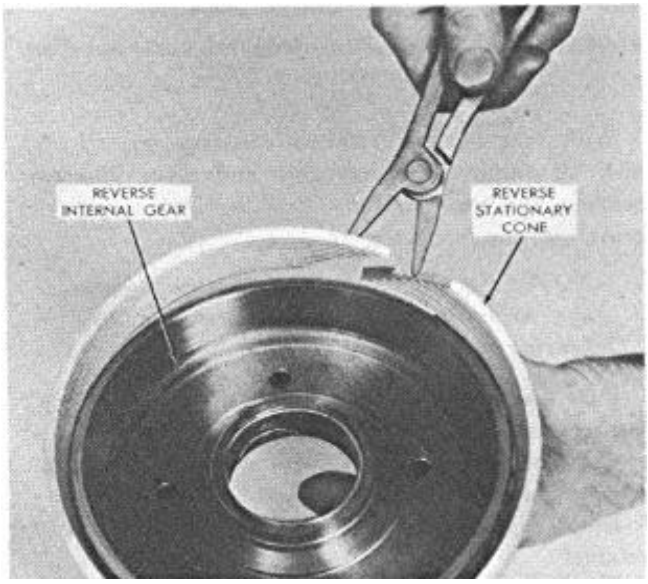


FIGURE 138—Installing Reverse Stationary Cone

Install reverse cone piston inner seal with lip down I Fig. 139). (Work seal well into groove.) Apply light coat of Hydra-Matic fluid over outer surface of inner seal.

Install outer seal on reverse cone piston with seal lip down away from cone and work seal well into groove (Fig. 140). Coat surface of outer seal with Hydra-Matic Fluid.

FIGURE 139—*installing Reverse Cone Piston Inner Seal*

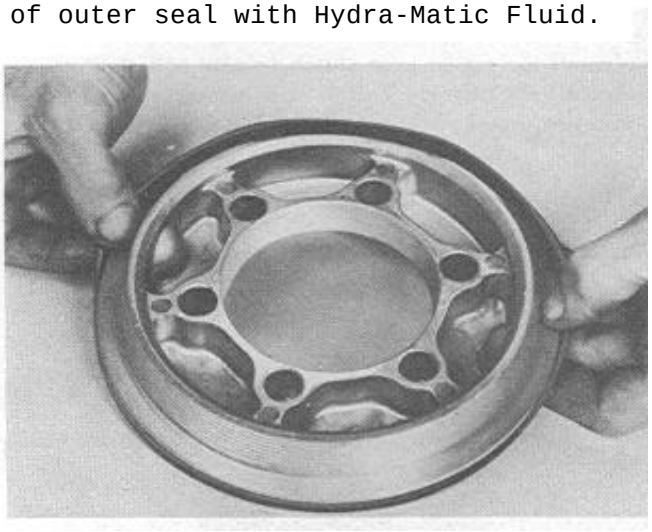


FIGURE 140—*Installing Reverse Cone Piston Outer Seal*

Install reverse cone piston in rear bearing retainer, so it rests on the dowel pins. Install outer seal compressor tool J-4752 around seal and down into bottom of shallow counterbore of the rear bearing retainer (Fig. 141). Then turn the reverse cone piston until the dowel pins are aligned with holes in piston and carefully push piston into retainer. (Use extreme caution when installing to prevent damage to the seal.) To make certain piston is fully seated, lay a straightedge across the face of the piston and measure from straightedge to face of rear bearing retainer. The measurement should read %" to 13/32".

FIGURE 141—*Installing Reverse Cone Piston in Rear Bearing Retainer*

Install the six reverse clutch release coil springs.

Install the reverse clutch coil spring retainer and compress springs with special tool J-4670 (Fig. 142).

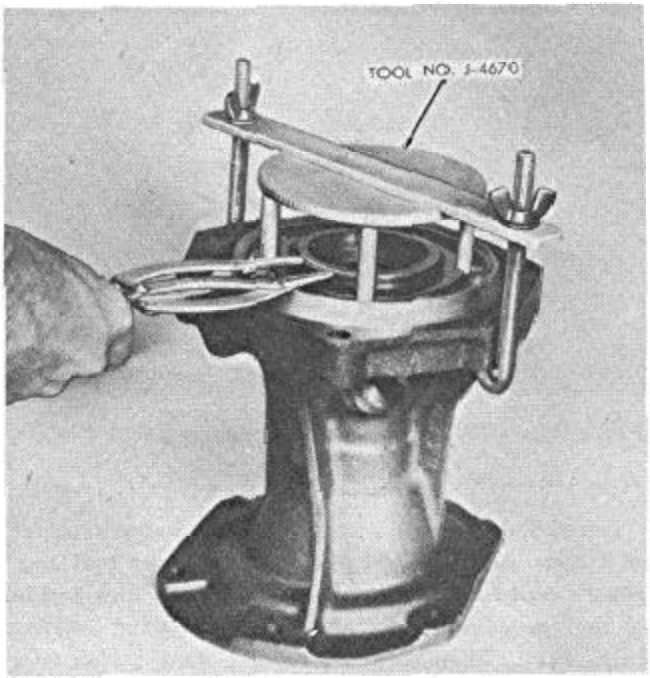


FIGURE 142—*Installin• Reverse Clutch Coil Spring Retainer*

Install large type snap ring, holding retainer in place and remove special tool.

Install ball bearing in rear bearing retainer. (Be sure that the bearing is fully and squarely. seated by tapping gently.)

Install a new large special type bearing snap ring in the rear bearing retainer.

Install reverse internal gear and stationary cone into rear bearing retainer, compressing stationary cone by hand (Fig. 143). (Position keyway of stationary cone so it will line up with keyway in case when installed.)

FIGURE 143—*Installing Reverse Internal Gear and Stationary Cone*

With rear bearing retainer standing on tail end, pick up output shaft assembly and place into rear bearing retainer carefully meshing reverse carrier gears with the internal gear.

NOTE: *Use extreme caution to prevent damage to bushing and ball bearing in rear bearing retainer.*

Install snap ring on output shaft, locking rear bearing retainer to output shaft. This snap ring is smaller than snap rings used elsewhere in the transmission.

Install speedometer gear in rear bearing retainer.

Install rear bearing retainer gasket on rear bearing retainer.

Install stationary cone to case lock key (Fig. 144). Use lubriplate to hold key in place.

Front and Rear Drum Unit Removal

Install rear hub retaining tool J-2174 to rear unit drum using a reverse drive flange attaching bolt (Fig. 145).

Bend back edge of lock plate under two center bearing cap attaching bolts with chisel and light hammer.

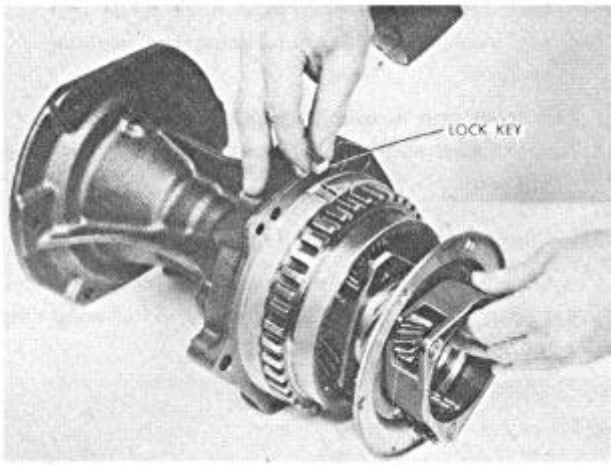


FIGURE 144—*Installing Stationary Cone to Case Lock Key*

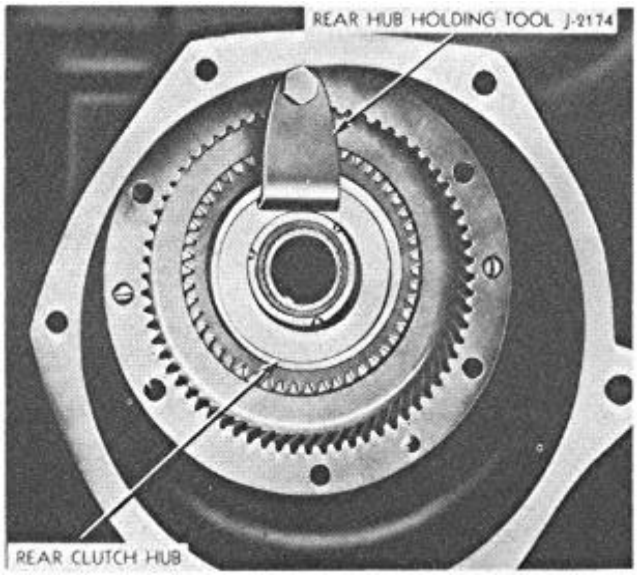


FIGURE 145—*Holding Rear Hub with Tool J-2174*

Remove two center bearing cap to case bolts and lock plate.

NOTE: *It may be necessary to equalize distance by moving front and rear clutch drums to allow socket wrench to seat on bolt head.*

Lift the rear unit to allow the band to slide clear of drum and remove rear band and strut assembly.

Install spring or wire to hold front band on front unit drum (Fig. 146).

Lift both front and rear planet assemblies with band from transmission case (Fig. 147).

Removal of Rear and Front Units from Planet Carrier

Remove Front Band

Place planet carrier with front and rear planet assemblies into holding fixture J-2187 (Fig. 148).

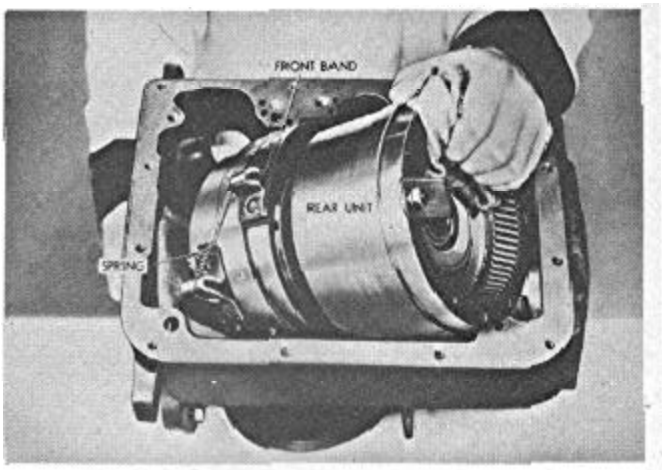


FIGURE 146—*Spring Holding Front Band on Drum*

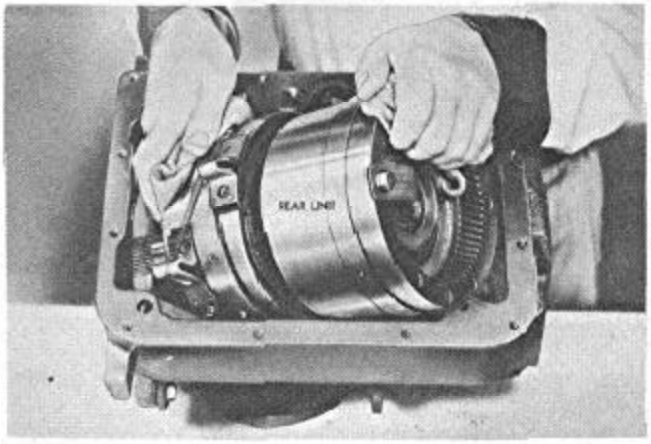


FIGURE 147—*Removing Units from Case*

FIGURE 148—*Disassembly of Front and Rear Units*

Remove rear clutch hub rear snap ring and steel washer (Fig. 149).

FIGURE 149—*Removing Rear Clutch Hub Rear Snap Ring*

Lift rear unit from planet carrier.

Remove rear clutch hub front snap ring from planet carrier.

Remove center bearing cap from oil delivery sleeve.

Remove oil delivery sleeve from planet carrier. Remove snap ring from recess in front unit (Fig.150).

FIGURE 150—*Removing Snap Ring from Recess in Front Unit*

CAUTION: *Hold snap ring open while lifting from carrier to avoid damaging bearing surface.*

Lift front unit assembly from planet carrier.

Remove steel and bronze thrust washers from recess of front unit.

Disassembly of Front Unit

Place front unit assembly in press and remove clutch drum snap ring (Figs. 151 and 152). After snap ring is removed, release pressure.

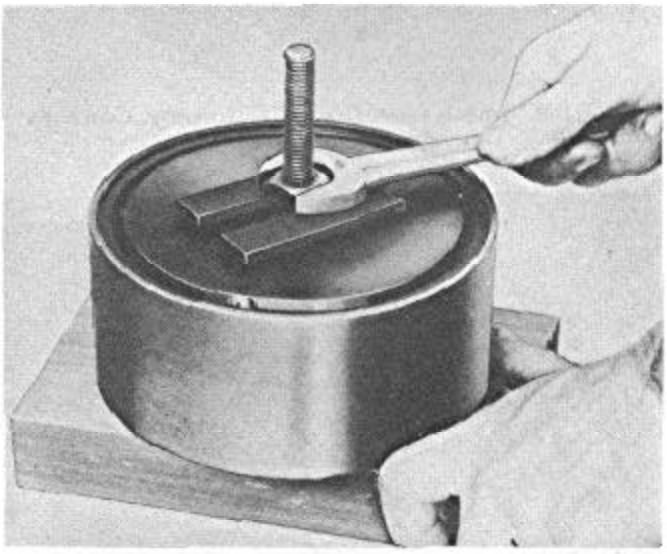


FIGURE 151—*Compressing Clutch Drum.*

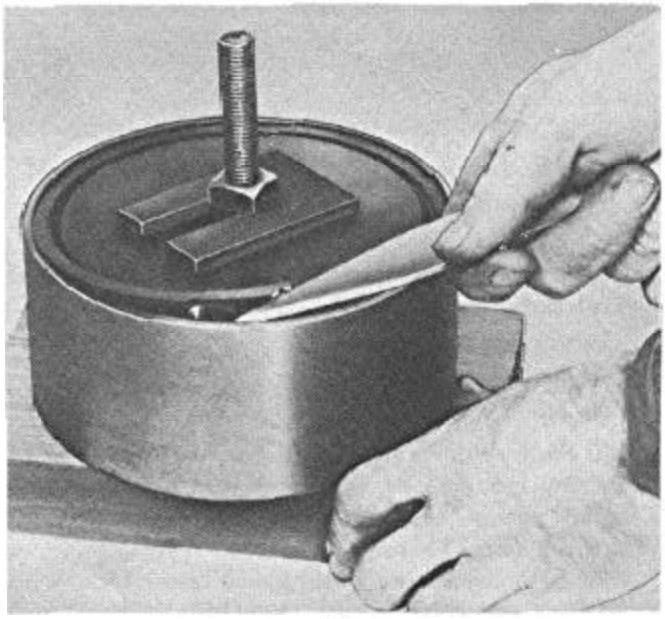


FIGURE 152—*Removing Clutch Drum Snap Ring*

Separate drums by tapping front face of center gear on front clutch drum with rawhide or similar hammer (Fig. 153).

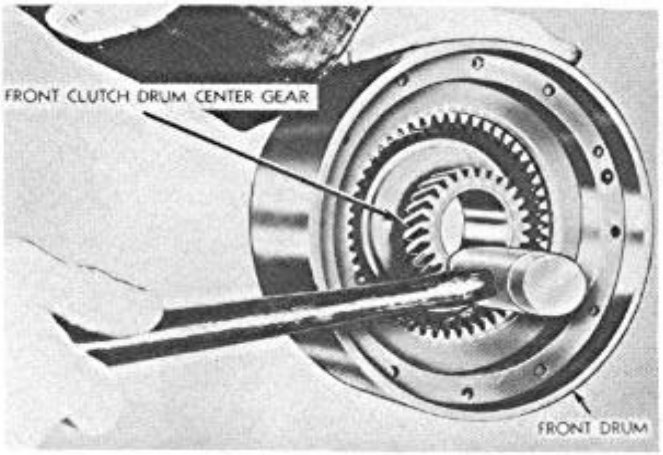


FIGURE 153—*Removing Center Gear and Clutch*

NOTE: *Use care not to lose clutch release springs.*

Remove six inner and six outer front clutch release springs from front unit drum.

Remove front clutch annular piston from clutch drum by bumping front face of center gear on soft wood block (Fig. 154).

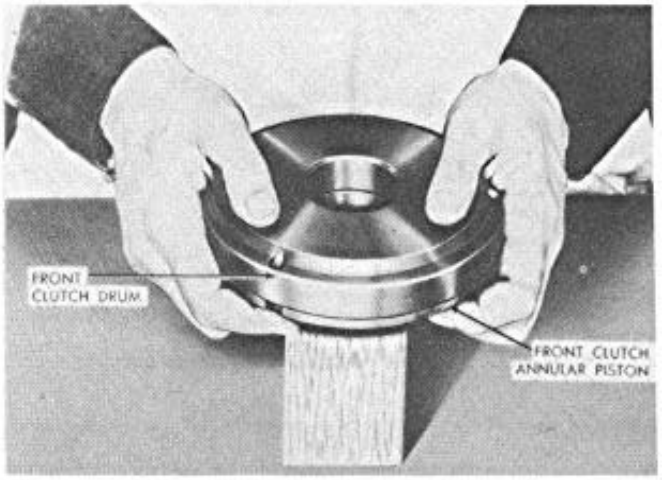


FIGURE 154—*Removing Annular Piston*

Remove rubber piston seals and brass expanders from annular piston and clutch drum piston. Use blunt edge screw driver (Fig. 155).

Inspection of Front Unit

Inspect clutch drive pins in front unit drum. If they are scored, loose or distorted, replace drum and drive pin assembly. Pins are not furnished separately.

Inspect drum for deep grooves or scores at band surface and clutch plate surface.

Inspect clutch release springs for distortion or collapsed coils. Free length 2-15/64".

NOTE: *Slight wear, "bright spots," on side of outer release springs indicating slight contact with drum is permissible.*

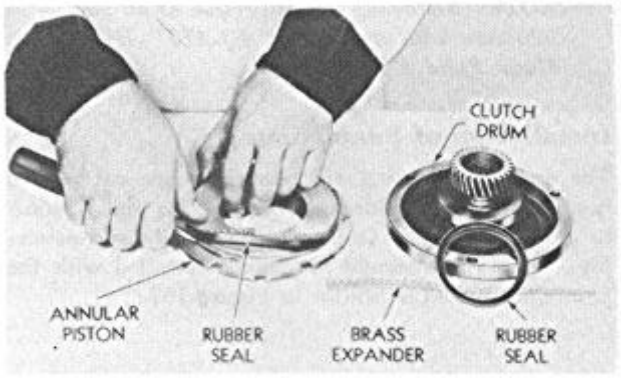


FIGURE 155—*Removing Rubber Seals and Brass Expanders*

Inspect clutch drive plates for damaged or loose facings.

NOTE: *If flakes of facing material can be removed by scratching the surface with the thumbnail, the plate should be replaced. Discoloration of drive plates is not an indication of failure.*

Inspect clutch driven plates for scored surfaces. Driven plates must be flat.

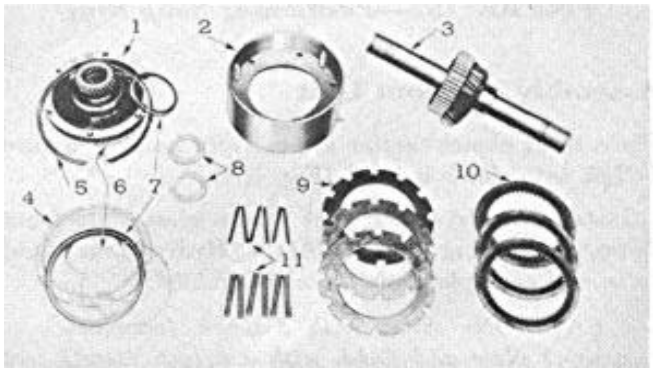
Inspect annular clutch piston for scores. Be sure oil seal grooves are thoroughly clean.

Inspect front clutch drum for scores in piston bore, oil delivery sleeve bore and oil seal grooves. Inspect gear teeth and thrust faces for damage.

Inspect front planet carrier gears for damaged teeth and excessive roller bearing wear.

Inspect bearing surfaces of planet carrier shaft. Inspect steel and bronze thrust washers.

Clean all parts thoroughly.



1. Front Clutch Drum Assembly
2. Front Drum and Pin Assembly
3. Planet Carrier Assembly
4. Clutch Annular Piston
5. Retaining Ring
6. Oil. Seal Expanders
7. Oil Seals
8. Steel and Bronze Thrust Washers
9. Clutch Driven Plates
10. Clutch Drive Plates
11. Clutch Release Springs

FIGURE 156—*Disassembled View of Front Unit —"Rambler" Series Shown*

NOTE: *Following the inspection of all parts lubricate with approved "AQ-ATF" HydraMatic Fluid.*

Installation of Snap Rings

The ends of retaining or snap rings are cut with a double taper to provide a sharp point for tool J-1466A to grip and thereby facilitate disassembly and assembly. Snap rings should always be installed with the points positioned as shown in Figure 157.

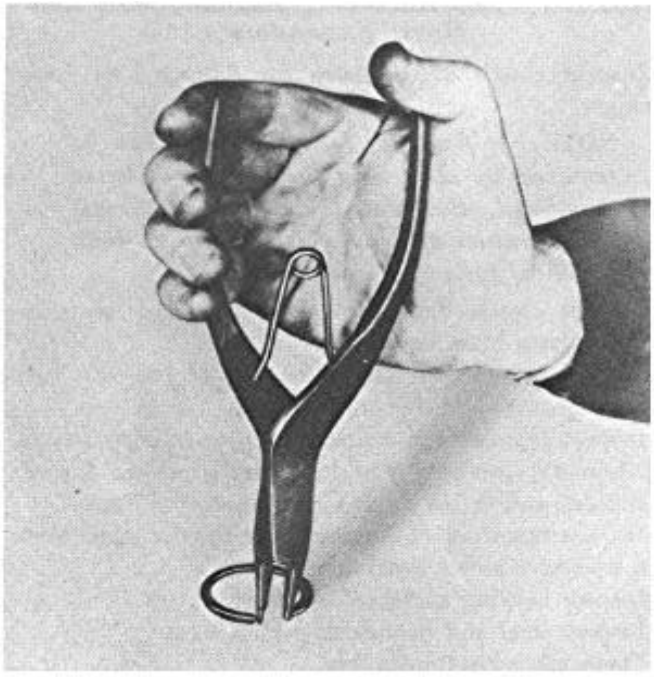


FIGURE 157—*Positioning Snap Ring*

Assembly of Front Unit

Place front planet carrier assembly in holding fixture J-2187 with clutch hub up (Fig. 158).

Install four drive and four driven plates into front drum, alternating plates. Apply Hydra-Matic fluid to face of each plate surface as assembled.

CAUTION: *Start with a drive (composition) plate and finish with a driven (steel) plate. Assemble the driven plates with square notches over the drive pins (Fig. 159).*

NOTE: The "Wasp" and "Rambler" Series have three drive and three driven plates in the front unit.

Install six outer clutch release and then six inner clutch release springs through plates into spring holes of drum (Fig. 160).

Install new inner brass expander into ring groove in clutch drum with expanding lips down (Fig. 161).

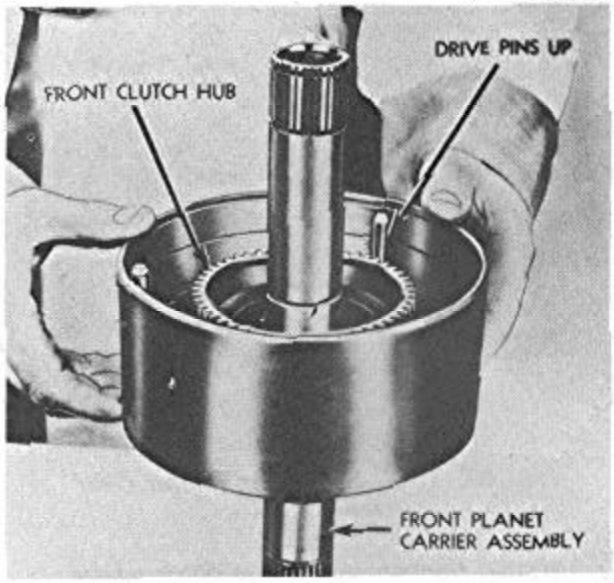


FIGURE 158—Assembling Front Unit Drum to Planet Carrier

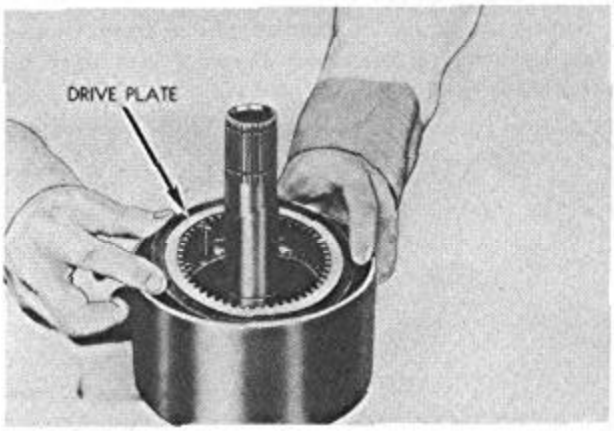


FIGURE 159—Installing Clutch Plates

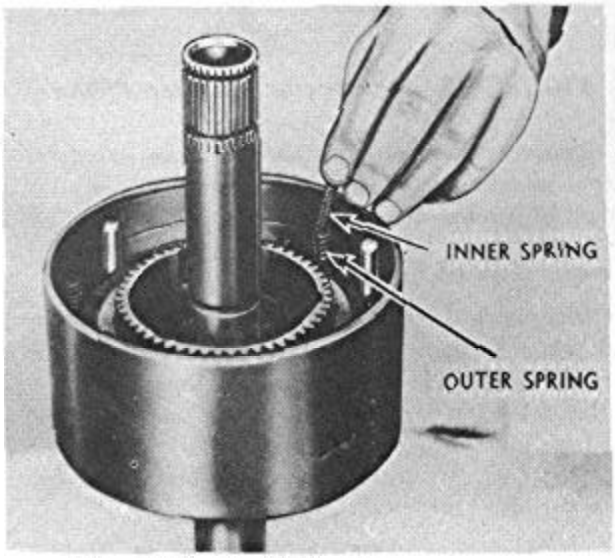


FIGURE 160—*Installing Clutch Release Springs*

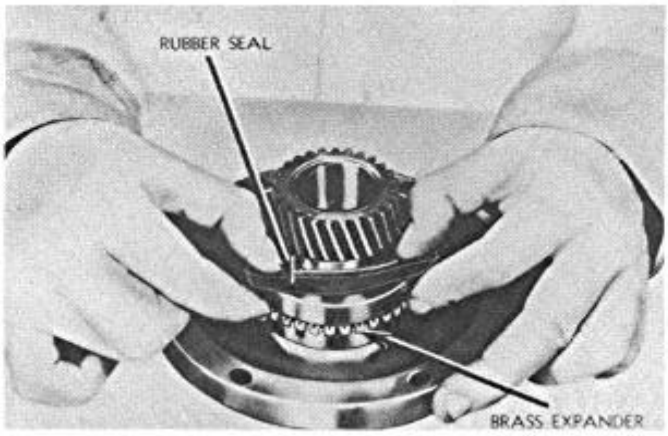


FIGURE 161—*Installing Brass Expander and Rubber Seal*

While holding brass expander in position with masking tape, work new inner piston rubber seal into ring groove with lip down over brass expander (Fig. 161).

NOTE: Work expander well back into position under seal so brass edges are not exposed. Hold brass expander in place with piece of masking tape. Before replacing large outer seal on clutch piston, install the piston into the clutch drum to insure proper installation and seating of new inner rubber seal and expander. Remove clutch piston and inspect inner seal.

Place new large rubber seal over front annular piston beyond seal groove. Install new large brass expander in piston groove with lips up (Fig. 162) .

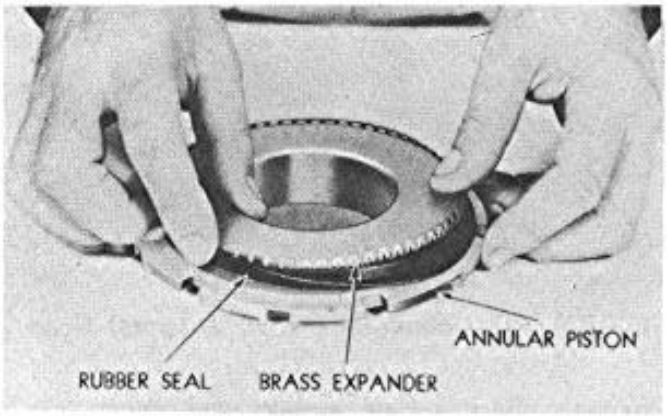


FIGURE 162—*Installing Piston Seal and Expander*

While holding expander in position, work rubber seal well into groove with lip up.

Install piston into clutch drum resting on outer rubber seal. Align square notches in piston with holes in drum. While applying slight hand pressure to piston, guide seal into bore with the flat side of blunt screw driver (Fig. 163)

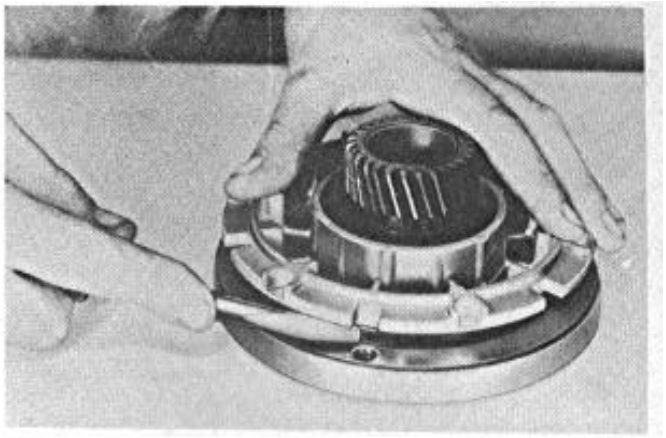


FIGURE 163—*Installing Annular Piston*

Install clutch drum and piston assembly over front planet carrier into front unit drum.

CAUTION: *Be sure clutch release springs enter into recesses of annular piston.*

Lift front unit assembly off of planet carrier, place in press and press clutch drum below snap ring groove. Install clutch drum snap ring, positioning gap of ring between two drive pin holes (Fig. 164).

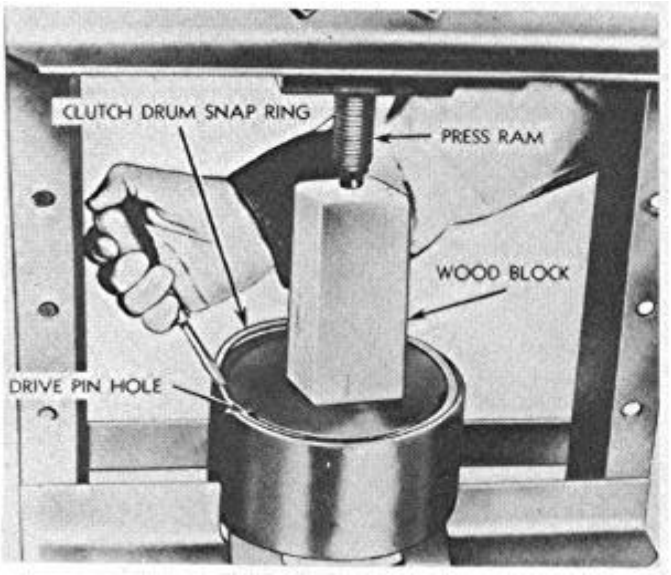


FIGURE 164 *Clutch Drum Snap Ring*

CAUTION: *Snap ring must be well seated into groove to prevent interference with ledge on drum.*

Release press and remove assembly.

Tap front face of center gear with rawhide or similar hammer so the clutch drum will seat against snap ring (Fig. 165).

Remove planet carrier from holding fixture and insert planet carrier into drive plates and drum by rolling drum on bench while pressing carrier firmly into the plates (Fig. 166).

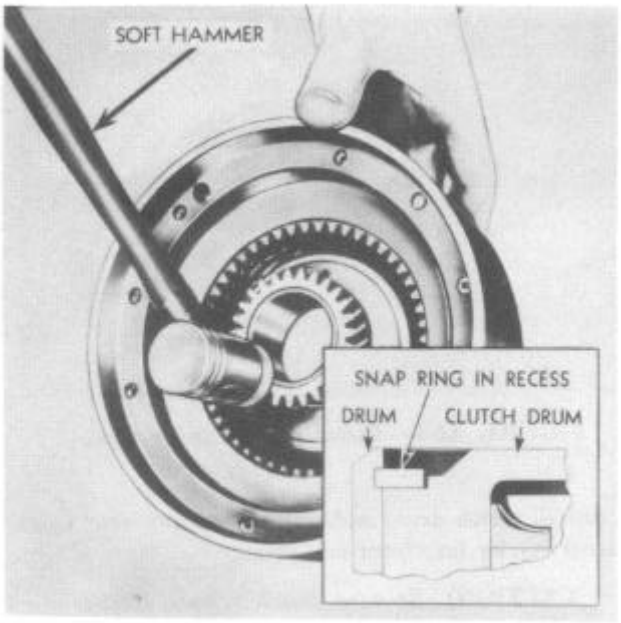


FIGURE 165—Seating Clutch Drum Against Snap Ring

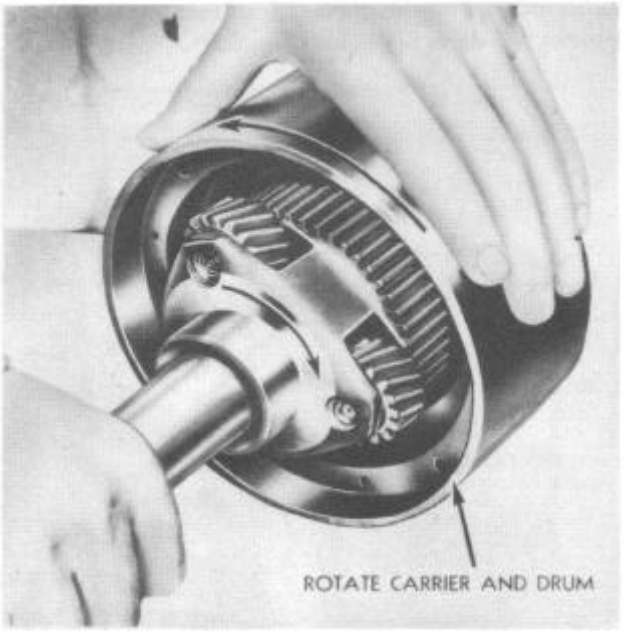


FIGURE 166—Aligning Clutch Plates

Place planet carrier and drum assembly into holding fixture.
Install bronze then steel thrust washer over planet carrier (Fig. 167).

NOTE: Locating lug on steel washer must fit over flat portion of planet carrier.

Install snap ring over planet carrier into groove above steel washer.

CAUTION: Do not allow snap ring to score bearing surface of planet carrier.

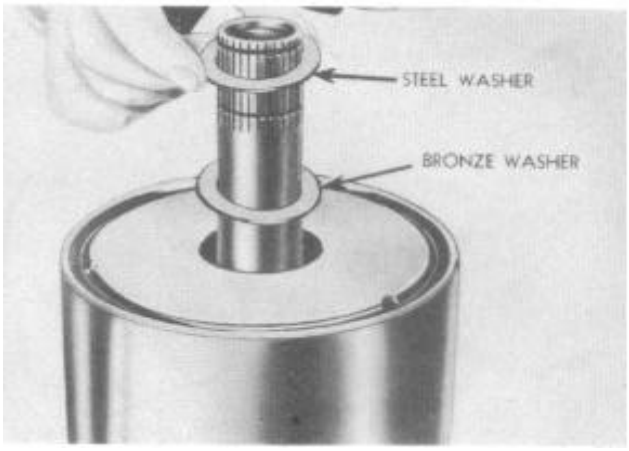


FIGURE 167—Installing Front Unit Thrust Washers

Disassembly of Rear Unit

Remove rear clutch hub retainer tool J-2174 from rear unit drum.
Remove rear clutch hub and bronze thrust washer. Remove two fillister head screws attaching rear internal gear to drum (Fig. 168).

FIGURE 168—Removing Rear Internal Gear

Remove clutch release springs and guide pins. Separate springs and guide pins. Separate springs for inspection (Fig. 169).
Remove clutch drum retainer ring.
Separate drums by tapping lightly on clutch drum rear thrust face with block of wood (Fig. 170).

NOTE: Do not damage teeth of composition clutch plates.

Remove annular piston from clutch drum by tapping drum rear thrust face on block of wood (Fig. 171).

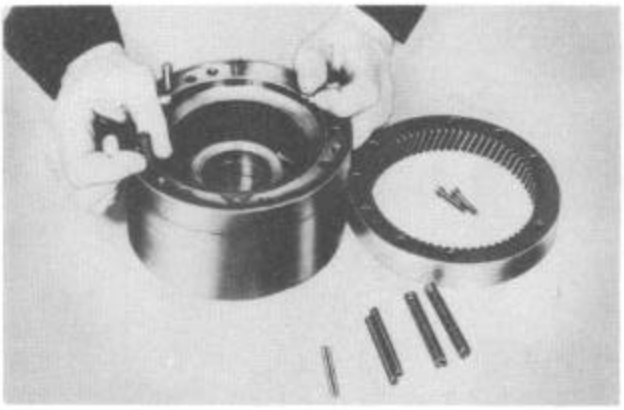


FIGURE 169—Removing Clutch Release Springs and Guide Pins

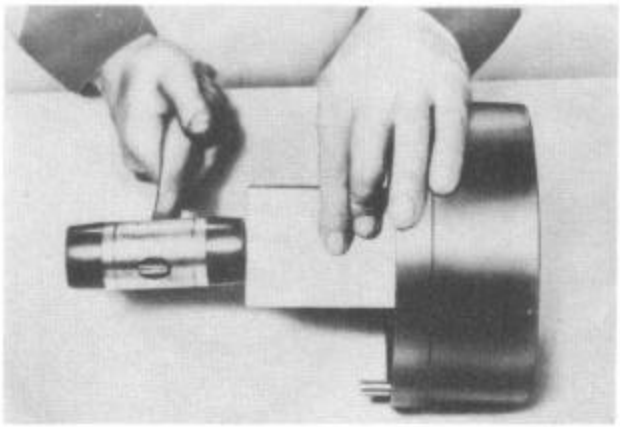


FIGURE 170—Removing Rear Unit Clutch Drum

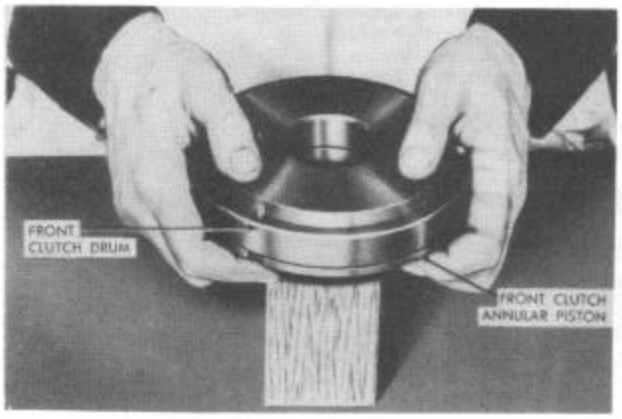


FIGURE 171—Removing Annular Piston from Clutch Drum

Remove rubber seals and brass expanders from annular piston and rear unit clutch drum.

Remove composition and steel clutch plates (7 "Hornet"; 6 "Wasp"; 5 "Rambler") .

Inspection of Rear Unit

Inspect rear internal gear for damaged teeth.

Inspect clutch drive pins in rear unit drum. If they are scored, loose or distorted, replace rear drum and drive pin assembly. Pins are not furnished separately.
Inspect rear unit drum for deep grooves or scores at band surface and clutch plate surface.
Inspect drive plates for damaged or loose facings.

NOTE: If flakes of facing material can be removed by scratching the surface with the thumbnail, the plate should be replaced. Discoloration of drive plates is not an indication of failure.

Inspect driven clutch plates for scored surfaces. Driven plates must be flat.
Inspect rear unit clutch drum for scores in piston bore and thrust surface.
Inspect surface of babbitt bushing in clutch drum. Inspect annular clutch piston for scores. Be sure oil seal grooves are thoroughly clean.
Inspect clutch release springs for distortion or collapsed coils. Free length 21%4".

NOTE: Slight wear, "bright spots," on side of outer release springs indicating slight contact with drum is permissible.

Inspect clutch release spring guide pins for distortion and length (1%" ± .010") .
Inspect front and rear thrust faces, internal and external splines. Blow out drilled passages on rear clutch hub.
Clean all parts thoroughly.

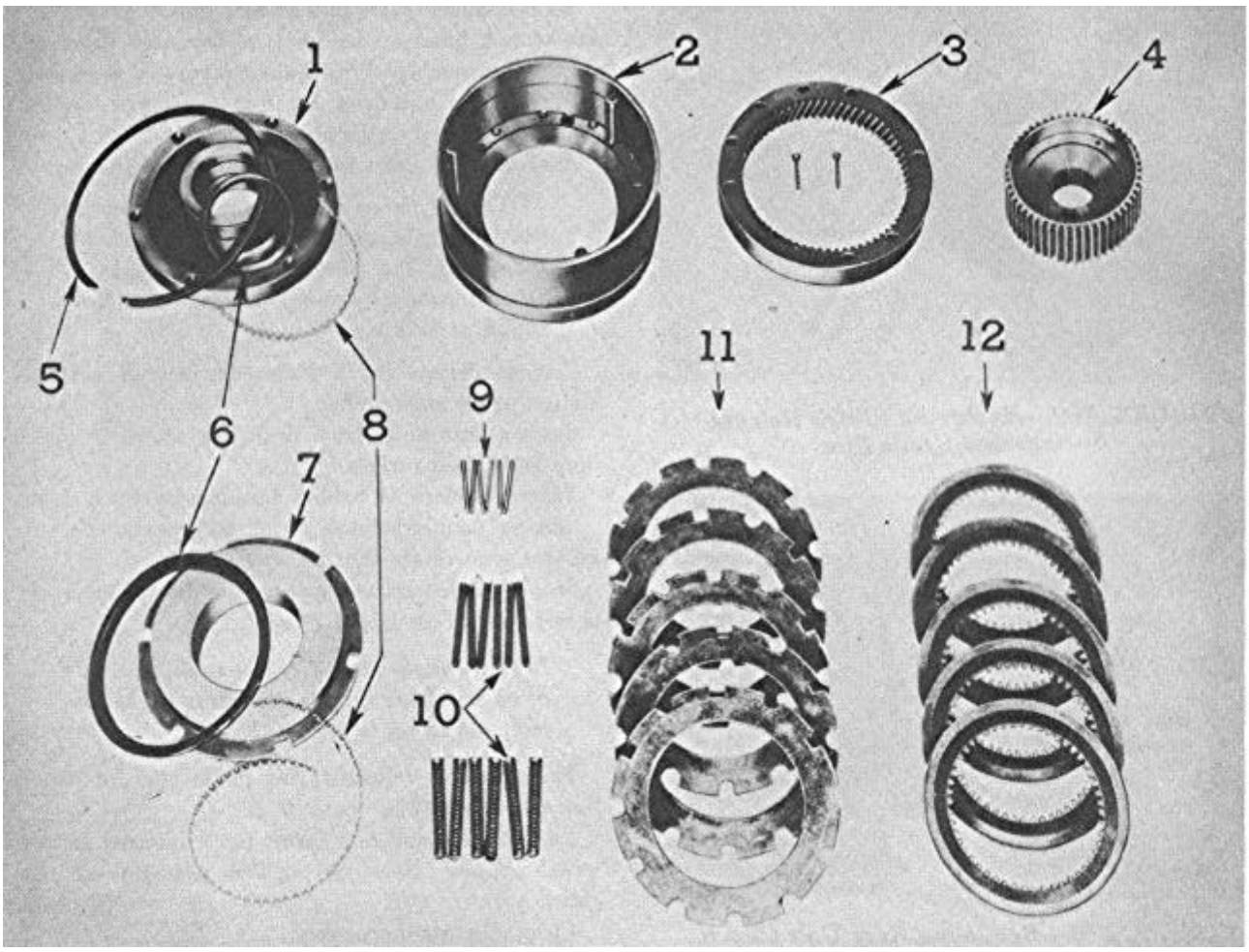
Assembly of Rear Unit

Place rear unit drum less internal gear on the bench with drive pins up.
Install drive and driven plates into drum alternating plates. Apply Hydra-Matic Fluid to face of each plate as assembled.

NOTE: Start with a drive (composition) and finish with a driven (steel) plate. Assemble driven plates with square notches over drive pins (Fig. 173).

Position new inner rubber seal on inner piston of clutch drum above groove.
Install new small brass expander into ring groove of clutch drum with expanding lips down.
While holding the brass expander in position, work rubber seal into ring groove with lip down over brass expander (Fig. 174).

NOTE: Work expander well back into position under seal so brass edges are not exposed. Hold brass expander in place with piece of masking tape. Before replacing large outer seal on clutch piston, install



1. Rear Clutch Drum Assembly
2. Rear Drum and Pin Assembly
3. Rear Internal Gear
4. Rear Clutch Hub
5. Retaining Ring
6. Oil Seals
7. Clutch Annular Piston
8. Oil Seal Expanders
9. Release Spring Guide Pins
10. Clutch Release Springs
11. Clutch Driven Plates
12. Clutch Drive Plates

FIGURE 172—*Disassembled View of Rear Unit "Rambler" Series Shown*

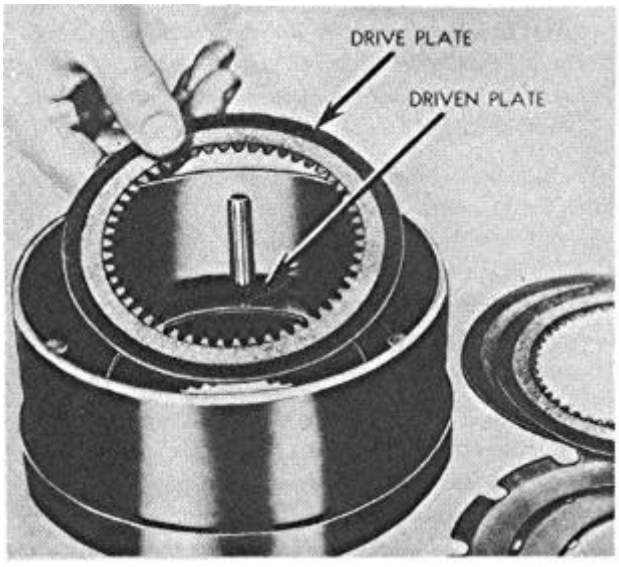


FIGURE 173—*Assembling Clutch Plates*

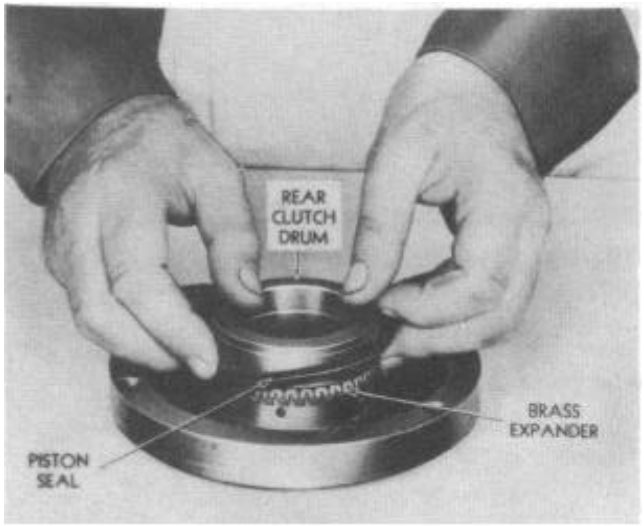


FIGURE 174—*Installing Rubber Seal Over Brass Expander*

into the clutch drum to insure proper installation and seating of new inner rubber seal and expander. Remove clutch piston and inspect inner seal.

Place new large rubber seal over rear annular piston beyond seal groove.
Install new large brass expander in piston groove with lips up.
While holding expander in position, work rubber seal with lip up well into the groove.

NOTE: Work expander well back into position under seal so brass edges are not exposed.

Place piston into clutch drum resting on outer rubber seal. Align square notches in piston with holes in drum. While applying slight hand pressure to piston, guide seal into bore with a blunt screw driver.
Install rear clutch drum and piston assembly over drive pins into drum (Fig. 175).

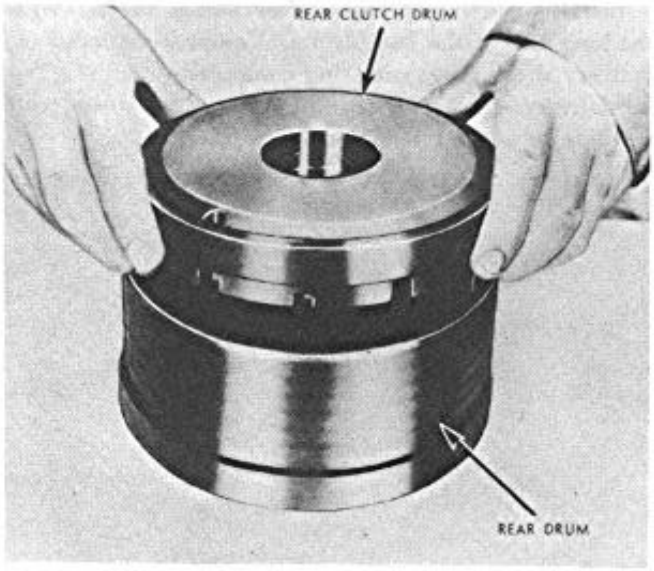


FIGURE 175—*Installing Rear Clutch Drum*

Install clutch drum snap ring, positioning gap of ring between two drive pin holes.

NOTE: *With a wood block and hammer, tap drum rear thrust face until drum seats against snap ring (Fig. 176).*

Install six outer and six inner clutch release springs into recesses in piston.
Install six clutch release spring guide pins (Fig. 177).
Assemble rear unit internal gear to rear drum. Use two reverse flange attaching bolts to position internal gear to drum. Install and tighten .two fillister head screws and then remove the two reverse flange attaching bolts.

FIGURE 176—*Seating Clutch Drum Against Snap Ring*

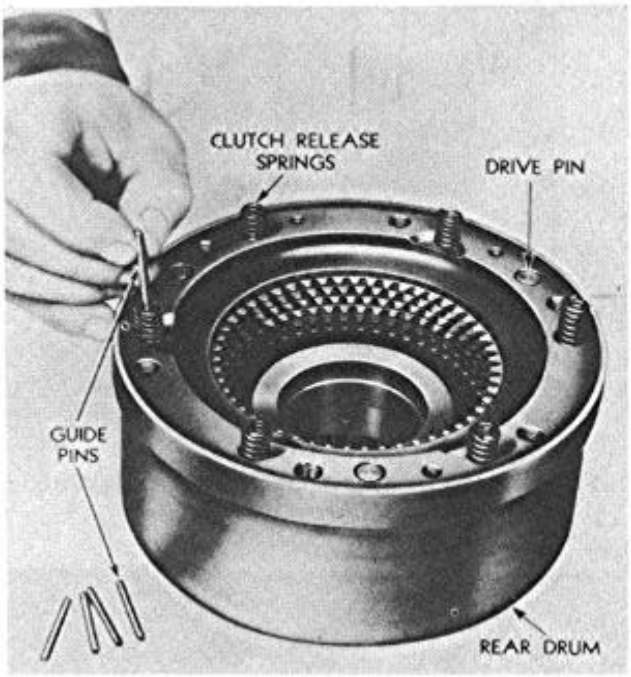


FIGURE 177—*Installing Clutch Release Springs and Guide Pins*

Install front bronze thrust washer into deep counter- bore in rear clutch hub and retain with petrolatum (Fig. 179).
Install rear hub and thrust washer into clutch drive plates. Rotate hub and drum on bench to mesh splines with teeth of plates (Fig. 180).
Install rear clutch hub holding tool J-2174 on rear drum to hold hub in place. Use one reverse drive flange attaching bolt to hold tool (Fig. 181).

FIGURE 178—*Assembling Internal Gear to Rear Drum*

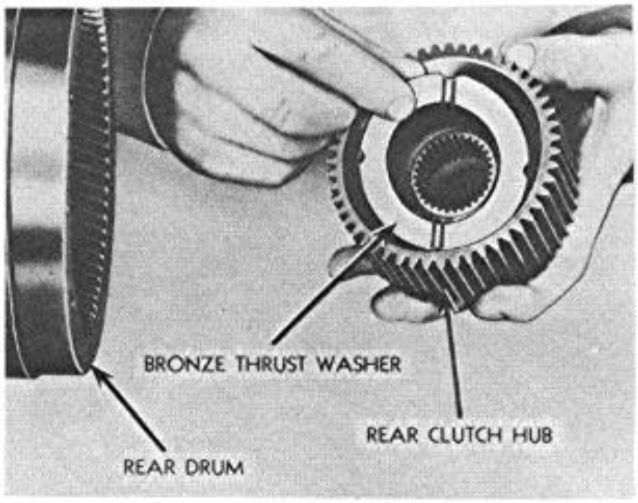


FIGURE 179—*Installing Rear Clutch Hub Front Thrust Washer*

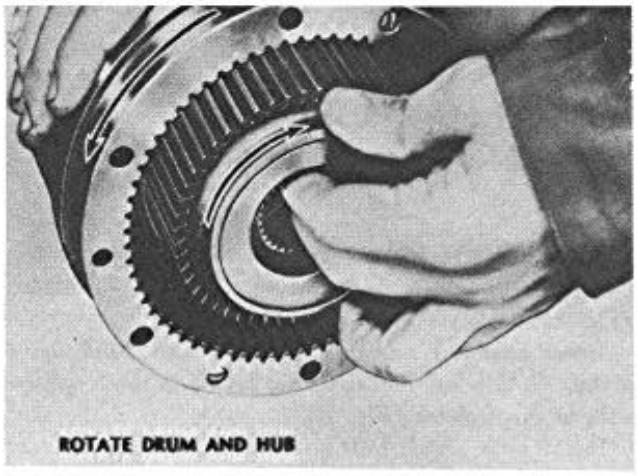


FIGURE 180—*Installing Rear Clutch Hub*

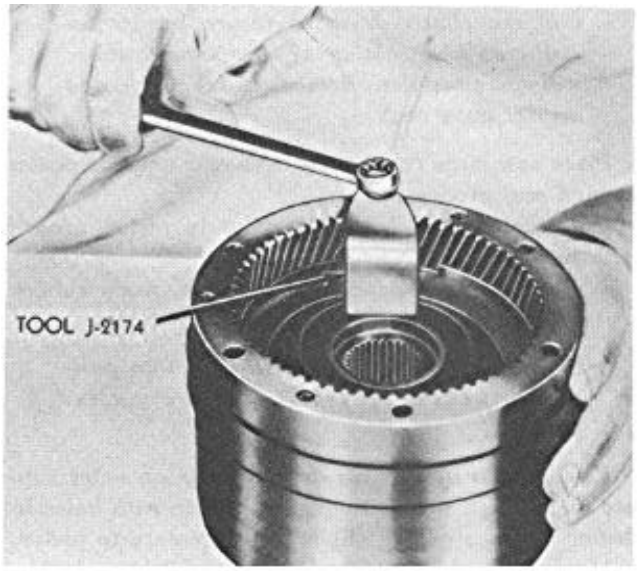


FIGURE 181—*Installing Rear Hub Tool*

Install oil delivery sleeve over planet carrier with the long end of the bearing up. Compress exposed oil delivery sleeve rings with ring compressor J-1537. Tap oil delivery sleeve into bore of front clutch drum with rawhide or similar hammer (Fig. 182) .

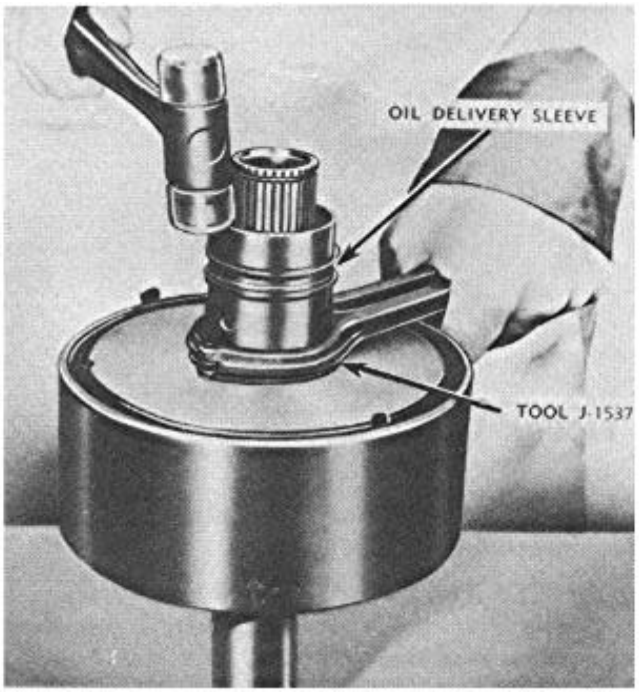


FIGURE 182—*Installing Oil Delivery Sleeve*

Install rear clutch hub front snap ring into second groove on planet carrier.

Compress exposed oil delivery sleeve rings and install rear unit drum assembly on planet carrier.

Install rear clutch hub rear steel washer and snap ring (Fig. 183) .

FIGURE 183—*Installing Rear Clutch Hub Rear Snap Ring*

NOTE: *Both the front drum and rear drum should be free to rotate under slight force. I f either drum binds, the unit should be disassembled and the cause of trouble corrected.*

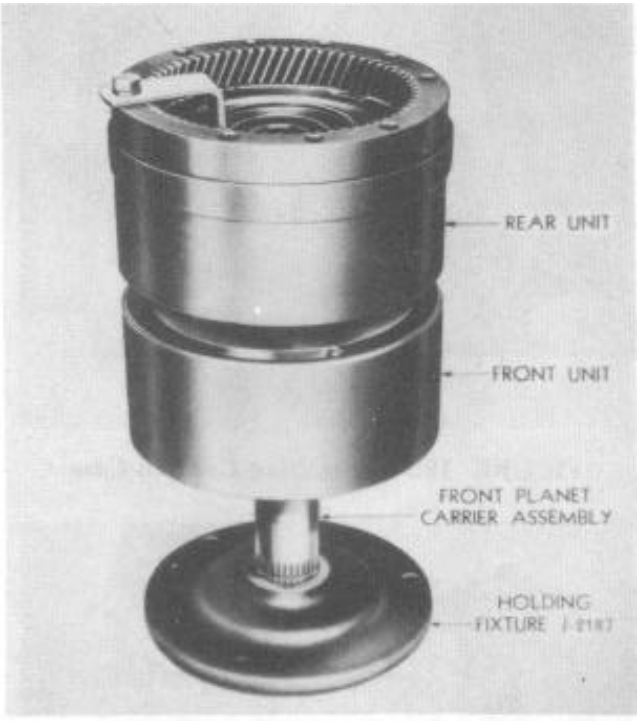


FIGURE 184—*Front and Rear Units in Holding Fixture*

ASSEMBLY OF UNITS INTO TRANSMISSION CASE AND INSTALLATION OF TRANSMISSION ASSEMBLY

ASSEMBLY OF UNITS INTO CASE

Remove front and rear units from holding fixture and position front band over front of front unit drum so short anchor end will be positioned to fit over adjusting screw when units are placed in the case. Install spring or wire to hold front band on front drum.

Install front and rear units in case by lowering front end of planet carrier into case first (Figs. 185 and 186).

NOTE: ***Make sure single hole in oil delivery sleeve is centered between center bearing cap attaching bolt holes and is facing up.***

Remove spring and position anchor end of band over adjusting screw.

Install rear band on rear unit drum.

Install rear band release spring in rear band and position anchor end of band over adjusting screw (Fig. 187).

Position center bearing cap over oil delivery sleeve with dowel registering with single

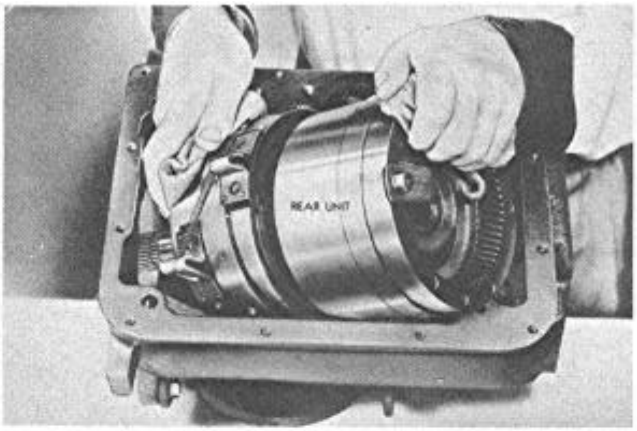


FIGURE 185—*Installing Units in Case*

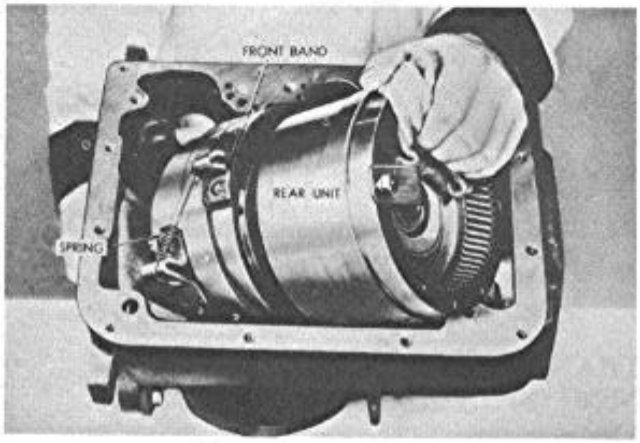
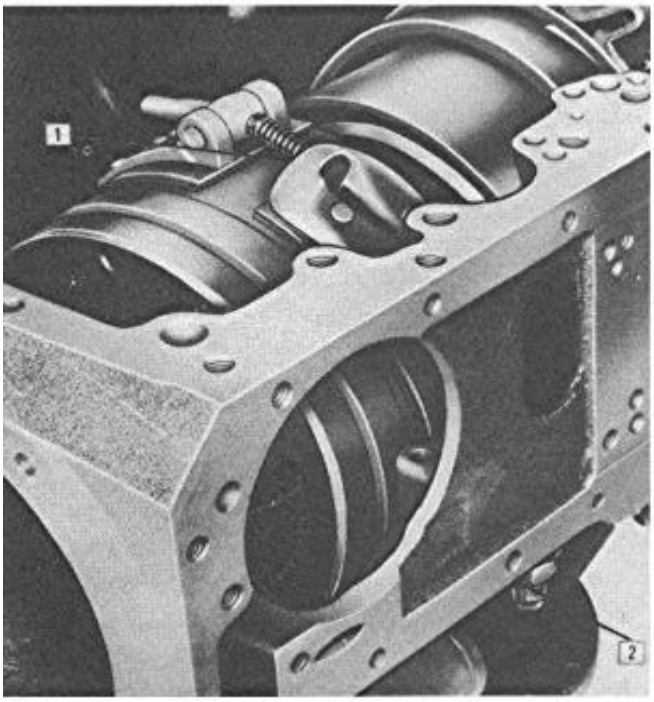


FIGURE 186—*Installing Units in Case*



1. Band Release Spring
2. Adjusting Screw

FIGURE 187—*Rear Band and Release Spring*

single dowel hole in sleeve. Lightly tap bearing cap in place.

Install a new center bearing cap lock plate under attaching bolts and tighten bolts to 40-50 foot pounds torque. Bend lock plate up around bolts using large pliers.

CAUTION: *Do not use a screw driver to pry corners of lock plate up as this may damage lapped edges of transmission case.*

Install screw driver between the center bearing cap and rear clutch drum to prevent the drum from moving forward. The screw driver should be placed at an angle to prevent damage to the oil delivery sleeve.

Remove rear clutch hub holding tool from rear drum.

Position rear clutch hub rear thrust washer in the counterbore of rear hub and retain with petrolatum (Fig. 188).

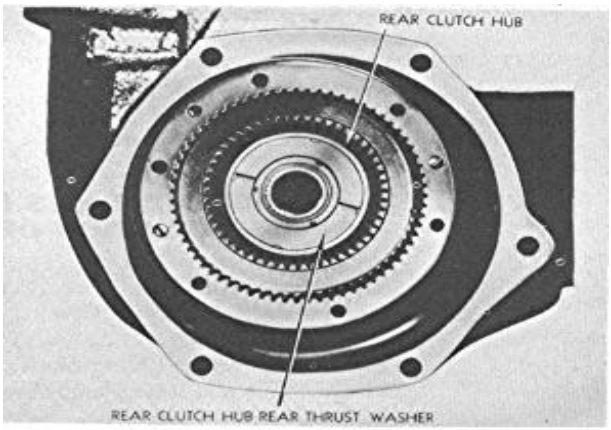


FIGURE 188—*Installing Rear Clutch Hub Rear Thrust Washer*

Install correct size selective washer in counterbore of output shaft and retain in place with petrolatum (Fig. 189).

NOTE: *If main shaft did not have correct end clearance prior to disassembly, select proper washer to bring end clearance within limits of .004" to .018".*

Selective washers are furnished in the following eight sizes:

MARK	SIZE	MARK	SIZE
1	.055"-.059"	5	.087"-.091"
2	.063"-.067"	6	.095"-.099"
3	.071"-.075"	7	.103"-.107"
4	.079"-.083"	8	.111"-.115"

Install Reverse Assembly in Case

Position gasket on rear bearing retainer.

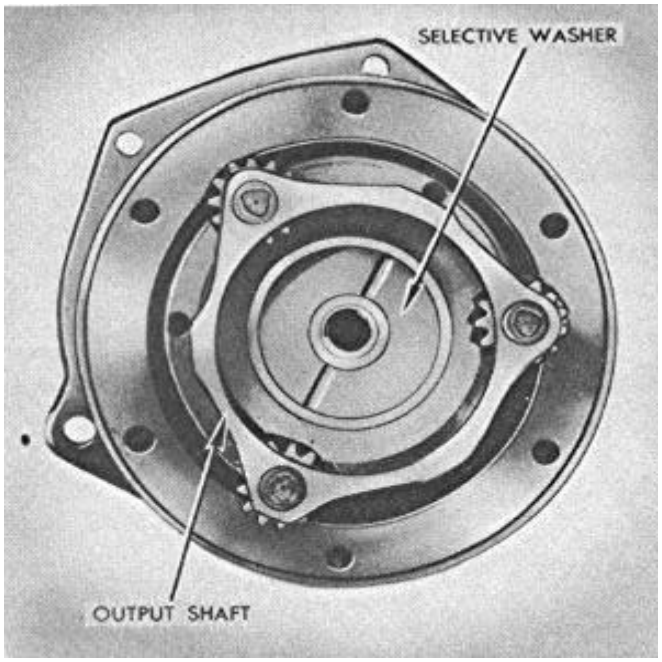


FIGURE 189—*Installing Selective Washer*

Install main shaft in output shaft meshing center gear with planet pinions.

Install main shaft and reverse assembly into rear end of transmission case aligning stationary cone lock key into keyway in case. Then align rear bearing retainer bolt holes to case (Fig. 190).

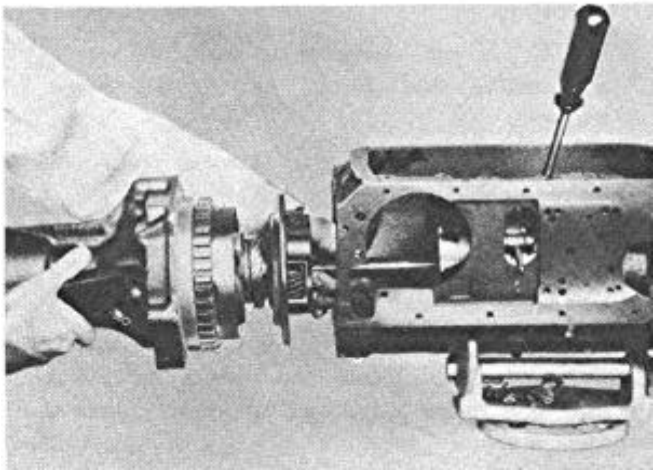


FIGURE 190—*Installing Main Shaft and Reverse Assembly*

CAUTION: *Tighten the six bolts evenly without distorting flange. While tightening bolts, test for freeness by holding output shaft and turning main shaft.*

NOTE: *Revolve output shaft to facilitate meshing planet gears with drum internal gear.*

Just start five rear bearing retainer to case attaching bolts with lock washers. Also start parking brake pawl support bolt and lock.

Align holes in reverse drive flange and rear drum and install six reverse drive flange bolts and lock washers (Fig. 191). After two bolts are entered finger tight, remove screw driver.

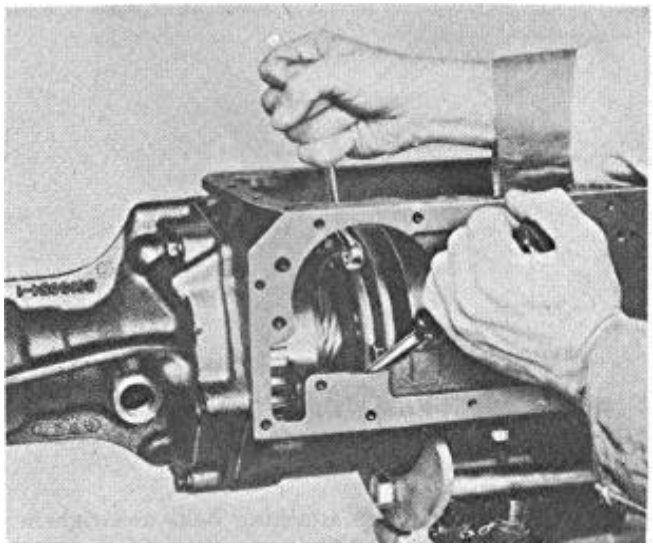


FIGURE 191—*Installing Reverse Drive Flange Bolts*

Push or tap rear bearing retainer against case. Then tighten mounting bolts evenly. It is not necessary to tighten parking brake pawl support bolt at this time.

Test for freeness by turning main shaft, output shaft, and front and rear unit drums.

Install rear bearing retainer oil seal using tool No. J-1354.

Position bronze thrust washers over planet carrier shaft.

Position front oil pump gasket over front pump cover.

Install Front Oil Pump

Install front pump and front drive gear assembly over planet carrier (Fig. 192).

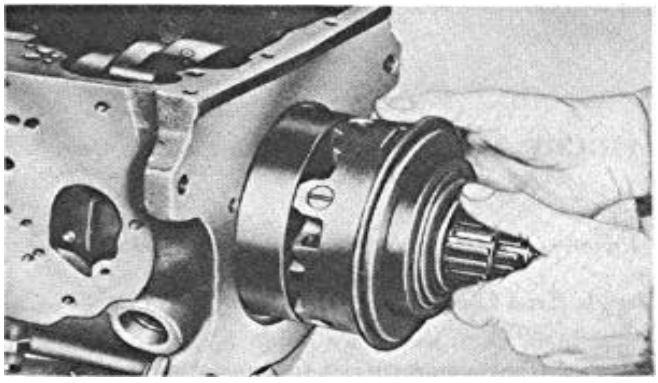


FIGURE 192—*Installing Front Pump and Front Drive Gear*

Align locating counterbore in pump cover with counterbore in case. Install pump cover locating washer in counterbore (Fig. 193).

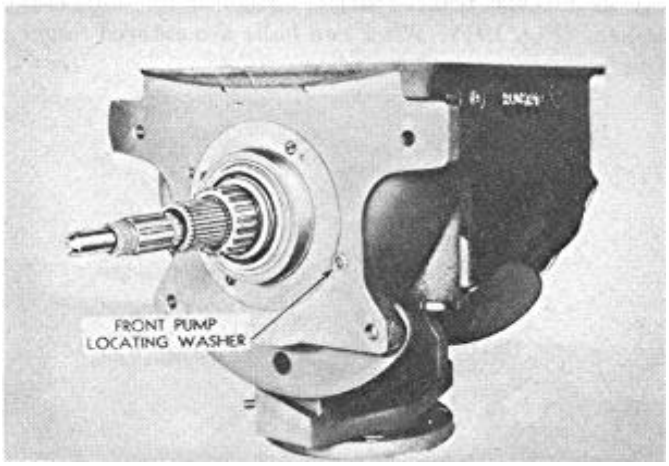


FIGURE 193—*Pump Cover Locating Washer Installed*

Install two front pump attaching bolts and tighten bolts to 10-12 foot pounds torque.

Install the bronze, then steel thrust washer over planet carrier, against front end of drive gear. These washers were tied together during disassembly.

Install snap ring holding thrust washers in place (Fig. 194).

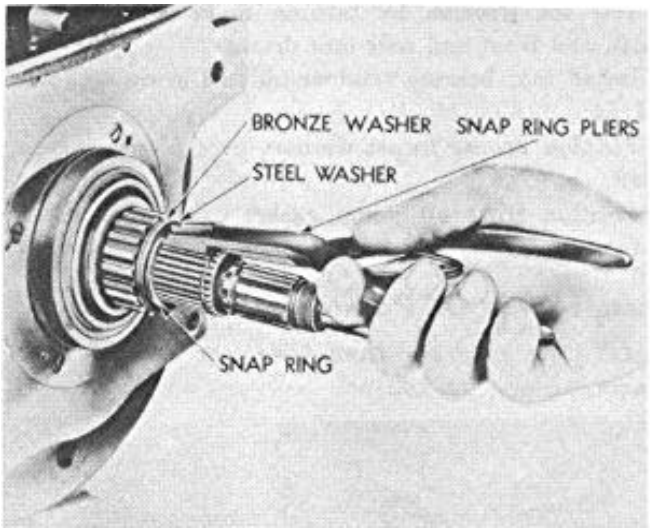


FIGURE 194—*Installing Front Drive Gear Snap Ring*

Install open type snap ring in groove on main shaft

Check End Clearance of Main Shaft

Install main shaft end play guide J-2587 over main shaft and front planet carrier to support main shaft.

Set up dial indicator on transmission case using tool J-1465 (Fig. 195)

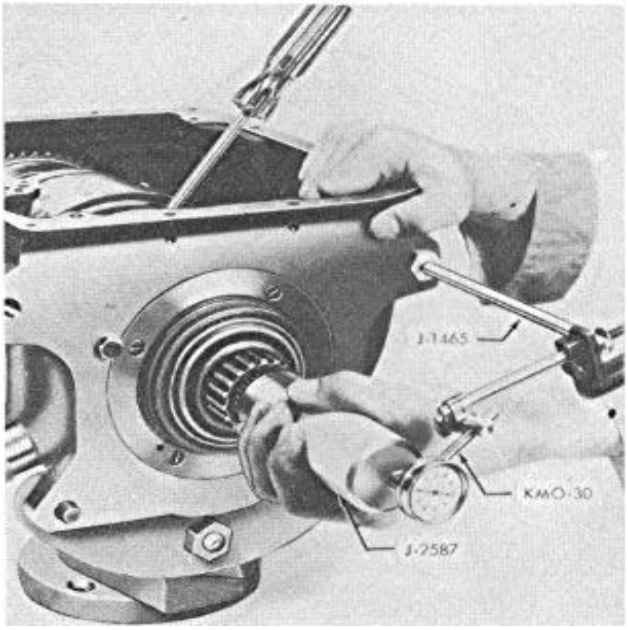


FIGURE 195—*Checking Main Shaft End Play*

Insert screw driver between front clutch drum and center bearing cap holding the front planet unit forward.

Move main shaft back and forth (Fig. 195). End clearance should be .004" to .018". Be sure to get just float. Do not pull far enough to compress clutch release springs.

NOTE: *If end clearance is outside limits, disassemble and install correct selective washer.*

Remove screw driver from between front clutch drum and center bearing cap. Remove dial indicator.

Install Governor and Rear Pump Assembly

Position the large round governor weight to the front of transmission and locate one reverse drive flange attaching bolt up to provide clearance for pump and governor assembly to slide into transmission case (Fig. 196).

Slide the pump and governor assembly into position in case and install and tighten two attaching bolts and lock washers 15 to 18 foot pounds torque.

Check Governor Runout

Install dial indicator and check governor runout at tower about 1/4" from the end of the governor (Fig. 197).

Runout should not exceed .005". If runout exceeds .005", remove governor assembly and check runout of governor drive flange which should be less than .002”

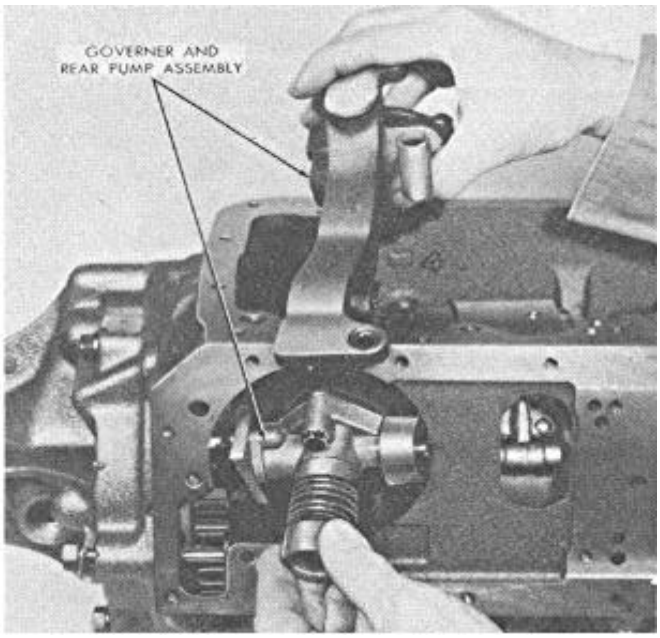


FIGURE 196—*Installing Governor and Rear Pump Assembly*

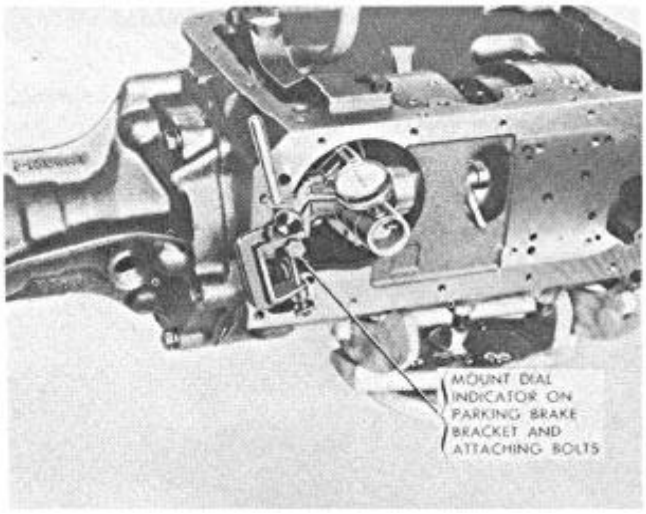


FIGURE 197—*Checking Governor Runout*

If flange is within .002", rotate governor 180°, assemble and recheck.

If governor does not exceed .005", no further correction is required. If governor runout still exceeds .005" after this check, it will be necessary to change the governor flange or rear pump assembly.

Install Parking Brake Bracket Assembly

Remove parking brake pawl support bolt from case. This bolt was previously installed to assure alignment of threads.

Install parking pawl into position in case and let pawl slide down in case. Do not install parking brake pawl support bolt at this time.

Place parking brake bracket over end of the governor and press gently (Fig. 198).

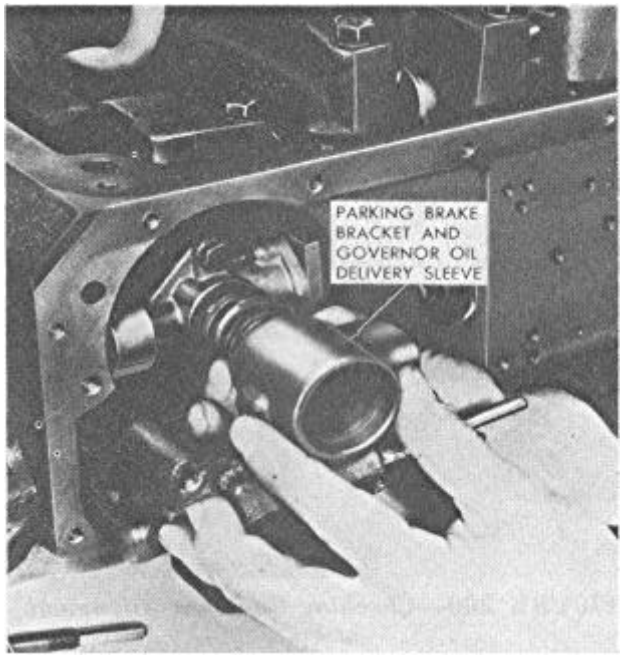


FIGURE 198—*Installing Parking Brake Bracket Assembly*

Install the two attaching bolts with the parking blocker piston pin retainer on the lower bolt (Fig. 199).

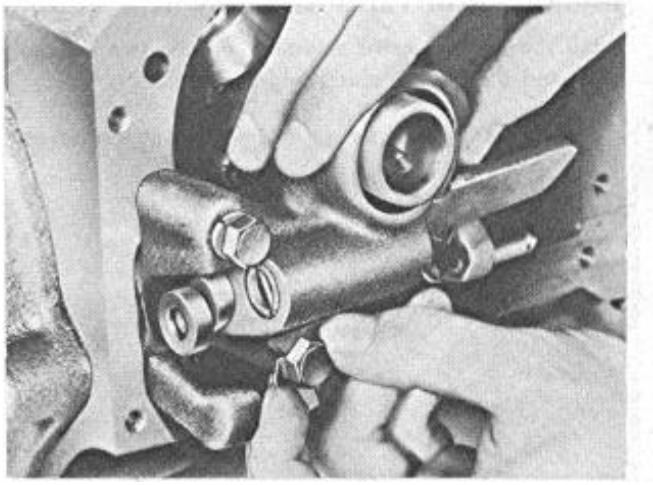


FIGURE 199—*Parking Blocker Piston Pin Retainer*

Tighten assembly to case; then lift parking pawl in position and install the parking pawl pivot bolt. Install two oil delivery pipes and spring.

Install governor aligning tool J-4731 in place as shown in Figure 200.

The aligning tool should rotate freely and the governor should rotate freely as much as gear back lash will permit. Rotate output shaft 1/4 turn and check governor and tool again for freeness. If binding,

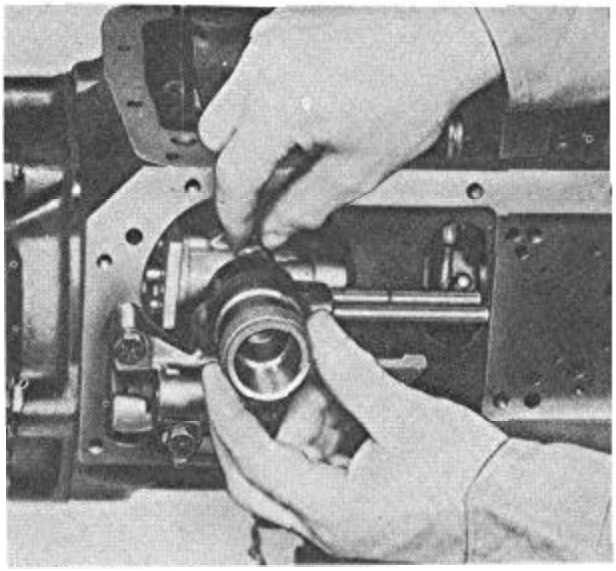


FIGURE 200—*Checking Governor Alignment*

loosen bracket and/or rear pump and adjust to give free movement.

Recheck governor each 1/4 turn for a complete revolution. Remove tool J-4731.

Install the reverse clutch oil delivery pipe.

NOTE: *Refer to Minor Services and Repairs for disassembly, inspection and assembly of parking brake bracket assembly.*

Install Control Valve Assembly

Install the control valve assembly on the two oil delivery and the reverse clutch pipes (Fig. 201).

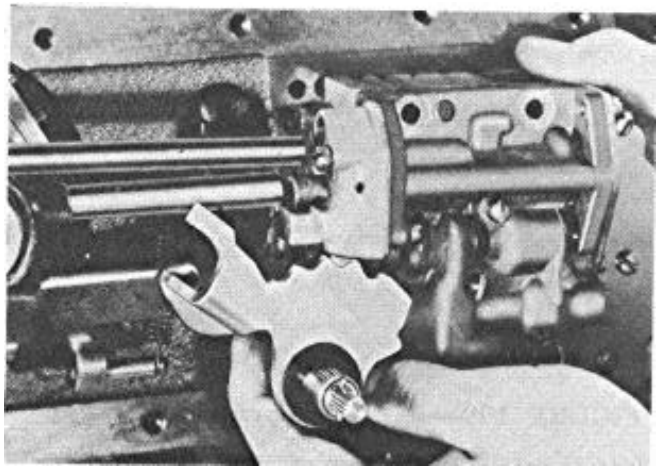


FIGURE 201—*Installing Control Valve Assembly*

Install the pressure regulator reverse oil pipe (Fig. 202).

Install Pressure Regulator Assembly

Place new gasket over pressure regulator plug.

NOTE: *Be sure to install the pressure regulator plug gasket with the seam toward the threaded end of the plug.*

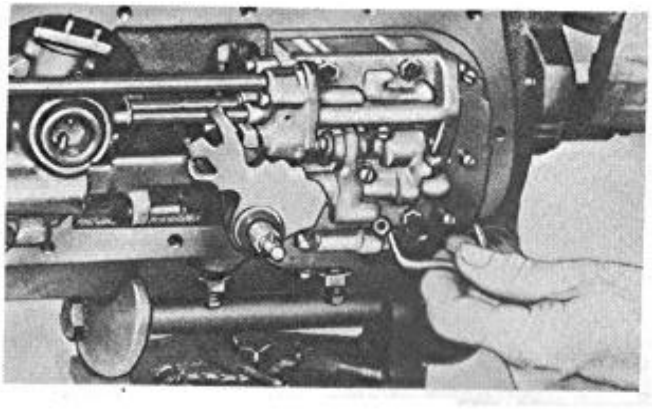


FIGURE 202—*Installing Pressure Regulator Reverse Oil Pipe*

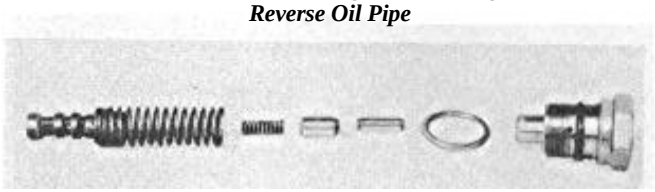


FIGURE 203—*Pressure Regulator Assembly*

With pressure regulator valve assembled into spring, locate valve on seat in front pump (Fig. 204).

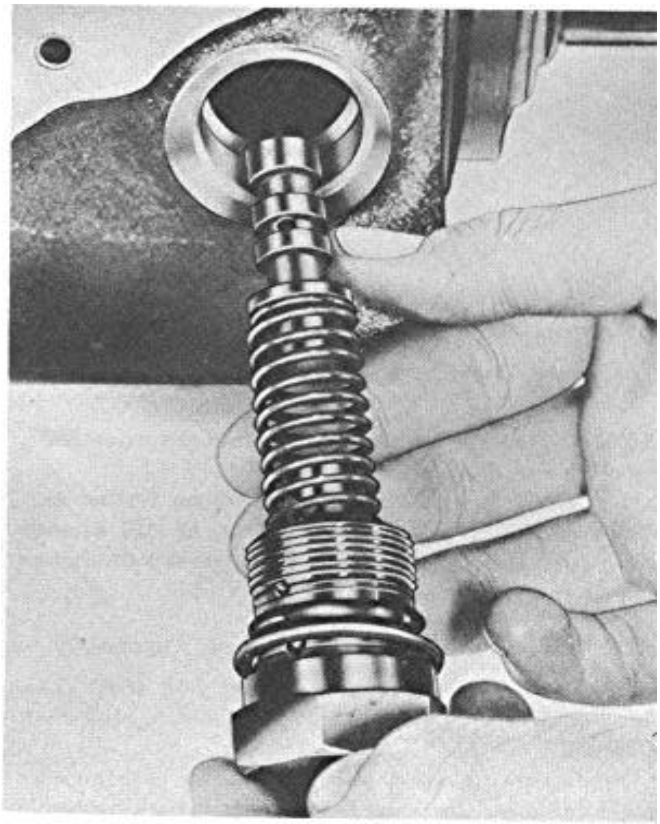
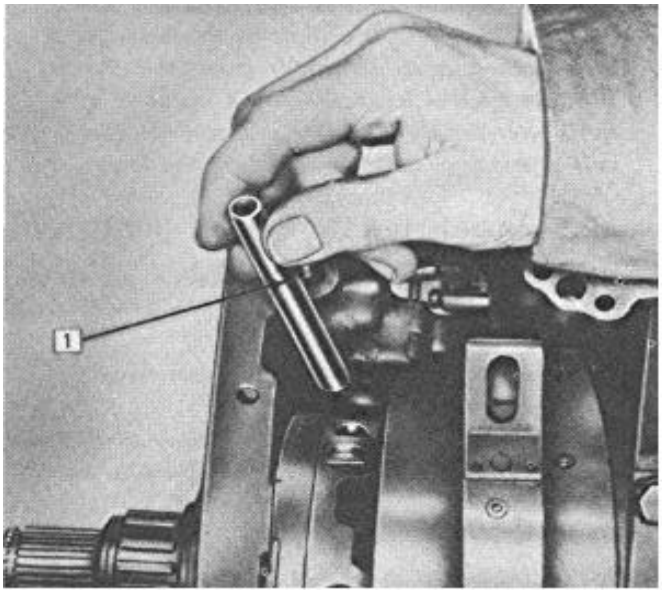


FIGURE 204—*Installing Pressure Regulator Assembly*

Apply pressure on regulator plug and tighten transmission case to 40-50 foot pounds torque.

Front and Rear Servos

Install the front pump delivery pipe in front pump body (Fig. 205).



1. Front Pump Delivery Pipe

FIGURE 205—*Installing Front Pump Delivery Sleeve*

Install rear pump discharge pipe in hole in rear pump. Position front servo with piston stem in socket on end of front band; place servo on front pump delivery pipe and insert rear pump discharge pipe in servo and lower to case (Fig. 206).

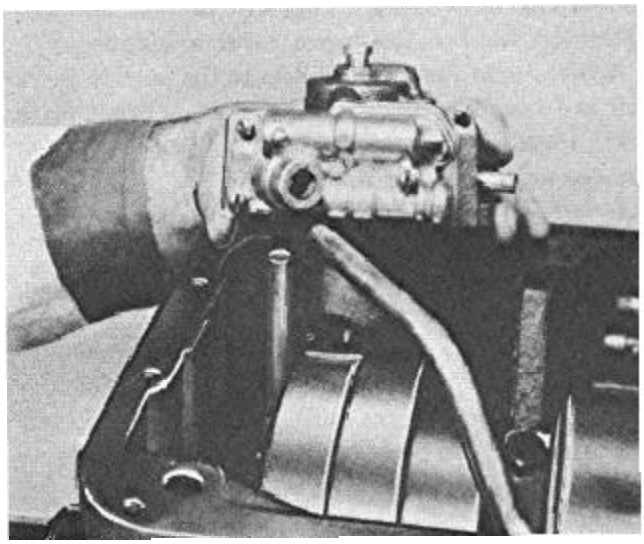


FIGURE 206—*Installing Front Servo and Rear Pump Discharge Pipe*

Enter front servo attaching bolts and lock washer approximately two or three threads.

Install rear servo by entering transfer pipe into rear servo body and install two rear servo attaching bolts. Tighten both front and rear servo bolts and torque to 23 to 28 foot pounds torque (Fig. 207).

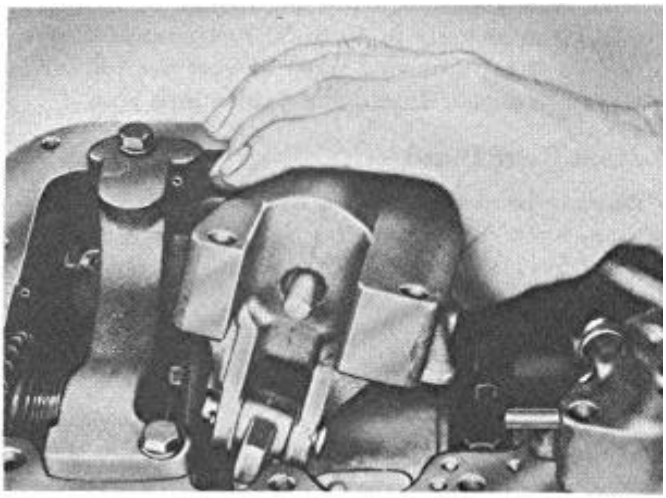


FIGURE 207—*Installing Rear Servo*

Adjust Front Band

Remove the pipe plug from front servo using a 7/16" six point socket. Loosen "hex" adjusting screw of gauge J-1693 until approximately 1/8" of threads are exposed above gauge body. Install gauge tightening by HAND ONLY (Fig. 208).

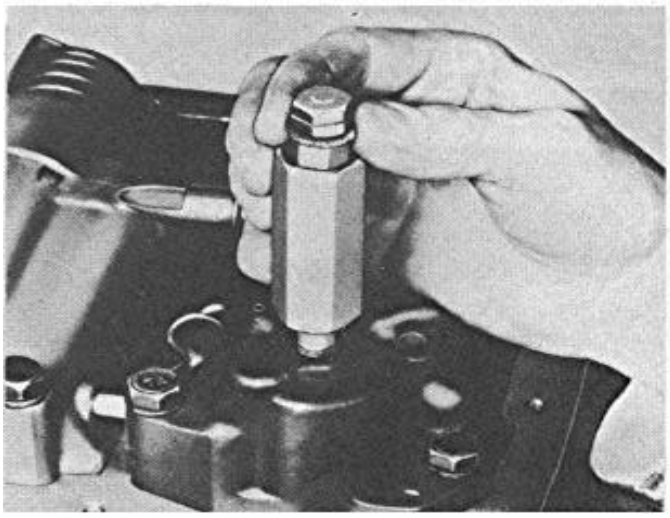


FIGURE 208—*Adjusting Front Band*

Tighten the "hex" adjusting screw with fingers until the stem of gauge is felt to JUST touch piston in front servo.

NOTE: *Before tightening adjusting screw, be sure band is centered on drum.*

Using a wrench, tighten the "hex" adjusting screw five complete turns from the point where it was felt, by hand, that

the stem JUST touched the piston.

Tighten front band adjusting screw until knurled washer on top of the band adjusting gauge is just free to turn.

Hold band adjusting screw and tighten band adjusting lock nut securely to 40 to 50 foot pounds torque.

Loosen "hex" adjusting screw at least five full turns and remove gauge. Install and tighten pipe plug.

Adjust Rear Band

With rear band centered on drum, tighten band adjusting screw until actuating lever contacts face of gauge J-5071 (Fig. 209).

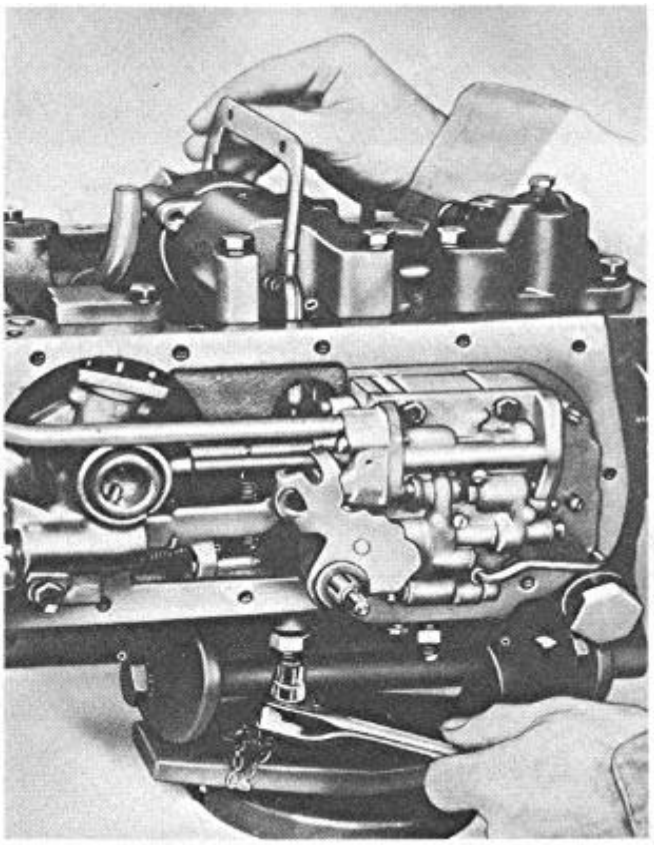


FIGURE 209—*Adjusting Rear Band*

CAUTION: *Do not go beyond adjustment. If adjusting screw is accidentally turned beyond adjustment, loosen two or three turns and repeat adjustment.*

Holds band adjusting screw and tighten adjusting screw lock nut to 40 to 50 foot pounds torque.

Install Side Cover and Outer Shift Lever

Place a new gasket on side cover and retain in place with petrolatum.
Position side cover and gasket assembly over manual shaft.
Install side cover and gasket assembly over manual shaft.

Install side cover attaching bolts and washers with new COPPER WASHERS on lower bolts finger tight. Shift cover to centralize manual shaft in hole and tighten bolts 10 to 12 foot pounds torque.

Install outer shift lever. Tighten clamp bolt 10 to 13 foot pounds torque.

NOTE: *Throttle control lever (outer) was removed from throttle shaft at the time the transmission was removed from the car. Throttle control lever should be installed on shaft after the transmission is installed. This will prevent accidentally bending the lever.*

Install Transmission Oil Screen and Pan

Install front pump intake pipe and slide oil screen over front pump intake pipe and position over rear pump intake pipe.

Place new oil pan gasket on transmission case.

Position oil pan over gasket.

Start attaching bolts with lock washers to line up pan. Then tighten bolts 10 to 13 foot pounds torque.

Install new oil pan drain plug gasket and tighten plug 35 to 45 foot pounds torque.

NOTE: *Soak new gasket until it is sufficiently pliable to install on drain plug and allow to dry. Do not enlarge hole of gasket.*

Install Flywheel Housing and Torus Members

Position flywheel housing on front of transmission and install attaching bolts and lock washers. Tighten 40 to 50 foot pounds torque.

Position the oil seal ring in the pump cover so that the gap in the ring is at the top at the time of installation of the torus cover. This will prevent the possibility of ring breakage when cover is installed.

Apply a light film of lubriplate to the outside cover hub and install torus cover on splines of front drive gear. Push cover evenly without rocking to prevent damage to oil seal and ring.

Install drive torus on splines of front planet carrier and install snap ring.
Install driven torus, check valve and spring on main shaft.

Move shift lever into reverse position.

Install a NEW main shaft nut lock plate (place projection over flat on torus hub) and install main shaft rut. Tighten 50 to 60 foot pounds torque.

Bend lock plate up against nut.

Install plug between band adjusting screws.

INSTALLING HYDRA-MATIC TRANSMISSION

Thoroughly clean face of flywheel.

Place a new gasket on face or in groove of flywheel.

To provide a good seal, it is very important that the gasket be in perfect condition and that the flywheel be free of any burrs. Gasket should be held in place with petrolatum. Do not use shellac or any other sealer.
Line up flywheel dowel pins in relation with dowel pin holes in torus cover.
Lift transmission into position with a hydraulic floor jack with tool J-2808 attached and with handle to the rear of car.
CAUTION: Tool J-2808 must be securely fastened to jack pad to prevent slipping.
NOTE: While lifting transmission, guide main shaft pilot into pilot bushing.

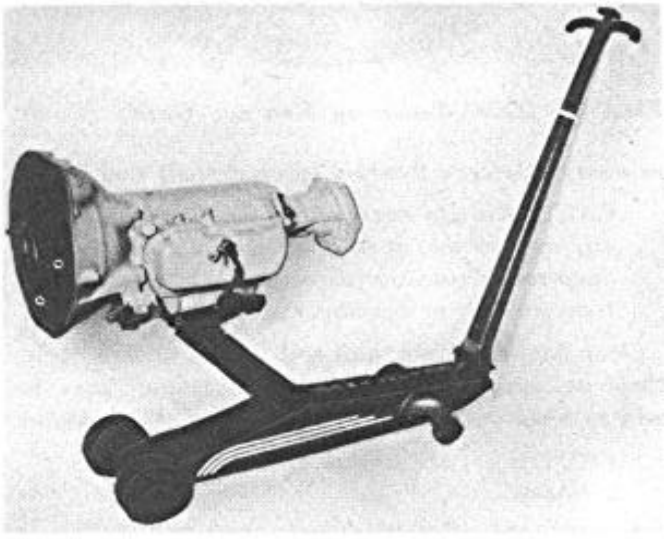


FIGURE 210—*Transmission on Tool J-2808*

Push transmission forward, guiding the aligning sleeves of the flywheel housing into the corresponding holes in the rear engine plate, and the dowel pins of the flywheel into the corresponding holes in the torus cover. Install housing attaching bolts, lock washers and nuts. Install 30 torus cover to flywheel bolts with lock washers finger tight.

NOTE: *Torus cover to flywheel bolts are alloy steel. No substitutes should be used.*

Tighten torus cover to flywheel bolts as follows: Tighten two bolts adjacent to dowels 12 to 15 foot pounds torque.

Tighten two bolts located 90° from dowels 12 to 15 foot pounds torque.

Tighten all bolts in rotation 20 to 25 foot pounds torque.

Tighten all bolts in rotation 30 to 35 foot pounds torque.

Tighten torus cover and oil pan drain plugs.

Install flywheel housing bottom cover.

Install outer throttle control lever on transmission.

Install engine support cross member and supports.

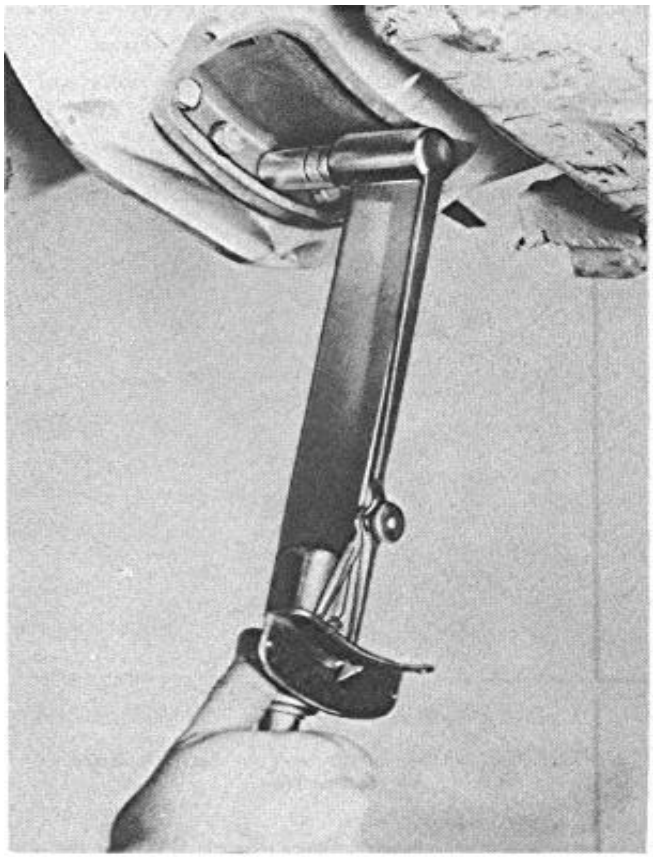


FIGURE 211—*Tightening Torus Cover to Flywheel Bolts with Torque Wrench*

Remove Hydraulic jack.

Install the propeller shaft and universal joint to the output shaft and/or connect the torque tube to the rear bearing retainer.

Connect the control rod to the shift lever.

Connect the throttle rod to the throttle lever. Connect the speedometer cable and housing to the transmission adapter.

Connect the hand brake cable and adjust.

Install rear brake hose bracket.

Install oil filler tube and bracket.

Fill transmission with Hydra-Matic drive fluid.

Follow instructions in "Minor Repair Section" listed under Fluid Capacity.

Test main line oil pressure. Refer to instructions outlined in "Trouble Diagnosis and Testing." Install floor hole cover, mat and accelerator pedal.

Adjust throttle control and shift control linkage.
Refer to instructions outlined in "Adjustments with
Transmission in Car.

Remove car stands and road test car. Use Hydra-Matic Diagnosis Guide.

REPLACEMENT OF FLYWHEEL

Flywheel to Crankshaft Construction

The flywheel is held with six 1/2" special bolts which are tightened diametrically gradually to 105 foot pounds torque.

A dowel pin is used to carry part of the torque. This dowel pin is a press fit in both the flywheel and crankshaft (Fig. 212).

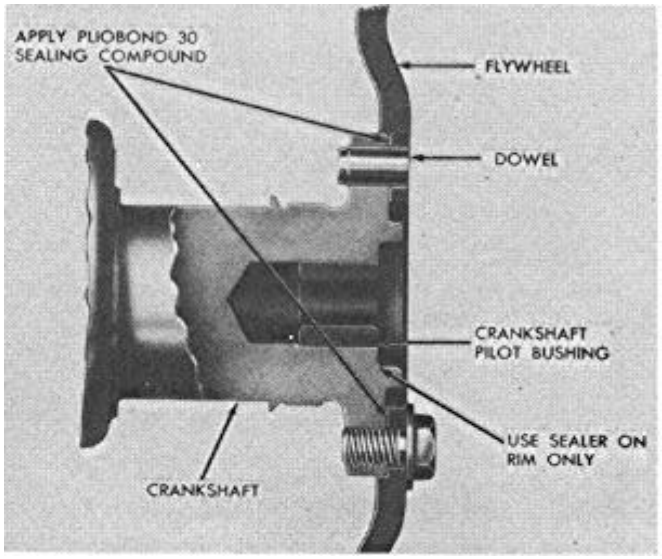


FIGURE 212—*Flywheel to Crankshaft Construction*

When making repairs, the dowel hole is finish reamed and an oversize dowel is installed after the six flywheel to crankshaft bolts are tightened. Dowels cannot be re-used after removal, nor can another dowel be used in the same dowel hole. This procedure removes scores and prevents oil leakage. Special tools are available for this procedure.

Ream dowel hole for oversize (service) dowel using tools J-2774-12, J-2774-14, J-2774-15, J-2774-16, and J-2774-17 (Fig. 213).

CAUTION: *The bolts used for holding the Guide Block, tool 1-2774-12, to flywheel are not heat treated alloy steel and should be tightened only enough to hold the block firmly to flywheel (45 to 50 pounds torque).*

Oil Leak at Flywheel Seal, Dowel or Bolts

When inspection shows an oil leak to be located at the flywheel to crankshaft seal, dowel, or at one or more of the flywheel to crankshaft bolts (refer to Trouble Diagnosis and Testing), it will be necessary to remove the flywheel and make the following repairs:

Remove transmission assembly.

Remove flywheel bolts, plates, and flywheel. If flywheel does not come off easily, a slight prying action between front surface of flywheel and block may be necessary. Remove flywheel to crankshaft dowel.

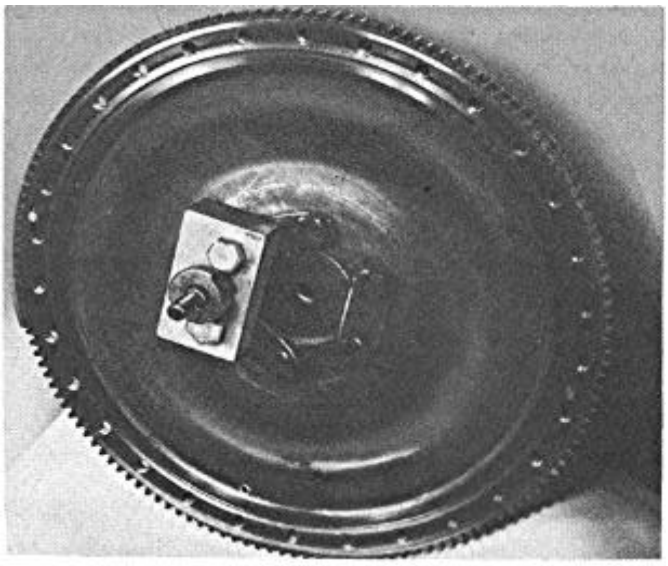


FIGURE 213—*Locating Reamer Guide Block*

CAUTION: **Do not hammer on flywheel in any way so that it will become damaged or distorted. Protect torus cover gasket surface from nicking or burring.**

Clean flange of crankshaft and mating surface of flywheel by scraping. If available, "Acetone" may be used as a solvent for the Pliobond 30 seal compound.

CAUTION: *Do not scratch or nick these surfaces.*

Apply a thin film (approximately 1/2" wide) of Pliobond 30 seal compound on the surface of crankshaft at bolt circle diameter. Smooth seal compound around toward outer edge and allow to dry (approximately one minute).

Install flywheel on crankshaft flange carefully and enter all flywheel bolts through plates. Tighten bolts diametrically opposite in uniform manner to 105 foot pounds torque.

NOTE: *Care exercised to draw the flywheel on evenly during this operation will prevent leakage and excessive runout.*

Mount dial indicator so stem or button rests on torus cover gasket seal area and check flywheel runout. Runout should not exceed .005" total indicator reading (Fig. 214).

INSPECTION OF TORUS COVER

Inspect inner and outer diameter of torus cover oil seal hub for score marks.

Inspect grooved gasket surface for nicks or burrs. Two continuous ridges should appear on the sealing surface.

Inspect the splines of hub for wear or damage. Check torus cover hub runout as follows:

FIGURE 214—*Checking Flywheel Runout*

Assemble the torus cover to the flywheel using four bolts evenly spaced.

Assemble a dial indicator to a holding tool so the stem or button contacts the hub of the torus cover (Fig. 215).

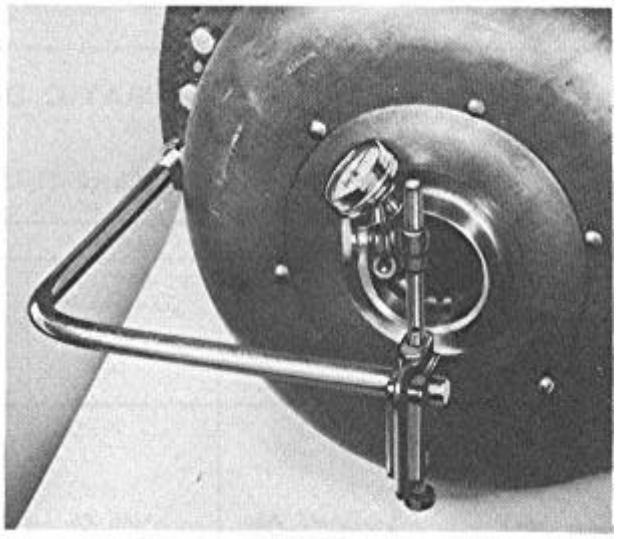


FIGURE 215—*Checking Torus Cover Runout, Tool and Indicator Can Be Mounted for Reading Underneath Car if Desired*

Rotate the engine and observe the runout which must not exceed .005". Replace torus cover.

DIAGNOSIS AND TESTING

HYDRA-MATIC DIAGNOSIS GUIDE

The Hydra-Matic Diagnosis Guide (Fig. 216) provides a uniform and systematic trouble diagnosis which is both accurate and thorough.

The Diagnosis Guide Sheet is to be used for noting malfunctions while actually driving the car.

Following is a complete breakdown of the legend and should be followed in sequence after the diagnosis has been completed. For example: No. 4-3 forced downshift—we find the possible cause to be B-2, B-3, G-1, and Q-3. The sequence then is as follows:

B-2 Throttle Linkage too Long
B-3 Outer Throttle Lever Bent
G-1 Valves Sticking in Control Valve Assembly
Q-3 Gear Set Failure Locking Front Unit in Direct Drive

3y following the operations in the order as listed will prevent performing a major repair where only a minor repair would correct the malfunction.

DIAGNOSIS AND TESTING

The procedures contained in this section are for use when testing a Hydra-Matic equipped car for standard performance. Select the test required and perform it in the manner recommended. This will lead to an accurate diagnosis of the trouble and minimize the need for a complete disassembly of the transmission. Transmission fluid level must be checked and Hydra-Matic fluid added, if required, before any tests are conducted.

Stall test vehicle to check engine performance and any sign of transmission slippage.

Drive the car in each range and through all shifts including forced downshifts observing any irregularities of transmission performance. It is important to note pressure readings throughout the test run.

Make a record of malfunctions observed on Diagnosis Guide Check Sheet.

HYDRA-MATIC DIAGNOSIS GUIDE

BEFORE TESTING:
1. Adjust Engine Idle 2. Check Fluid Level 3. Install Pressure Gauge

CONDITION	HIGH	LOW	ROUGH	SLIPS	MISSES
UPSHIFTS	B1-B3-G1-G3 I1-I2-I3-I5	B2-B3-G1-G2 G3-I2-I3-I5 K4	B1-B2-B3-C1 E1-C2-G1-G2 K9-L3-L9-Q1 Q4-R1-R4	B2-B3-C1-E1 C2-G1-G2-K1 L1-S1-Q1-R1 K10-K11-K2 L2-L3-L9-S2 S3	G1-H1-I1-I2 N1-S1
1ST.SPEED				B2-B3-C1-C2 E1-G1-G2-K1 K11-L1-L9-S2	I1-I4-I5-G1 K4-K11-Q3-S2
1-2 SHIFT	SAME AS UPSHIFTS	SAME AS UPSHIFTS	SAME AS UPSHIFTS	L2-K2-S1-Q1 S2-S3-Q2-Q4 K1-G1-G2-L9	I1-I4-I5-G1 G2-G4-G5-K2 K4-L2-Q2-S1 S2
2nd SHIFT				SAME AS SLIPS 1-2 UPSHIFT	SAME AS MISSES 1-2 UPSHIFT
2-3 SHIFT	SAME AS UPSHIFTS	SAME AS UPSHIFTS	SAME AS UPSHIFTS	B2-C1-E1-C2 G1-G2-K1-K6 K10-L3-S1-R1 R2-S2-S3-L9	G1-K4-K11-S2 Q3
3RD SPEED				SAME AS SLIPS IN FIRST SPEED	SAME AS SLIPS 2-3 UPSHIFT
3-4 SHIFT	SAME AS UPSHIFTS	SAME AS UPSHIFTS	SAME AS UPSHIFTS	I2-K2-S1-Q1 S2-S3	SAME AS MISSES 1-2 UPSHIFT
4TH SPEED				SAME AS SLIPS 1-2 UPSHIFT	SAME AS MISSES 1-2 UPSHIFT
FORCED 4-3			C1-E1-G1-K7	K4-K5-K10	B2-B3-G1-Q3
FORCED 3-2				G1-G2-G4-L2 L9-K2-K9-Q1 Q2-Q4	B2-B3-G1
CLOSED THROTTLE 3-2 or 3-1			A-B1-C1-L3 L4-L5-L9-G1 G2		

MALFUNCTIONS	POSSIBLE CAUSES
No reverse—Slips	D-E2-F1-G5-I4-J1-N2-S2-K4
Locks up in reverse (light throttle or coast)	D-E2-L3-J1
Jumps out of reverse	D
Selector won't go into "R"	(Eng. Run.) I1-I5-M1-I4-D (Eng. Off) H2-D
Clashes when shifted to "R"	A-E1-H3
Will shift into "R" above 12 MPH	H4
Will not lock in "R" Eng. Off	H4
No Drive after shifting from "R"	N3
No Drive when eng. is first started	O1
No Drive	D-E1-F2-G5-S2-J1-P1-C3
Slips in D normal start in L	I1-I5-G1-M1
Slips intermittently in all Ranges	E1-F2-J1-P1-G1-G2
Slips in D 3 on Coast	K8
Trans. shifts or hunts vehicle not moving	S2-I4
Rough shifting N to D	A-B1-C1-E1-G1
Slow Band Apply—Shifting N to D	C1-K9-L6-L7-L8
Unable to Drive Engine by Push or Tow	M2

FIGURE 216—*Hydra-Matic Diagnosis Guide*

LEGEND FOR HYDRA-MATIC DIAGNOSIS GUIDE

A —Engine idle.
B1 —Throttle linkage too short.
B2 —Throttle linkage too long.
B3 —Outer throttle lever bent.
B4 —Throttle linkage binding.
C1 —Bands should be adjusted externally to factory specifications. Occasionally a transmission may be encountered that will not take a good external adjustment. If a transmission with normal pressure shifts roughly after a linkage and external band adjustment, the bands should be adjusted internally.
C2 —Adjust bands by the internal method.
C3 —A broken front band will cause loss of drive in all positions except where second speed start is normal. A broken rear band will cause loss of drive in all positions except reverse.
D —Adjust manual linkage.
E1 —Check line pressure in all ranges. See manual for test procedure and specifications. Watch pressure thru complete shift pattern.
E2 —Check line pressure in reverse. Excessive pressure loss may be caused by missing or mispositioned pressure regulator reverse oil pipe, or reverse clutch pipe.
F1 —Pressure loss in reverse may be caused by the reverse booster plug missing or sticking in the pressure regulator assembly.
F2 —Pressure regulator sticking will cause loss of or extremely high pressures-remove regulator valve and run engine at idle speed not over 30 seconds to flush circuit.
G1 —Valves sticking in control valve assembly.
G2 —Internal leak in control valve assembly—possible loose screws or mating surfaces require lapping.
G3 —Incorrect model valve body assembled to transmission.
G4 —Passages not machined in control valve assembly. G5 — Improperly assembled control valve assembly.
H1 —Oil passage leak in parking brake bracket (possibly missing plug). Check with air pressure.
H2 —Reverse blocker piston sticking in parking brake bracket.
H3 —Parking pawl actuating crank bent on parking brake bracket.
H4 —Parking blocker piston sticking.
I1 —Valves sticking in governor or improper valve travel.
12 —Governor oil delivery pipe leaking at connections.
13 —Incorrect model governor assembled to transmission.
14 —Internal leak in governor.
15 —Broken governor ring.
J —Line exhaust valve sticking or leaking. The line exhaust valve is located in the front servo valve body.
K1 —Compensator leak in front servo, between case and servo, or at rear servo compensator pipe connection. Check for leak with air pressure.
K2 —Leak in front servo release passage. Check with air pressure.
K4 —Leak between front servo valve body and front servo.
K5 —Front servo by-pass apply passage not drilled through servo body.
K6 —4-3 downshift valve stuck in closed position.
K7 —4-3 downshift valve stuck in open position.
K8 —Over-run control valve sticking.
K9 —Front servo apply piston sticking. K10—Misalignment of front servo sleeve to servo body. K11—Leak in front of servo apply passage.
L1 —Compensator passage leak in rear servo. Check with air pressure.
L2 —Leak in 1-2 oil passage to exhaust valve in rear servo.
L3 —Leak in rear servo release passage. Check release passage with air pressure with servo mounted on case. Make certain servo applies and releases freely without tendency to stick or chatter.
L4 —Broken or misaligned rear servo check valve.
L5 —Rear servo exhaust valve sticking open (possibly caused by misaligned gasket).
L6 -Rear servo sticking when applying.
L7 —Rear servo check valve misaligned or orifice hole undersize.
L8 -Rear servo exhaust valve sticking closed would retard servo application.
L9 -Oil passages not drilled or inter-connected in servo body and or accumulator body. Check with air pressure. Refer to manual for identification of passages.
MI —Governor drive flange off position or rear pump mispositioning governor in parking brake bracket. M2 —Rear pump inoperative.
N1 -Steel locating ball missing from bronze rear pump drive gear allowing gear to slip on reverse carrier. Condition may only be apparent when transmission is hot, allowing bronze gear to expand.
N2 —Leaking reverse piston seals will allow slipping and pressure loss in reverse.
N3 —Reverse cone sticking will result in no forward drive after reverse application. Free up and burnish in cone by driving car.
01 —Torus check valve sticking or damaged. Refer to manual for checking excessive drain back after engine is shut off.
P1 —Slide sticking (Vane Type Pump) will cause intermittent low and high pressures or complete loss of pressure.
Q1 —Incorrect number of clutch plates, release springs or wrong annular piston in front unit.
Q2 -Front unit annular piston seals or expanders damaged.
Q3 —Gear set failure locking front unit in direct drive.
Q4 —Annular piston sticking in front unit.
R1 —Incorrect number of clutch plates, release springs or wrong annular piston in rear unit.
R2 —Rear unit annular piston seals or expanders damaged.
R3 —Annular piston sticking in rear unit.
51 -Loose bearing cap bolts in case allowing leak between oil delivery sleeve and cap. Check for leak at this point by applying air pressure to front and rear clutch apply passages in case after removing valve body. If a leak exists with cap bolts at recommended torque, dress down cap to provide snugger fit to oil delivery sleeve.
S2 —Oil passages not drilled or inter-connected in case. Remove valve body and air check all case passages. Refer to manual for identification of case passages.
S3 —Broken ring—oil delivery sleeve.

FOLLOW THE INSTRUCTIONS OUTLINED AND PERFORM A COMPLETE DIAGNOSIS

Remember

75% OF ALL TROUBLES CAN BE CORRECTED BY EXTERNAL ADJUSTMENTS AND OIL LEVEL —OVER 85% OF REMAINDER OF TROUBLES CAN BE CORRECTED WITH THE TRANSMISSION IN THE CAR.

Test Route

A predetermined test route should be established to save time and permit comparison of different cars over the same route. Where possible, the route should be laid out to include a hilly section to test for open throttle upshift, slippage and throttle downshifts, a level section for testing for noise. When a chassis dynamometer is available, it may be used as a substitute for the road test.

HYDRA-MATIC SHIFT POINTS IN M.P.H.

"HORNET"

UPSHIFTS — DRIVE 4 RANGE

SHIFT	MINIMUM THROTTLE	FULL THROTTLE
1-2	6-9	21-25
2-3	12-17	36-39
3-4	21-24	66-76

DOWNSHIFTS — DRIVE 4 RANGE

SHIFT	CLOSED THROTTLE	PART THROTTLE	FULL THROTTLE	FORCED THROTTLE
4-3	17-14	31-15	31-28	66-15
3-2	10-7		10-7	24-8
2-1	6-3		5-3	

UPSHIFTS — DRIVE 3 RANGE

SHIFT	MINIMUM THROTTLE	FULL THROTTLE
1-2	6-9	21-25
2-3	12-17	36-39
3-4		76-81

DOWNSHIFTS — DRIVE 3 RANGE

SHIFT	CLOSED THROTTLE	PART THROTTLE	FULL THROTTLE	
4-3	80-75			
3-2	10-7			
2-1	6-3			

DOWNSHIFT LOW RANGE

SHIFT	CLOSED THROTTLE	
4-2	50-15	

"WASP"

UPSHIFTS — DRIVE 4 RANGE

SHIFT	MINIMUM THROTTLE	FULL THROTTLE
1-2	3-7	17-21
2-3	10-13	30-35
3-4	18-21	61-65

DOWNSHIFTS — DRIVE 4 RANGE

SHIFT	CLOSED THROTTLE	PART THROTTLE	FULL THROTTLE	FORCED THROTTLE
4-3	14-11	25-11	55-21	55-12
3-2	9-6		9-7	21-7
2-1	4-2		4-2	

UPSHIFTS — DRIVE 3 RANGE

SHIFT	MINIMUM THROTTLE	FULL THROTTLE
1-2	3-7	17-21
2-3	10-13	30-37
3-4		65-70

DOWNSHIFTS — DRIVE 3 RANGE

SHIFT	CLOSED THROTTLE	PART THROTTLE	FULL THROTTLE	
4-3	68-63			
3-2	9-6			
2-1	4-2			

DOWNSHIFT LOW RANGE

SHIFT	CLOSED THROTTLE	
4-2	43-12	

"RAMBLER" SERIES

UPSHIFTS — DRIVE 4 RANGE

SHIFT	MINIMUM THROTTLE	FULL THROTTLE
1-2	5-9	13-17
2-3	9-13	27-32
3-4	18-22	55-63

DOWNSHIFTS — DRIVE 4 RANGE

SHIFT	CLOSED THROTTLE	PART THROTTLE	FULL THROTTLE	FORCED THROTTLE
4-3	12-8	27-12	55-15	55-12
3-2	8-4		19-15	
2-1	5-3		5-3	

UPSHIFTS — DRIVE 3 RANGE

SHIFT	MINIMUM THROTTLE	FULL THROTTLE
1-2	5-9	13-17
2-3	9-13	27-32
3-4		

DOWNSHIFTS — DRIVE 3 RANGE

SHIFT	CLOSED THROTTLE	PART THROTTLE	FULL THROTTLE	
4-3	71-67			
3-2	8-4			
2-1	5-3			

DOWNSHIFT LOW RANGE

SHIFT	CLOSED THROTTLE	
4-2	42-11	

STALL TEST

TESTING CONDITION	ENG. R.P.M.	ENG. R.P.M.	ENG. R.P.M.
HORNET WASP AND RAMBLER	1700-1900 1600-1800	Under 1700 Under 1600	Over 1900 Over 1800
With the engine at operating temperature, set control lever in D position. Fully apply hand and foot brake, and accelerate engine to wide open throttle.	NORMAL	Poor engine performance. Tune up, etc.	Transmission slippage or excessive coupling slippage. (Do not hold throttle open.)

FIGURE 217—*Hydra-Matic Shift Points*

"Stall" or Torque Test

A "Stall" or Torque test may be made to determine engine and transmission performance This test must be used with moderation because considerable strain is exerted on the drive line, differential gears and axles. To perform "Stall Test," proceed as follows:

Start engine and warm up to operating temperature.

Connect electric tachometer.

Set hand brake lever tightly and apply foot brake firmly.

Place selector lever in "D" position.

Depress accelerator pedal to floor.

Action has placed transmission in first speed. Brakes are applied, therefore, the car cannot move. Opening the throttle and speeding up the engine is comparable to slipping a mechanical clutch, as the driving torus is turning and trying to turn the driven torus which is held stationary by the transmission being in first speed and brakes locked.

The engine will speed up until the friction created between the torus members equals the power output of the engine. Engine speed will denote efficiency and should compare to specifications outlined in the diagnosis guide.

If engine RPM is less than the low limit, the engine is in need of a tune-up.

NOTE: *If transmission front unit is tied up, low engine RPM will result.*

If engine continues to speed up to approximately 350 RPM above the high limit, it indicates that bands are not holding properly or that there is slippage in fluid coupling due to missing check valve, damaged torus members, or defective front pump cover oil seal ring.

CAUTION: *Extreme care must be used in making this test. NEVER HOLD THROTTLE OPEN MORE THAN ONE MINUTE. If engine speeds up to 350 RPM over specifications, close throttle immediately to avoid possible damage to transmission.*

Sometimes it is desirable to know which band is slipping. After making test with selector lever in "D" position, place lever in "R" position and test again. If slippage still occurs, fault is with front band or both. If slippage does not occur, then all slippage is in the rear band.

Check Cause for Slipping Under "Stall Test"

Set hand brake lever tightly.

Start engine and run at a speed equivalent to 20 MPH for approximately 11/2 minutes. Then, with engine IDLING, selector lever in "N" range, check the fluid level in the transmission.

See that fluid is at the Full mark on the indicator.

After level has been checked, shut off engine and wait 10 minutes. Recheck fluid level with engine shut off. If after 10 minutes, the fluid level in the transmission has not raised more than 1/2 inch, the driven torus check valve is operating satisfactorily.

If check valve is operating satisfactorily, adjust bands and test car using Diagnosis Guide.

LOCATING HYDRA-MATIC DIFFICULTIES WITH AIR PRESSURE

Time can be saved in determining the cause of difflculty with all guess work eliminated by using the air pressure method described herein before the HydraMatic transmission is disassembled.

After a transmission overhaul, this method can also be used to make sure the unit is operating properly prior to reinstallation.

The test can be made on the car by removing the following parts:

Bottom oil pan and screen.
Side cover.
Control valve assembly.
Reverse clutch oil pipe.

Apply approximately 80 pound air pressure, with an air hose nozzle that will fit into the oil holes, and check each passage and unit for possible leakage in the following sequence (Fig. 218).

Air pressure applied to Item 9, should actuate the front clutch. As pressure is applied intermittently', the movement of the clutch piston should be audible and can be felt with a free hand by holding on to the drum. If an abnormal amount of air escapes around the oil delivery sleeve area, another check at this point must be made after the servo is removed to observe more clearly the exact point of leakage; look for a broken or damaged oil delivery sleeve ring. If a MIST OF OIL IS NOTED FROM THE INSIDE OF THE FRONT UNIT DRUM ASSEMBLY, accompanied by the escape of a large amount of air, it is probably due to a faulty front clutch annular piston seal. If leakage is noted from other drilled passages in the side of the case, while pressure is applied, this indicates a faulty transmission case or oil delivery sleeve allowing pressure to by-pass between passages.

Air pressure applied to passage (6) should activate the front servo and apply the band with no unusual escape of air. There should be no leakage of air at the area around the flat surface of the servo body that rests on the case. A slight leak from the oil hole (11) and the 4 to 3 valve exhaust hole is permissible. However, a leak from hole (11) should not be an open blow-by, but only the amount that would leak past the servo apply piston ring gap.

Applying pressure at passage (11) will not actuate the servo because the apply piston is held in the

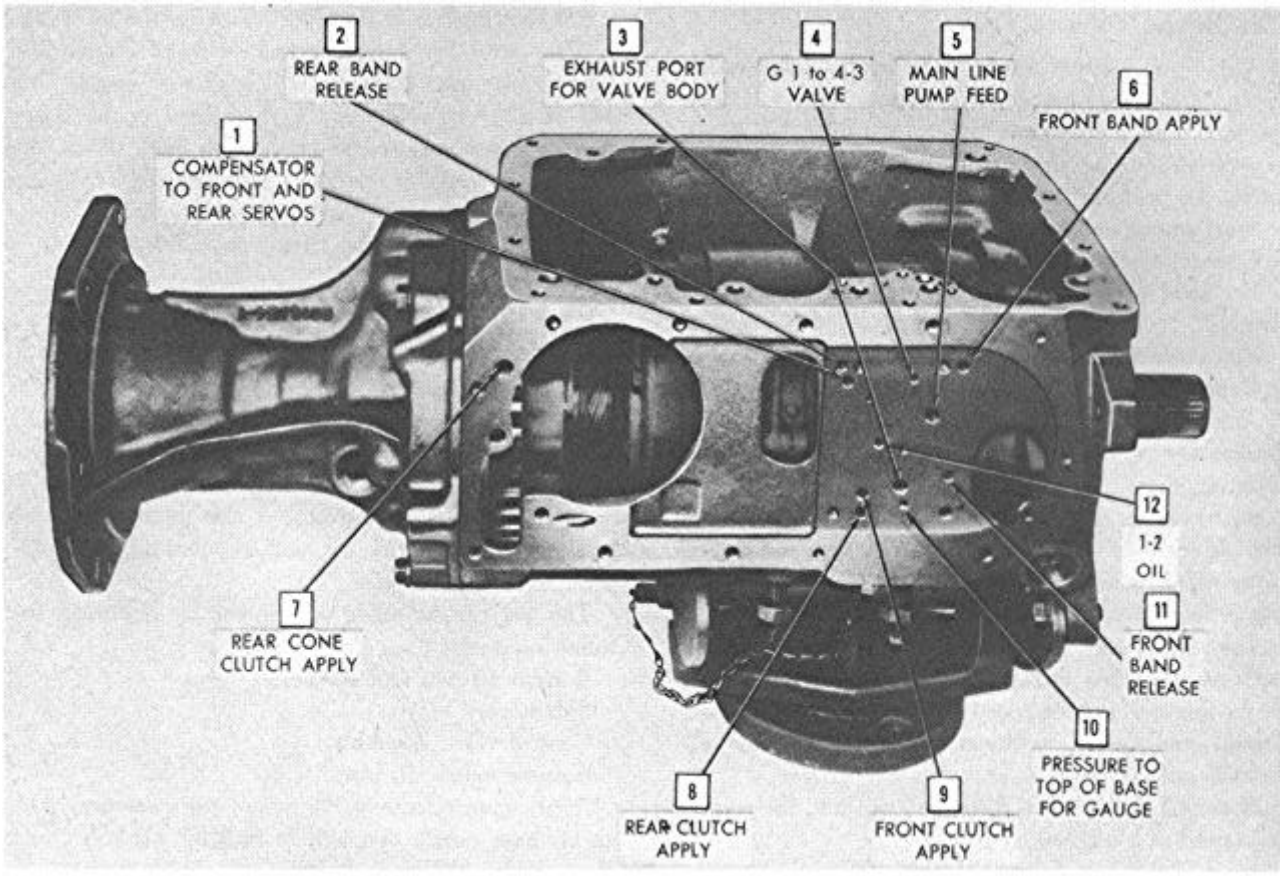


FIGURE 218—*Location of Oil Hole Passages*

release position by the retracting spring. There should be no unusual escape of air between the servo body and transmission case or from any other passage on the side of the case except possibly a small amount from passage (6).

To test the governor, apply air pressure into passage (4). A leak around the 4 to 3 valve wire retainer is normal. No air should escape between the servo body and transmission case or from any other passage on the side of the case except possibly a small amount from passage (6).

Air pressure applied to passage (2) should release the rear band. A small amount of air will escape between the piston ring gap, but this would not indicate enough leakage to affect normal servo operation. No great amount of air should escape between the servo body and case. A small leak at passage (1) is normal, but there should be no leakage from any other passage.

Air pressure applied into passage (8) should actuate the rear clutch. If pressure is applied intermittently, movement of the clutch piston should be audible and can be felt with a free hand holding on to the drum. If a large amount of air escapes around the oil delivery sleeve area, another check must be made at this point after the servos are removed to observe more clearly the exact point of leakage. If a mist of oil is noted from the inside of the rear drum unit, accompanied by an escape of a large amount of air, it is probably due to a faulty rear clutch annular piston seal. If any leakage is noted from other drilled passages inside of the transmission case, while pressure is applied at point (8) , this is an indication of a faulty transmission case, oil delivery sleeve, broken or damaged oil delivery sleeve ring allowing pressure to by-pass between oil passages.

To test the compensator between the front and rear servos, apply pressure at passage (1) . This should actuate the rear servo to tighten the rear band which is applied by spring pressure and should actuate the front servo to apply the band. Very little air should leak from the front or rear servos, or any other passage on the side of the case except that which might escape between the piston ring gaps.

To test the main line pump feed, apply pressure to passage (5). This will result in a large amount of air blowing out from the side of the front drum assembly. This blow-by is emitted from the rear side of the front pump and is considered normal. When applying pressure at point (5), observe all other passages on the side of the case for the slightest amount of escaping air or oil bubbles which would be an indication of an interconnecting passage due to a faulty case.

Apply air pressure into passage (10) to test the pressure gauge hole to the top of the case. No leaks should occur. Should any air escape, this would indicate faulty connecting passages.

A complete blow-by to the inside of the case should occur while applying air pressure to the exhaust port for the valve body hole (3). Any obstruction in this passage will cause poor shifting conditions.

Apply air pressure to passage (7) to test the reverse cone clutch. This should actuate the reverse cone clutch with no unusual escape of air. By applying pressure intermittently, movement of the reverse internal gear can be felt as the cone clutch is applied and released.

Applying air pressure to passage (12) should actuate the rear servo exhaust valve. Insert and hold a small rod through the hole at the exhaust valve. When applying air pressure the valve should move the rod in and out.

TESTING "MAIN LINE" OIL PRESSURE

Use Pressure Checking Gauge J-2540 when checking oil pressure in the Hydra-Matic transmission.

To check the oil pressure proceed as follows:

Remove accelerator pedal and front compartment mat.

Remove floor hole and adjusting cover. Remove pipe plug from transmission case (between band adjusting screws) . Use '1/46" six point socket.

Install pressure gauge and thoroughly warm transmission oil to approximately 150° to 200°F.

With engine running at approximately 490 to 510 (Rambler 4501 RPM, note pressure indicated on gauge with selector lever in N, D-4, D-3, and L, positions. Pressure should be 60 S.I. minimum (60 P.S.I. maximum in all ranges) except reverse which could be high

NOTE: *When selector lever is moved to reverse, pressure will momentarily drop before the higher pressure reading.*

If pressure checked satisfactorily, place selector lever in reverse position and apply foot brake. Accelerate engine to approximately half throttle. Pressure should increase to at least 125 pounds.

Perform Zero Throttle Pressure Test by Road Test

Depress accelerator pedal to give car over 30 MPH in 4th speed.

Close throttle and note pressure gauge reading when car speed drops to exactly 30 MPH. Pressure should read not less than 60 S.I. and increase 20 S.I. as throttle position is changed from zero to full throttle.

TESTING FOR FLUID LEAKS

Transmission fluid leaks can be divided into two groups, those which can be corrected without removing the transmission and those which require its removal. If a transmission fluid leak is detected, the following locations should be checked.

The First Group Includes:

Torus cover drain plug.
Side cover bolts or pressure line pipe plug. Side cover at manual shaft seal.
Oil pan bolts.
Oil pan drain screw.
Rear bearing retainer bolts and seal.
Pressure regulator plug gasket.
Fluid leaks at any of the above points are easily located and should be corrected no matter how slight they may seem.

Fluid Leaks That Require Removal of the Transmission from the Car Include the Following:

Crankshaft to flywheel seal, dowel, and bolts. Flywheel to torus cover.
Damper rivets in torus cover.
Front oil pump cover screws.
Front oil pump cover casting (sand hole). Front oil pump cover oil seal.
Front oil pump cover oil seal rings.
Front oil pump cover to transmission case. Sand hole in transmission case.

Check for Fluid Leaks at Torus Cover and Flywheel

Run engine until transmission fluid is at operating temperature.

Remove flywheel housing bottom cover.

Wipe fluid from flywheel and torus cover.

Place a clean piece of paper under flywheel and transmission.

Start engine and run at approximately 800 RPM for two minutes.

Stop engine and examine paper for fluid leaks.

Fluid leaks, if present will be indicated by a fine spray on the paper usually directly in line with the leak.

Locating Fluid Leaks at Torus Cover and Flywheel

If fluid leaks are indicated, examine flywheel and torus cover for fluid. Fluid on the front face of the flywheel indicates a leak at the crankshaft to flywheel seal, dowel, or bolts. Remove transmission, remove flywheel, replace seal, flywheel and dowel as outlined in Repair Section.

NOTE: *Do not confuse an engine oil leak at the rear main bearing with a flywheel fluid leak.*

Fluid on the torus cover may be coming from the front cover oil seal rings, the front cover oil seal or damper rivets.

If there is no fluid on either the flywheel or torus cover, the leak is at torus cover

to flywheel.

Tighen all bolts to 30 foot pounds torque and if leak continues, it is due to a broken gasket or insufficient or damaged sealing surface on the flywheel or torus cover. If damage cannot be corrected, install new parts.

If all parts ahead of the front of the transmission are dry and fluid leaks between flywheel housing and transmission, the leak may be caused by:

Loose pump cover screws.
Sand hole in pump cover.
Poor seal between front cover and case.

To correct above cause of leak proceed as follows: Remove transmission from the car. Remove torus members and rear flywheel housing from transmission. If a sand hole is present in pump cover casting, replace complete front pump assembly.

Locating Oil Leaks in Reverse System

Check reverse booster oil circuit in the pressure regulator.

Remove pressure regulator valve and disassemble. Inspect reverse booster plug for nicks, scores, and for free movement in regulator plug.

See that the reverse booster is not loose in the bore of the pressure regulator plug allowing excessive oil to escape past it.

Check the oil passages in the pressure regulator with air for obstructions or leaks.

Check pressure plug seal and gasket for damage or wear.

Check connecting passages between control valve assembly and pressure regulator.

Remove side cover and gasket.

Remove pressure regulator reverse oil pipe. Pipe should fit fairly tight into valve body and case. Inspect pipe to be certain it does not leak.

See that pressure regulator reverse oil passage in case is unobstructed. Also apply air to the pressure regulator reverse oil passage on the outside of the case while blocking the opening in the pressure regulator hole to be certain the passage is not leaking.

Check reverse piston, piston seals and connecting passages to reverse piston. To positively locate a leak in the oil passages to the reverse piston or in the reverse clutch piston or seals proceed as follows:

Remove pressure regulator reverse oil pipe if it
has not previously been removed.

Remove four valve body to case attaching bolts. Slide valve body forward far enough to allow removal of the reverse clutch pipe. Check to see that clutch pipe fits properly in case and valve body does not leak. If clutch pipe is found to be satisfactory apply air pressure at hole in transmission case where clutch pipe was removed. "Air pressure to be 80 pounds minimum." Apply sufficient air to actuate the reverse friction clutch cone to engage the reverse internal gear. When the reverse friction clutch cone has been applied there will be a slight forward movement of the reverse gear. If the reverse unit is satisfactory there will be a very slight leakage of air into the transmission case from the reverse unit. Check to determine if the rear bearing retainer to the transmission case attaching bolts are tight, and that there is no air leak between the retainer and transmission case faces. If the reverse unit engages properly as above, the trouble must be in the reverse unit of the transmission. If pressure is still below specifications the trouble is most probably in the valve body, pressure regulator, or connecting passages.

If trouble is isolated to the reverse unit, it will be necessary to remove the transmission from the car to correct it. With the transmission on the bench, remove parking brake bracket, rear pump and rear bearing retainer. Completely disassemble the reverse unit. Remove the reverse clutch piston seals. Inspect oil passages and inner and outer clutch piston sealing surfaces. Check reverse clutch oil passage in the case with air to be certain it is not blocked and does not leak.

Check control valve assembly.

If no defect has been found by the foregoing procedure, the leak or malfunction is probably in the valve body. The valve body assembly can be checked by replacing it with one which is known to be good.

OIL LEAKS

Possible Points of Oil Leaks	Possible Cause
Front face of flywheel	Crankshaft to flywheel flange gasket, or bolts. Rear main bearing
Oil around drain plug and inside of bell housing in line with plug.	Loose torus cover drain plug.
Oil on transmission side of flywheel starter gear teeth and inside of bell housing in line with torus cover gasket.	Torus cover to flywheel bolts not torqued to specifications. Damaged torus cover to flywheel gasket.

Possible Points of Oil Leaks	Possible Cause
Oil on torus cover streaked radially outward and in- side bell housing.	Pin hole in torus cover (rare). Loose torus cover damper rivet (rare).
Oil on torus cover and inside of bell housing in line with front oil seal.	Broken oil seal rings in front pump or excessive ring groove wear in torus neck I.D. Excessive run-out at torus cover neck—(.005" maximum). Damaged front oil seal.
Oil on torus cover and/or front face of transmission case and inside of bell housing.	Porous or cracked front pump cover. Loose fit or poor seal of front oil seal in pump cover. Front pump cover attaching screws not torqued to specifications.
Oil on front face of transmission case.	Front pump cover not sealing in case. Caused by insufficient chamfer at pump bore in case, or missing "0" ring. Cracked or porous transmission case front face

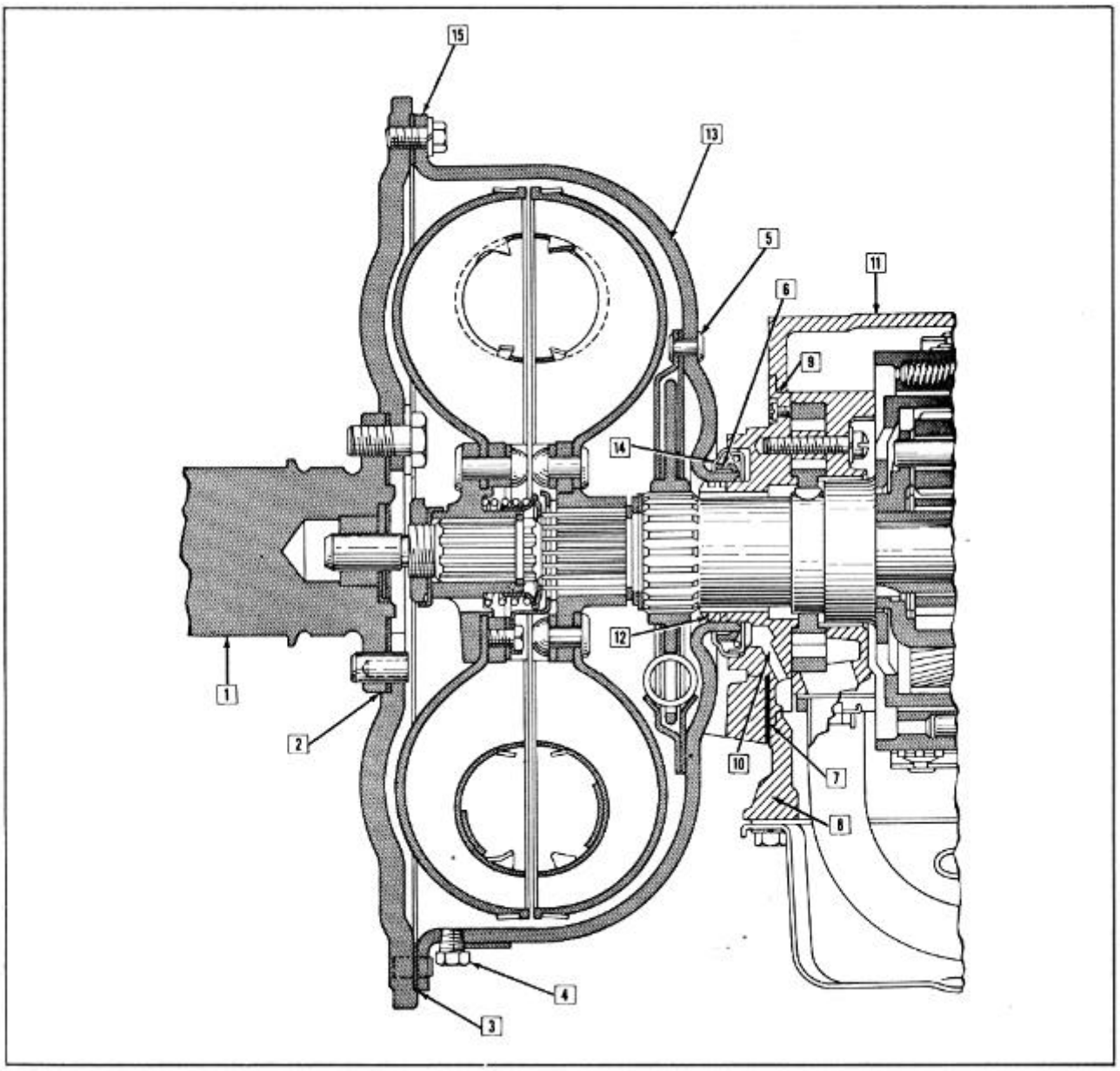


FIGURE 219—*Points to Check for Oil Leaks*

NOISE

OCCURS UNDER FOLLOWING CONDITIONS	POSSIBLE CAUSE
Neutral and All Gears Whenever Engine is Running	Front Oil Pump
Neutral, 1st and 2nd Gears Only	Rear Unit Planetary Gears
Neutral, 1st, 3rd, and Reverse Gears Only	Front Unit Planetary Gears
Reverse Gear, Acceleration Only	Reverse Unit Planetary Gears
Reverse Gear, Deceleration Only	Rear Unit Planetary Gears
Metallic Scraping at Front of Transmission	Excessive End Play Torus Members
Constant and Loud Flutter in Pressure Regulator Valve	Front Servo Oil Hole Plug Missing
	Front Pump Suction Pipe Loose or Seal Damaged

TESTING FOR NOISES

Hydra-Matic transmissions are relatively quiet in operation. However, they do make a certain amount of noise, as well as any such unit when operating. One should become familiar with these before testing the transmission. Tune the engine to run smoothly before testing for noise.

Rear Unit Planet Gear Noise

Noisy rear planet gears may be heard as a low growl on idle which increases to a very high pitched whine when engine speed is increased (selector lever in neutral).

Test for Rear Unit Gear Noise (Car Standing)

Drive car to a reasonable quiet spot. Stop car. Move selector lever into neutral position. Listen for noise with engine idling. Accelerate engine to higher speed. Rear planet gear whine will increase to a very high pitch as engine speed is increased.

Test for Rear Unit Gear Noise (Car in Operation)

Move selector level into L range position. Drive the car until it shifts in 2nd speed. Accelerate and decelerate in 2nd speed. Rear planet gear noise will follow car speed and if present will be very noticeable in second gear.

NOTE: *Open the front door and listen. Rear planet gear noise will seem to be transferred down the propeller shaft.*

Move the selector lever back into the D range position and again accelerate through the gears. Rear planetary whine, if present, will be heard in 1st and 2nd speed, and will disappear after transmission shifts into 3rd or 4th speed (rear unit is then in direct drive).

NOTE: *Where no objectionable low growl in neutral is heard while engine is idling and only a very slight whine is heard when engine speed is increased, which disappears* when selector lever is placed in D range position, no attempt should be made to eliminate the slight whine.

The three units responsible for rear planetary noise are the center gear on the main shaft, rear planet pinions on the output shaft and the rear unit internal gear.

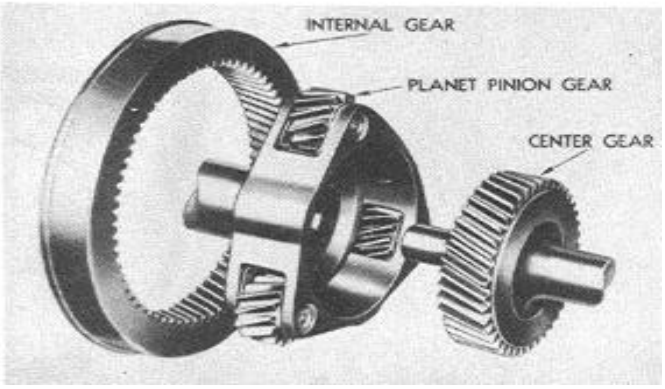


FIGURE 220—*Rear Planet Gears*

Front Unit Planet Gear Noise

Front unit planet gear noise is similar to front pump noise, but of a higher pitch. To test for front planet noise, start the engine, place the selector lever in D position. Start the car in motion. If front planet gears are noisy, whine will be heard in first speed and disappear after transmission shifts into second speed. The cause is probably worn or nicked planet pinion gears, center gear, front drive gear, worn pinion needle bearings, or thrust washers.

Reverse Planet Gear Noise

Reverse planet gear noise, if present, will be heard in reverse, only when car is under ACCELERATION. In this case noise is in the reverse planet assembly.

NOTE: *Due to the ratio of the reverse gears and engine speed when accelerating in reverse, it is doubtful that reverse gear noise will ever become objectionable.*

NOTE: Reverse noise on DECELERATION ONLY, is caused by noisy rear unit planet gears (see rear unit planet gear noise).

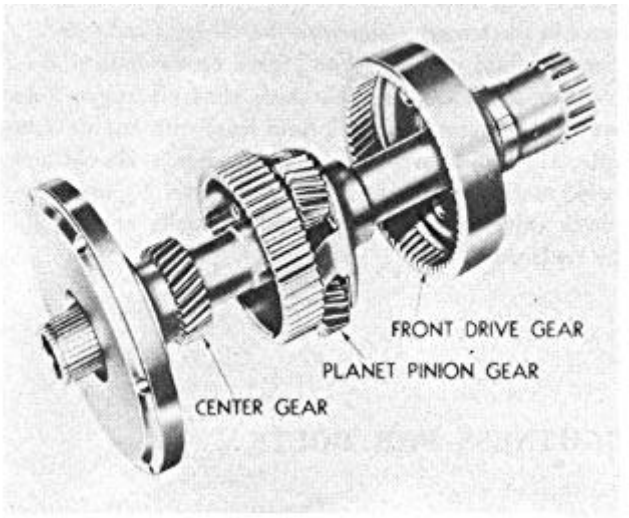


FIGURE 221—*Front Planet Gears*

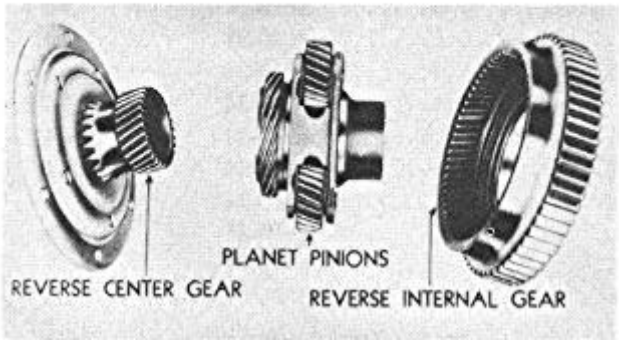


FIGURE 222—*Reverse Planet Gears*

Scraping Torus Torus Members

Scraping torus members can be identified by a metallic scraping at the front of transmission. If this noise is present it may be caused by:

Main shaft nut not tightened.

Main shaft nut lock plate broken or not bent over. Either one of the above conditions may permit the driven member to strike the flywheel.

Rear Oil Pump Noises (Cross Drive Noise)

Rear oil pump noise may be heard as a high pitched whine much like axle noise, but not sensitive to throttle opening, drive, float and coast.

REAR OIL PUMP WHINE in most cases will be heard at 20 to 30 MPH. It is seldom heard below 20 MPH. Rear axle whine may be audible at other speeds.

Tests for Rear Oil Pump (Cross Drive) Noise

Drive the car to determine at what speed noise is heard.

After noise is first heard, increase car speed approximately 10 MPH above the point. Move selector lever to neutral, turn off the ignition and coast down through the range in which noise is heard.

NOTE: *With the ignition off, the front oil pump is not running. I f noise is still present and was not sensitive to engine speed, the noise is in the rear oil pump.*

If there is any doubt between axle noise and rear oil pump noise, the following test will eliminate the rear axle.

Disconnect Torque Tube and propeller shaft.

Place selector lever in D range position.

Run engine to a speed where transmission shifts into 4th speed.

If noise is in the rear oil pump, it will be heard approximately at same speedometer reading as when road testing the car. This test definitely eliminates the rear axle.

Inspection of the bronze driver gear can be made without removing transmission from car. Remove rear oil pump and governor assembly as described in Minor Services and Repairs Section.

Examine bronze gear for deep running groove; remove and disassemble reverse unit assembly and replace the bronze gear.

TEST FOR BROKEN REAR SERVO CHECK VALVE

When the rear servo check valve is broken, the 3-1 shift is rapid and produces a severe "clunk."

With engine idling at 490 to 510 (Rambler 450) RPM move selector lever from neutral to the D range' position. A broken check valve will cause rapid rear hand application causing the car to lunge forward.

With transmission cold, drive car to a speed where transmission shifts into 4th (direct).

Coast to a stop. When the transmission is cold, no objectionable "clunk" will be noticeable during the 3-1 downshift.

Apply hand brake and foot brake.

With selector lever in D range, speed up engine for approximately one minute to heat up oil in transmission.

Make the same test as outlined in the third and fourth paragraph of this subject. If the 3-1 shift occurs at above 7 to 2 MPH and is severe, causing objectionable "clunk," a broken rear servo accumulator check valve spring is indicated.

No attempt should be made to eliminate a slight bump felt only when the transmission is cold and which disappears when the transmission is warm. See "Replacement of Rear Servo Accumulator Check Valve" in "Minor Service and Repairs" Section. If accumulator check valve is not broken check tightness

of rivet. If rivet is loose replace valve and rivet. Check for free operation of plunger in body. If sticky, free up plunger.

TEST FOR MISSING OR STICKING TORUS CHECK VALVE

A missing or sticking torus check valve will cause the engine to speed up excessively when starting away after the car has been standing.

Determine the effectiveness of the torus check valve by checking the rate at which fluid drains back from the coupling into the transmission.

Set hand Brake lever Lightly.

Start engine and run at a speed equivalent to 20 MPH for approximately 11/2 minutes. Then, with engine idling, selector lever in D range, check the fluid level in the transmission with the oil level indicator. See that fluid is at the "Full" mark on the indicator.

After level has been checked, shut off engine and wait ten minutes. Recheck fluid level with engine shut off. The fluid level in the transmission should not raise more than 1/2 inch. If more than 1/2 inch, the check valve is not operating satisfactorily and should be replaced.

RECOMMENDED TORQUE TIGHTNESS FOR BOLTS

	Thread Size	Torque Ft. Lbs.
Internal Gear to Rear Drum	#10-24	3-4
Front Body to Inner Body	#10-24	3-4
Outer Body to Inner Body	#10-24	3-4
Rear Cover to Inner Body	#10-24	3-4
Front Body Plate to Body	#10-24	3-4
Rear Plate to Outer Body	#10-24	3-4
Governor Bushing Retainer to Governor Body	#10-24	3-4
Detent Retainer to Outer Valve Body	#10-24	3-4
Front Servo Assembly	1/8 Pipe	6-7
Torus Cover Drain	1/8 Pipe	6-7
Case—Oil Pressure Take-off	1/8 Pipe	15-18
Front Servo Assembly	1/4 Pipe	6-7
Front Pump Cover to Body	1/4-20	12-15
Intake Pipe to Front Pump	1/4-20	10-12
Governor Body to Drive Flange	1/4-20	6-8
Rear Pump Cover to Body	1/4-20	6-8
Control Valve Assembly to Case	1/4-20	6-8
Side Cover to Case	1/4-20	10-12
Front Servo Body to Cylinder	1/4-20	6-8
Blocker Piston Retracting Spring to Bracket	1/4-20	6-8
Outer Throttle Lever	1/4-28	10-12
Torus Check Valve Retainer	1/4-28	6-8
Oil Pan to Case	5/16 -18	10-13
Front Cover to Case	5/16 -18	10-13
Drive Flange to Rear Drum	5/16-18	10-13
Rear Servo Spring Retainer to Body	5/16-18	10-13
Reverse Shifter Bracket to Case	5/16-18	15-18
Rear Pump to Case	5/16-18	15-18
Outer Shifter Lever	5/16-24	10-13
Torus Cover to Flywheel	3/46-24	30-35
Front Servo to Case	3/8-16	23-28
Rear Servo to Case	3/8-16	23-28
Rev. Int. Gear Support to Rear Bearing Support	3/8-16	28-33
Rear Bearing Support to Case	3/8-16	28-33
Center Bearing Cap to Case	7/16-14	40-50

Bolt—Reverse Anchor Support	7/16-20	23-28
Band Adjusting Screw Lock Nut	1/2-20	40-50
Oil Pan Drain Screw	5/8-18	35-45
Trans. Mainshaft Nut	7/8-16	50-60
Pressure Regulator Valve Plug	1-1/16	40-50

THRUST WASHERS—SPECIFICATIONS, LOCATION AND PURPOSE

The following chart covers the specifications, location and purpose of the various thrust washers used in the Hydra-Matic Transmission.

O.D.	I.D.	Thickness	Material	Location and Purpose
1.812 1.822	1.374 1.379	.088 .092	Steel—I.D. tang	Between the bronze washer in front of the Front Unit Drive Gear and the snap ring on the Front Planet Carrier Intermediate Shaft) behind the Drive Torus. Purpose—To act as a bearing surface for the bronze thrust washer.
1.822 1.815	1.377 1.384	.087 .091	Bronze	Between the front of the Front Unit Drive Gear and the steel washer. Purpose—It takes the forward thrust of the Front Drive Gear.
1.910 1.917	1.377 1.384	.087 .091	Bronze	Between the rear of the Front Drive Gear and the front of the Front Planet Carrier. Purpose—To take the rear thrust of the Front Drive Gear. Also use—Between the rear of the Front Unit Center Gear and the steel washer (with locating flat) on the Intermediate shaft. Purpose—To take the rear thrust of the Front Unit Center Gear.
1-15/16	1.374 1.377	.088 .092	Steel—I.D. tang	Between the snap ring on the Front Planet Carrier (Intermediate Shaft), in front of the Oil Delivery Sleeve and the bronze thrust washer behind the Front Unit Center Gear. Purpose—To act as a bearing surface for the bronze thrust washer.
2.872 2.878	1-15/16	.087 .091	Bronze	Between the rear of the Rear Unit Clutch Drum and in front of the Rear Unit Clutch Hub. Purpose—To take the rear thrust of the Rear Clutch Drum and the forward thrust of the Front Planet Carrier (Intermediate Shaft). Also use--Between the rear of the Rear Clutch Hub and the front of the Rear Unit Center Gear. Purpose—To take the rear thrust of the Front Planet Carrier (Intermediate Shaft) and the forward thrust of the Mainshaft.

THRUST WASHERS—SPECIFICATIONS, LOCATION AND PURPOSE (Continued)

2.247 2.253	1	.055 .059	Bronze	Selective. Between the rear of the Main-shaft and the front of the output shaft. Purpose-To take the rear thrust of the Mainshaft. (Note: Mainshaft end play is controlled by this washer.)
2.247 2.253	1	.063 .067	Bronze	
2.247 2.253	1	.071 .075	Bronze	
2.247 2.253	1	.079 .083	Bronze	
2.247 2.253	1	.087 .091	Bronze	
2.247 2.253	1	.095 .099	Bronze	
2.591 2.596	1-11/16	.087 .091	Bronze	Between the steel washer in front of the Reverse Center Gear and the Output Shaft. Purpose-To take the forward thrust of the Rear Drum and Internal Gear.
2-7/16	1.499 1.504	.049 .052	Steel	Between the front of the Reverse Center Gear and the bronze thrust washer behind the Output Shaft. Purpose-To furnish a bearing surface for the bronze thrust washer.

GENERAL SPECIFICATIONS

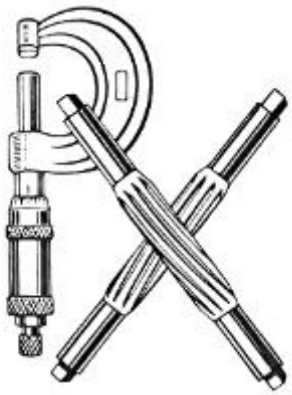
Main Shaft End Clearance		.004"-.015"
Oil Seal Rings	Installed Gap	.0005"-.010"
Except oil delivery sleeve rings		.001"-.007"
Rear Pump Drive Retaining Pin Height of peened end of pin must not exceed		.070"
Transmission Case Front Pump Cover With gasket in place and pump assembly installed in case, with attaching screws Tight, front pump cover should protrude beyond front of case		003"-.015"
Reverse Internal Gear Backlash When using tool J-2587 as per instructions indicator reading must be		.016"-.049"
Governor Runout Governor runout, taken with governor, governor sleeve and oil control valve Assembly Installed must not exceed		.005"
Governor Flange Runout Flange runout, taken with the governor removed, must not exceed		.002"
Throttle Lever Location With throttle lever installed (draw bolt tight) and lever moved to its extreme rear position dimension from rear machined face of transmission case to center of lever clevis pin hole Must be (Use Tool J-2545A)		7/16/16" 1/64
Torus Cover Hub Runout When mounted on Flywheel, Torus Cover hub runout must not exceed		.005"
Flywheel Runout The facial runout of the gasket seal surface of the flywheel, when mounted on crankshaft, must not exceed		.005"
Torus Member Clearance Clearance between Drive and Driven Torus members when assembled		.036"-.127" does not include.015" facial runout of torus members
Front Pump Pressure See Testing Main Line Oil Pressure		
Oil Capacity and Change Interval Drain oil pan and torus cover and refill—"Hornet" 11 qts., "Wasp" and "Rambler" 8-1/2 qts. Drain, disassemble. assemble transmission and refill—"Hornet" 12 qts., Wasp" and "Rambler 9-1/2 qts Change transmission oil every		25,000 miles
Band Adjustment Interval Initial band adjustment at 1,000 mile inspection; and at intervals of 10,000 and 20,000 miles. Transmission bands should be adjusted any time malfunction indicates adjustment is necessary.		
Rear Axle Ratio		
"Hornet" Series		3.2:1 (13-41)
"Wasp" Series		3.6:1 (12-43)
"Rambler" Series		3.3:1 (13-43)

TECHNICAL SERVICE LETTER REFERENCE

Date	Letter No.	Subject	Changes information on Page No.

HUDSON

TECHNICAL SERVICE MANUAL



TWIN ULTRAMATIC TRANSMISSION

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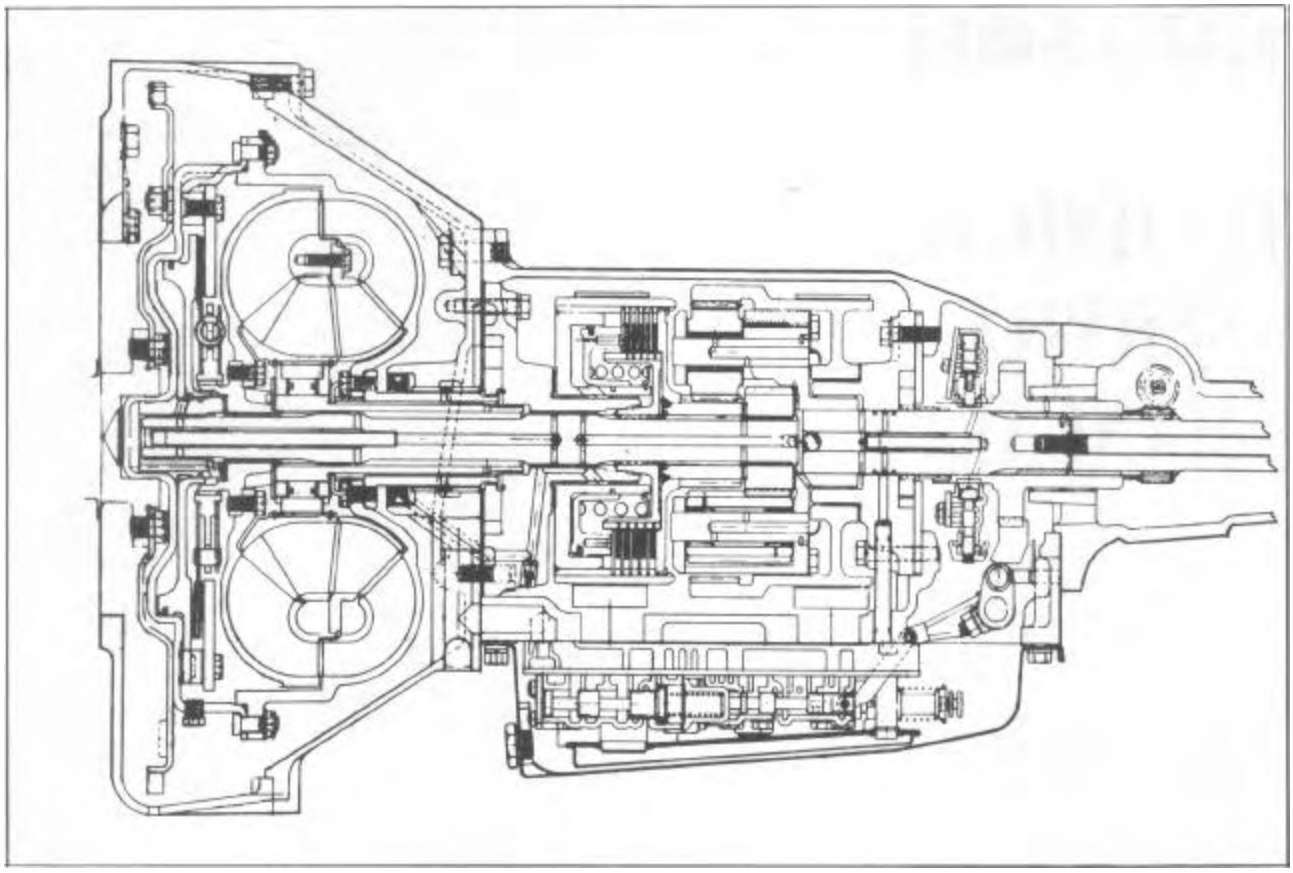


Cross-Sectional View of "Twin Ultramatic Transmission"

DESCRIPTION

The "Twin Ultramatic Transmission" provides a "dual" forward driving range. This permits the driver to select the range most desirable to satisfy individual driving tastes. One range offers the advantages of a geared start for rapid acceleration with a smooth up- shift out of the gears as the car gains momentum. The other range provides the ultimate in smoothness with less rapid acceleration.

The "Twin Ultramatic Transmission" incorporates:

A torque converter
A direct drive clutch
A high range clutch
Low Range and reverse brakes and bands
A compound planetary gear system
A hydraulic control system

The torque converter, in a few respects, is similar to the conventional fluid coupling in that it has a driving member and a driven member with oil being used as the medium of power transfer.

Torque Converter

The Torque Converter provides maximum torque multiplication through a wide range of ratios that will smoothly and automatically change at the right time to provide the correct ratio for any given condition while in converter drive.

Torque multiplication is accomplished by the use of a "pump" (driving member), a "two-stage turbine" (driven member) and a "reactor" which controls the direction of the flow of oil from the first stage to the second stage of the turbine (Fig. 1). These members all incorporate fixed vanes. Both the pump and the first turbine incorporate a torus ring which reinforces the vanes and also directs the oil between the vanes.

A hydraulically controlled, oil-cushioned direct drive clutch operates in conjunction with and forms a part of the Torque Converter.

The bowl shaped converter pump and the direct drive clutch housing enclose the converter and also acts as the container for the oil. Both the pump and the clutch housing always rotate with the engine flywheel. When the converter is in operation, the rotation of the converter pump causes the

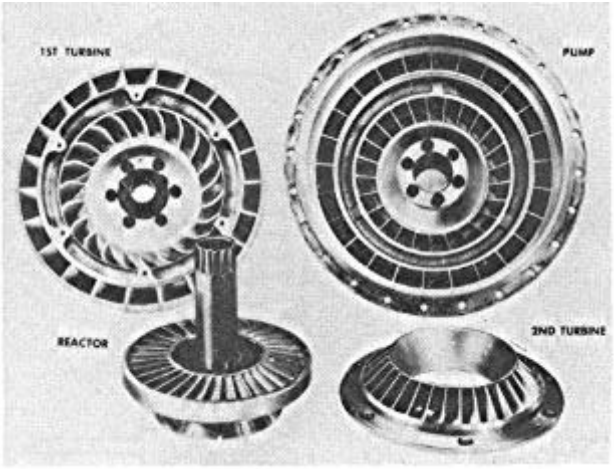


FIGURE 1—*The Torque Converter*

converter pump causes the swirling motion, or vortex flow, of the oil across the gap to strike the vanes of the first turbine in such a manner that the momentum and energy of the oil forces the turbine to rotate in the same direction as the pump.

As the oil leaves the first turbine, it is traveling in a direction opposite to the rotation of the first turbine and also to the second turbine which is bolted to the first turbine.

If this so called "backward" oil flow was admitted into the second turbine at this time, it would oppose the rotation of the turbine resulting in a loss of power. Therefore, some means of changing the direction of oil flow is required before the oil enters the second turbine.

The change in direction of the oil flow is accomplished by the "reactor" located between the first and second turbines and which operates through an overrunning sprag-type clutch in its hub.

When starting the car in motion or when accelerating, the force of the oil leaving the first turbine strikes the vanes of the reactor in a "backward" direction causing the clutch sprags to wind up and lock the reactor in place. With the reactor stationary, its curved vanes change the direction of oil flow as it leaves the first turbine so that the flow is in the same direction as that of the first and second turbines and actually offering assistance to both turbines.

The oil leaving the reactor enters the second turbine at great velocity where the remaining energy in the oil is absorbed to increase the total power output of the converter. Because practically all of the energy has been absorbed from the oil by the time it leaves the second turbine, it offers no opposition as it re-enters the pump where the flow cycle is repeated.

At steady car speeds when the turbines are rotating at approximately the same speed as the pump, the velocity of vortex oil flow is greatly reduced and the effects of the reactor are not needed. Since the reactor is operating through an overrunning clutch, it can rotate with both turbines. At this time the oil flow is almost entirely rotary and the assembly is operating with fluid coupling characteristics and no torque multiplication.

The fundamental difference between the Torque Converter and the conventional fluid coupling is the control of the direction of oil flow from the pump through the first turbine and then through the reactor and second turbine to absorb all of the energy from the oil before it returns to the pump.

It is this cycle of oil flow through the converter that permits greater engine speed with relatively lesser propeller shaft speed. This multiplies the torque or twisting force of the engine crankshaft.

Direct Drive Clutch

The direct drive clutch is incorporated within the Torque Converter assembly. This clutch, when engaged, provides a direct driving connection between the engine flywheel and the transmission input shaft eliminating slippage at all speeds.

This feature also permits the engine to act as a brake to reduce car speed on deceleration.

The direct drive clutch consists primarily of a combination piston and pressure plate, a stationary driving plate, and a driven plate faced with friction material. These details are all contained in the direct drive clutch housing (Fig. 2). Engagement of the direct drive clutch is accomplished by oil pressure acting on the piston to lock the three units together. This permits engine torque to be transmitted to the transmission input shaft at a 1 to 1 ratio in direct drive. Disengagement of the clutch is brought about by releasing the oil pressure on the front side of the piston and forcing the piston forward to the disengaged position by the oil pressure within the torque converter on the rear side of the piston. The driven plate is slightly "coned" to provide a quick "breakaway" or disengagement of the clutch when the pressure is released.

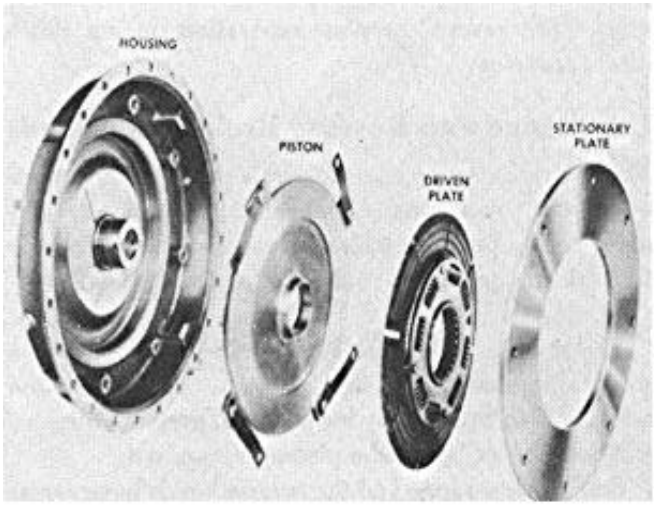


FIGURE 2—*Details of the Direct Drive Clutch*

High Range Clutch

The high range clutch is of the multiple disc type (Fig. 31.

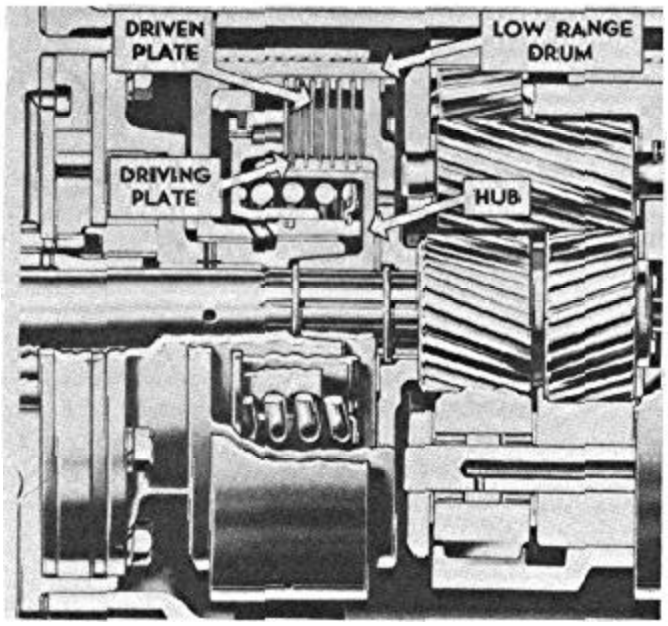


FIGURE 3—*Multiple Disc High Range Clutch*

One-half the number of plates are driving plates and have facings attached to both sides. The driving plates are internally splined to a hub which in turn is splined to the input shaft; consequently, these plates always rotate with the input shaft.

The driven plates have no facings and are externally splined to the low range drum which also forms the high range clutch housing.
The clutch is engaged by hydraulic pressure acting on a piston which compresses the plates locking them together. Disengagement is accomplished by means of a piston return spring and by releasing the oil pressure. The lined driving plates are waved to provide a quick "breakaway" or plate separation during clutch disengagement.

Low Range and Reverse Brakes and Bands

The low range brake incorporates a piston with a single aluminum piston ring. Application and release is by means of oil pressure with assist springs on the release side of the piston to obtain a quick "breakaway." (Fig. 4) .

The reverse brake also incorporates a piston with a single aluminum piston ring (Fig. 51. Application and release of the brake is by means of oil pressure directed either above or below the piston as required.

Both the low range and the reverse bands incorporate composition linings moulded to the inside of the band. One end of both bands remains stationary while the other end is free to be moved

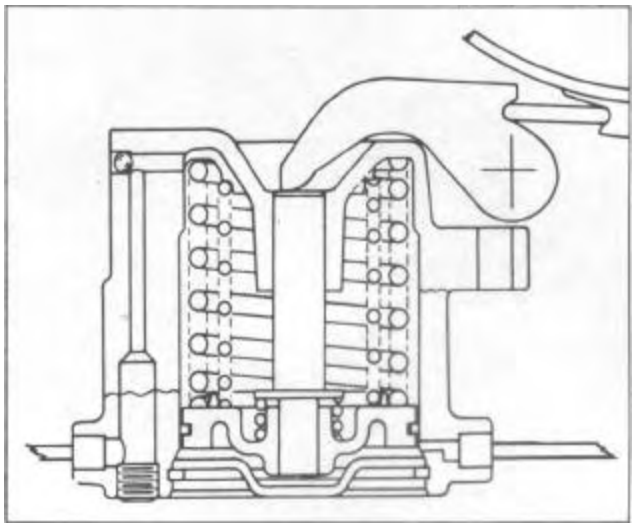


FIGURE 4—*Cross-Section Through Low Range Brake*

hydraulically to tighten and apply the bands.

The low range band surrounds the low range drum which in reality is the outside of the high range clutch housing. The front sun gear has an integral flange which is splined to this drum.

When the low range band is applied, the drum and the front sun gear are held stationary.

The reverse band surrounds the reverse drum which is formed integrally with the internally-toothed ring gear. When the band is applied the ring gear is held stationary.

The Planetary Driving System

The planetary driving system is the portion of the transmission which provides two forward ratios and the reverse ratio required to meet all, operating conditions.

This system basically consists of a compound planetary gear train, low range and reverse bands and a multiple disc high range clutch. The comb-

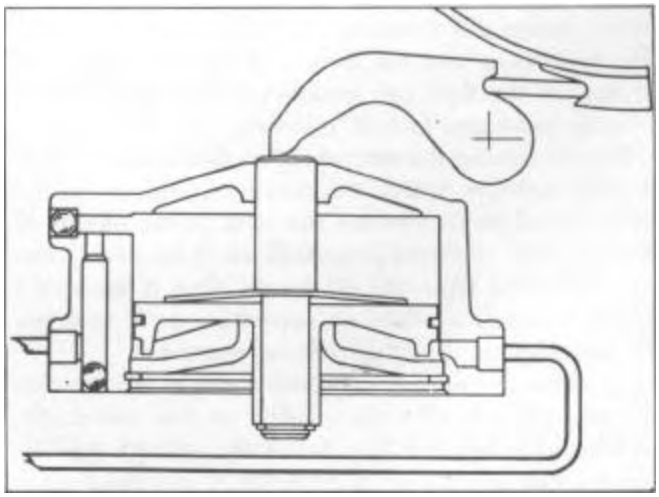


FIGURE 5—Cross-Section Through Reverse Brake

ination of these units have the following functions to perform:

To reverse the direction of propeller shaft rotation to move the car backward.

To provide a means for obtaining gear reduction with a resultant increase in engine RPM and torque for rapid acceleration, if desired, when starting from a standstill.

To provide an emergency low gear for operation under heavy engine loads such as when pulling through deep sand and also for ascending and descending steep grades.

To act as a direct or solid driving coupling for high range operation.

Planetary Gear Train

The planetary gear train consists of a driving sun gear (rear sun gear) , a low range reaction sun gear (front sun gear), three long and three short pinions, a planetary cage and a ring gear (Fig 6) .

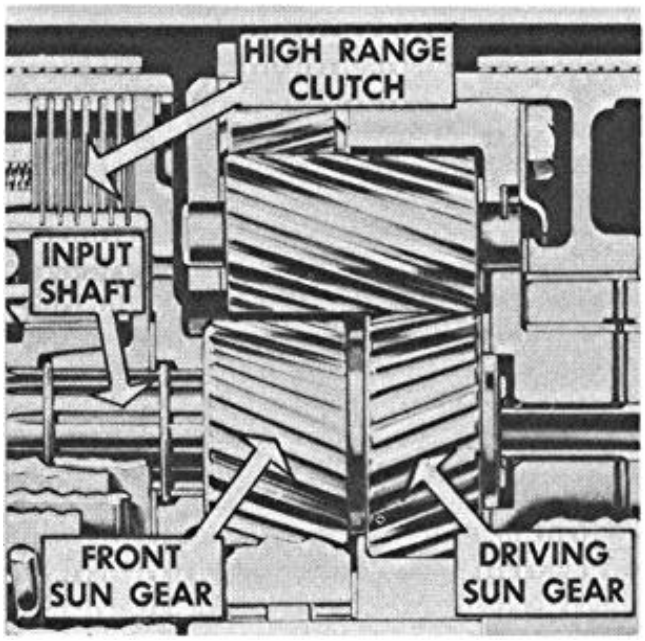


FIGURE 6—*The Planetary Gear Train*

The rear sun gear is the driver and is in mesh with the long planetary pinions. The long pinions mesh with the short pinions and the short pinions, in turn, mesh with the front sun gear and the internally-toothed ring gear. The pinions are carried in the planetary cage which is integral with the transmission output shaft. The driving sun gear (rear sun gear) is splined to, and always rotates with, the transmission input shaft. The front sun gear is indirectly attached to the input shaft through the medium of the high range clutch and low range drum assembly. This front sun gear rotates with the input shaft at times and at other times is held stationary.

Operation of the Planetary Driving System

During high range operation, the high range clutch plates are compressed and locked together and the clutch assembly must rotate with the input shaft. The front sun gear, being flanged to the clutch assembly, also must rotate with the input shaft. The rear sun gear is directly splined to the input shaft and, therefore, must always rotate with the shaft. When the two sun gears are locked together and rotating with the input shaft, the planetary gear train is locked up. This causes the entire planetary driving system to rotate as a solid coupling with no gear reduction.

During low range operation the low range band is applied holding the high range clutch housing (low range drum) stationary. The front sun gear, which is flanged to the clutch housing, also remains stationary.

The rear sun gear, being directly splined to the input shaft, turns with the shaft and rotates the long planetary pinions. The long pinions, in turn, rotate the short pinions which are in mesh with the front sun gear. Since the short pinions cannot rotate the front sun gear, because it is being held stationary, they "walk" around the gear. This results in the short pinions driving the planetary cage and output shaft at a reduced speed and in the same direction of rotation as that of the input shaft.

In reverse operation, the reverse band is applied holding the integrally-formed reverse drum and ring gear stationary. The rear sun gear, splined directly to the input shaft, turns with the shaft and rotates the long planetary pinions. The long pinions, in turn, rotate the short pinions which also mesh with the ring gear which is being held stationary and they "walk" within the ring gear. In doing so, they drive the planetary cage and output shaft at a reduced speed in a direction opposite to the rotation of the input shaft.

In neutral, the high range clutch is disengaged and both the low range band and the reverse band are free. At this time, no member of the planetary system is being held or are any two members locked together. All gears rotate freely with no force being transmitted to the output shaft; consequently, there is no movement of the car.

Hydraulic Control System

The hydraulic control system has the responsibility of furnishing oil under pressure and routing this oil at the proper time and rate to the various transmission components which provide the type of operation selected by the driver.

The system includes the following components or units which operate in conjunction with the brake

assemblies, high range clutch and direct drive clutch previously described.

Two rotor type oil pumps
Two governors
Hydraulic Control Valves

Oil Pumps

The front oil pump, driven at engine speed, is larger and has a greater capacity than the rear oil pump. Under normal operating conditions, the front pump furnishes oil under pressure during all operations in which the converter functions as a driving member. At this time, the system demands a greater quantity of oil than it does when the converter is inactive.

The rear oil pump may be thought of as being driven by the rear wheels. Although the rear pump is smaller than the front pump, it still is capable of furnishing oil to satisfy the demands of the system both as to quantity and pressure; however, being smaller, it must do this at higher speeds than the front pump. The rear pump takes over the duties of the front pump when a lesser quantity of oil is required in the system. This normally occurs when the converter becomes inactive and the direct drive clutch engages which is between approximately 18 and 65 miles per hour depending upon car speed and throttle opening. The rear pump also furnishes oil under pressure when pushing or towing the car to start the engine.

Hydraulic Control Valves

The control valves operate in conjunction with the oil pumps and governors and their functions are to route or to vent the oil as required at the proper time and rate to bring about the automatic shifts which take place within the transmission.

The valves may be divided into five types and the forces under which they operate will be described for each type. Figures 150 through 159 are schematic diagrams of the hydraulic circuit.

Figure 7 illustrates the manual valve which is a manually controlled distributing valve operated through linkage by the selector lever on the steering column.

This valve informs the transmission of the ranges or type of transmission operation the driver has selected. It is held in its selected position by spring loaded plungers which seat in detents in the forward end of the valve. When the car is in motion, the springs are supplemented by oil pressure acting on the plungers and this pressure increases as car speed is increased. This is a safety feature which makes it difficult to accidentally move the selector lever into another range while the car is under way. The passages through which the oil enters the plunger housing are indicated at points "A."

After the manual valve position has been selected, the valve then distributes the oil either directly to hydraulically operated units or to other valves for further distribution

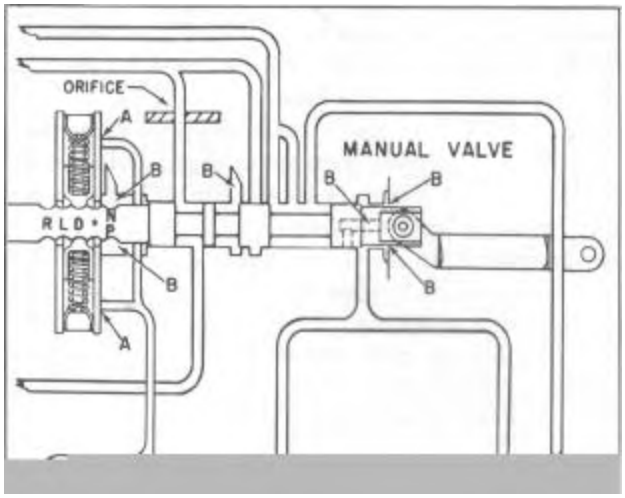


FIGURE 7—*Manually Controlled Distributing Valve*

It also vents or bleeds off pressure in the drilled passage in the valve or around the valve when required at points "B." This valve does not regulate pressure at any time.

You will note that one passage incorporates an orifice. The purpose of an orifice is to temporarily slow down or retard hydraulic action. Oil at the outgoing side of the orifice is temporarily at a lower pressure than it is at the incoming side. However, in time the outgoing pressure will rise to equal the incoming pressure. This principle applies to all orifices in the system.

Figure 8 illustrates the reverse shuttle valve which has only two positions and does not regulate pressure at any time. The movement of the valve is controlled by spring pressure at one end and oil pressure at the other end. When no pressure exists at the front end of the valve, the spring holds the valve against its forward stop connecting passages "A" and "B." When oil is directed to the front of the valve, its pressure value always is higher than the spring pressure and the valve immediately is forced against its rear stop shutting off passage "A" and connecting passages "B" and "C".

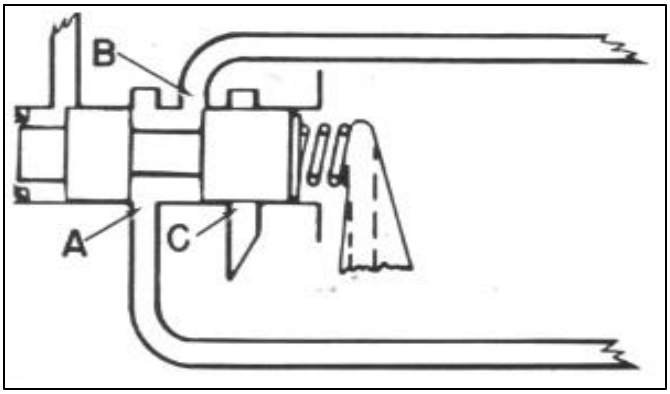


FIGURE 8—*Reverse Shuttle Valve Does Not Regulate Pressure*

The low regulator valve also operates on the same principles as the reverse shuttle valve. Figure 9 illustrates the throttle limit valve which, as its name implies, limits oil pressure. The limiting point is at "A" where the valve land partially closes off the incoming oil passage. The oil leaving point "A" passes out through passage "B" and also is routed behind the valve to point "C." When the pressure at points "B" and "C" exceeds the desirable predetermined pressure, the pressure at "C" partially overcomes the spring pressure moving the valve forward to further close off the passage at "A" to reduce the pressure. The valve does not begin to function until the pressure leaving point "A" exceeds the predetermined desired pressure.

Other valves which operate in a similar manner, but which regulate instead of limit pressure, are the converter valve and the shift regulator valve.

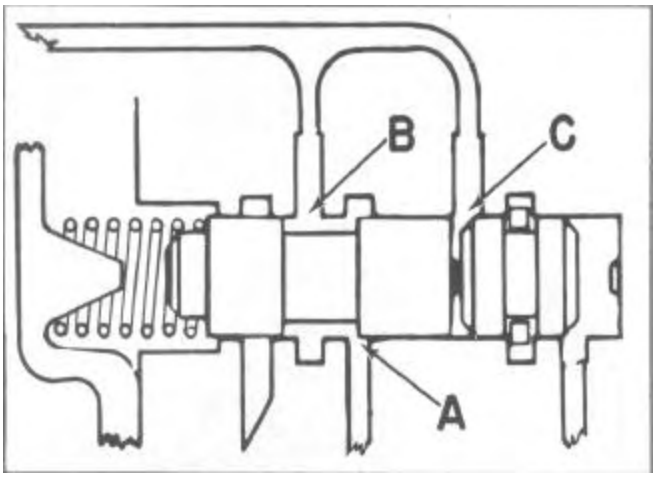


FIGURE 9—*Throttle Limit Valve Limits Pressure*

Figure 10 illustrates the direct shift throttle valve which also is a pressure regulating valve. Regulation, by this valve is accomplished by oil pressure at one end of the valve opposing spring pressure supplemented by oil pressure at the other end of the valve. The regulating point is at "A" where the valve partially closes off the passage. Oil is being delivered to point "A" and also is being routed to the front of the valve at point "B." Oil leaving point "A" passes out through point "C" and also is routed behind the valve to point "D" where it assists or supplements the spring to maintain a predetermined pressure. When the pressure at points "C" and "D" exceeds the predetermined pressure, the combination of oil pressure at "D" and spring pressure slightly overcomes the oil pressure at "B" moving the valve forward to further close off the passage at "A" to reduce the pressure. When the pre- sure at points "C" and "D" drops below the predetermined pressure, the oil pressure at "B" slightly overcomes the combination of oil pressure at "D" and spring pressure and the valve moves toward the rear to enlarge the opening at point "A" to increase the pressure.

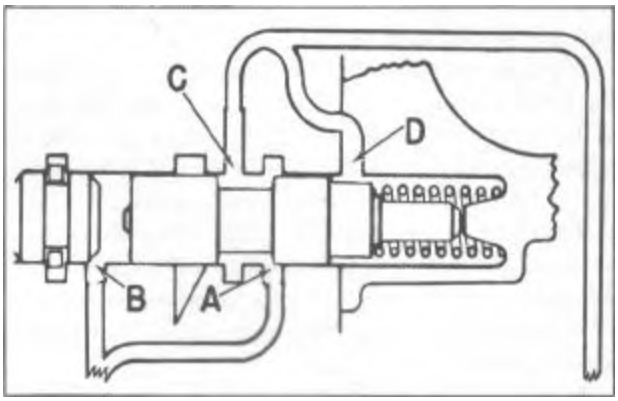


FIGURE 10—*Direct Shift Throttle Valve Regulates Pressure*

Other valves of this same type are the direct shift valve, low-high shift valve and the pump valve.

Figure 11 illustrates the throttle valve which is a combination of a manually operated valve within a pressure regulating valve. The function of this combination is to increase, decrease, and to maintain oil pressure in direct proportion to carburetor throttle openings. The manually operated valve, called the throttle valve shaft, is connected through linkage to the accelerator pedal which means that the position of this shaft has a relationship to the carburetor throttle valve openings.

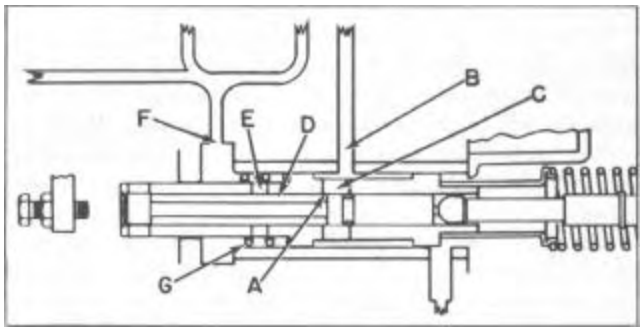


FIGURE 11—*A Manual Valve Within a Regulating Valve*

The cylindrical throttle valve regulates pressure by the action of oil pressure around the front of the valve opposing spring pressure at the rear of the valve. At idle and at small carburetor throttle openings the oil pressure around the front of the valve is supplemented by spring pressure to maintain the desired regulated pressure. Above a predetermined throttle opening, the spring around the front of the valve is inactive.

The pressure regulating point is between a land on the shaft and openings in the valve at "A." Oil is delivered to the valve at passage "B" and then passes through the openings "C" in the valve and past point "A" into area "D" between the shaft and the inside of the valve. From this area it passes through openings "E" in the valve and exerts pressure against the valve

forward land. At the same time, it passes out through passage "F" for distribution to other valves.

When the pressure at "F" exceeds the predetermined regulated pressure, the pressure rise around the front of the valve overcomes the main spring pressure to move the valve rearward to reduce the size of the opening at "A" and thereby reduce the pressure.

When the pressure at "F" falls below the predetermined pressure, the pressure around the front also decreases and the main spring pressure moves the valve forward enlarging the opening at "A" to increase the oil pressure.

At idle and at small carburetor throttle openings, the oil at point "F" would be at a pressure higher than would be desirable if idle spring "G" were not used and the shift pattern would be disrupted at low speeds. At low speeds, the spring supplements the oil pressure around the front of the valve to regulate the pressure at point "A."

Governors

Figure 12 illustrates the high speed and the low speed governors both of which incorporate regulating valves.

The valve in the high speed governor operates under the forces of oil pressure opposing spring pressure and centrifugal force.

The valve in the low speed governor operates with oil pressure opposing centrifugal force.

At low car speeds, oil from the rear pump is being delivered to the high speed governor where a certain amount of pressure regulation takes place. However, when the oil reaches the low speed governor, the pressure is higher than is desirable for low speed operation and it is further regulated by the low speed governor valve.

Oil enters the low speed governor through passage "A" and exerts pressure against the sides of the valve lands at points "B" and "C." Although the pressure is the same at these points, the valve area at "B" is larger than at "C" and this difference in areas causes the valve to move inward.

The regulating point is at "D" and oil leaving the governor passes out through passage "E" and also is routed through passage "F." When the pressure at point "E" rises above the desired regulated pressure, the pressure also rises at area "B" where it exerts enough force against the side of the valve land to partially overcome the centrifugal force and thereby move the valve inward. Moving the valve inward reduces the size of the opening at point "D" to lower the pressure.

Under some conditions of deceleration, it is desirable to have the pressure in passage "E" drop rapidly. This is accomplished by the valve moving inward far enough to uncover the opening of passage "F" to permit the oil to be vented at point "G."

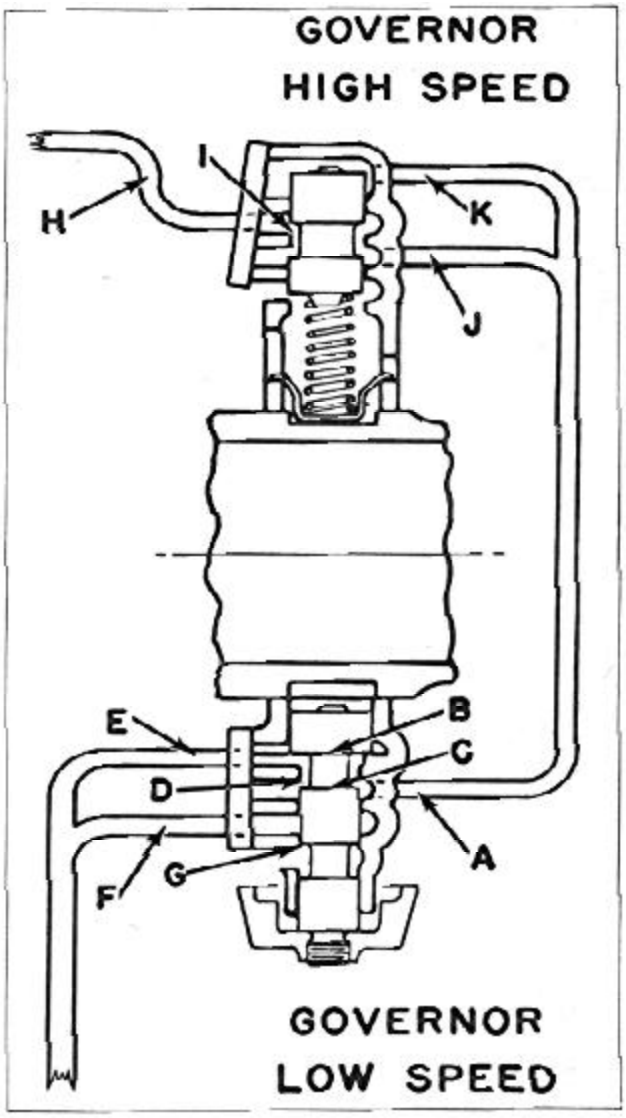


FIGURE 12—*Both Governors Incorporate Regulating Valves*

When the pressure at point "E" drops below the desired regulated pressure, centrifugal force slightly overcomes the lowered oil pressure at area "B" and moves the valve outward to enlarge the opening at point "D" and thereby increase the pressure at "E."

At higher car speeds, centrifugal force acting on the low speed governor valve and flyweight holds the valve in its fully extended position where the valve no longer regulates. At this time, all of the pressure regulation for the governor pressure circuit is taking place in the high speed governor.

Oil is delivered from the rear pump through passage "H" and the pressure is regulated in the governor at point "I." Oil leaving the governor passes out through passage “J” and also is routed

behind the outer end of the valve through passage "K."

When the pressure rises above the desired regulated pressure through passage "J," it also rises behind the outer end of the valve where it slightly overcomes the centrifugal force and spring pressure. This moves the valve inward to reduce the size of the opening at point "I" and thereby lower the pressure.

When the pressure falls below the desired regulated pressure, it also drops at the outer end of the valve and centrifugal force and spring pressure moves the valve outward to increase the size of the opening at point "J" to raise the pressure.

SERVICING THE TRANSMISSION

When servicing the transmission, it is vitally important that the bench or work space as well as tools and hands be clean. The proper tools should always be used, and above all, a torque wrench should be used whenever a tightening torque is specified.

Any time a part or unit is removed or disassembled. it should be thoroughly cleaned in a suitable cleaning solvent. After cleaning, the parts should be blown dry using compressed air. In the event a cloth is used, it should be clean and free of lint.

Before reinstalling parts or reassembling units, all parts should be thoroughly inspected.

When inspecting gears, pinions, or splined shafts, check all teeth for nicks or burrs.

Check the fit of the mating parts. Excessive clearance should not exist nor should the parts be excessively tight.

When inspecting any part which incorporates one or more oil passages, blow compressed air through the passages.

The friction facings and linings on clutch plates and brake bands should be inspected for excessive wear and proper bond. The areas on parts which are in contact with the facings and linings should be inspected for scored or distorted surfaces.

Castings should be checked for cracks and sand holes.

Where gaskets are used, the gasket contact areas should be clean, smooth, and free from deep scratches which would permit oil to pass the gasket. It is recommended that new gaskets be used on all reassembly operations.

All control valves should be very closely inspected for nicks and burrs. When it is necessary to clean up a burr or smooth out a nick, use a flat, finely gritted abrasive stone.

Check each valve in its respective bore in the valve body. The valve should move freely of its own weight as the body is tilted.

When assembling the valve controls, it is extremely important that the cap screws be tightened to their specified torque. Improperly tightening the cap screws can result in valves sticking or in excessive leakage past the valves with consequent pressure losses caused by normal expansion and contraction of the valves and bodies.

TRANSMISSION REMOVAL

Raise the car on a lift or raise the car at both ends and support it with stand jacks under the side sills.

Remove the starting motor and flywheel housing lower cover. Rotate the engine flywheel until one converter drain plug is at the bottom; loosen but do not remove the drain plug.

Rotate the flywheel one-half turn to bring the other drain plug to the bottom. Remove this drain plug and also the transmission oil pan drain plug and drain the fluid into a clean container. Reinstall the plugs. Remove the oil filler and level checking tube from the pan.

Disconnect the torque tube and propeller shaft from the transmission.

Disconnect the throttle valve linkage and the selector control linkage at the transmission.

Disconnect the speedometer cable and the cooler lines at the transmission.

Support the engine at the rear using a support beam across the frame channels or with a large block and hydraulic jack under the rear end of the engine oil pan.

Raise the engine and transmission enough to take the load off the rear support under the transmission rear housing. Remove the insulator to support nuts and washers and then remove the support to cross- member bolts and remove the support.

Place a transmission lift under the transmission with the lift adapter properly positioned around the oil pan. Pick up the transmission load by slightly raising the lift.

Remove the direct drive clutch housing to flywheel retaining nuts and slide the converter assembly toward the transmission.

Remove the bell housing to flywheel housing cap screws and then move the transmission rearward until the direct drive clutch housing is clear of the flywheel. Wire the converter assembly to the bell housing so that it cannot accidentally slide off the input shaft.

Lower the transmission lift and pull it from under the car. Transfer the transmission to a reconditioning stand.

DISASSEMBLY OF TRANSMISSION

Remove the converter and place it on a bench.

Place the transmission in a stand on the bench and remove the oil pan.

Remove the oil cooler tubes from the side of the case and extract the oil transfer tubes with needle nose pliers (Fig. 13).

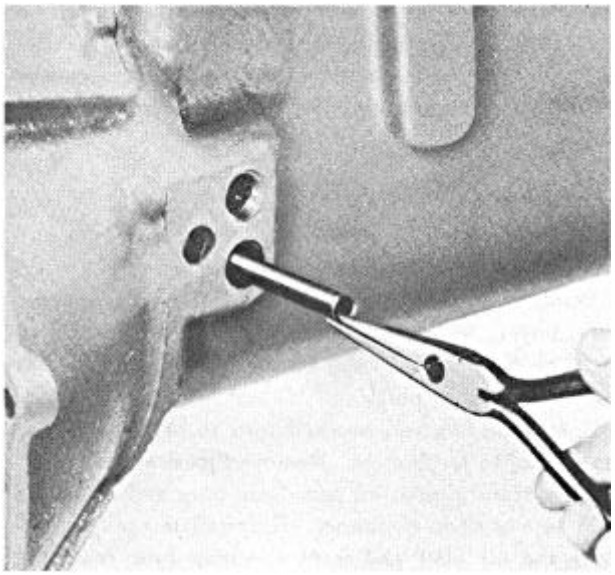


FIGURE 13—Extracting Oil Transfer Tube

Remove the bell housing to transmission case retaining bolts and remove bell housing and front oil pump assembly (Fig. 14).

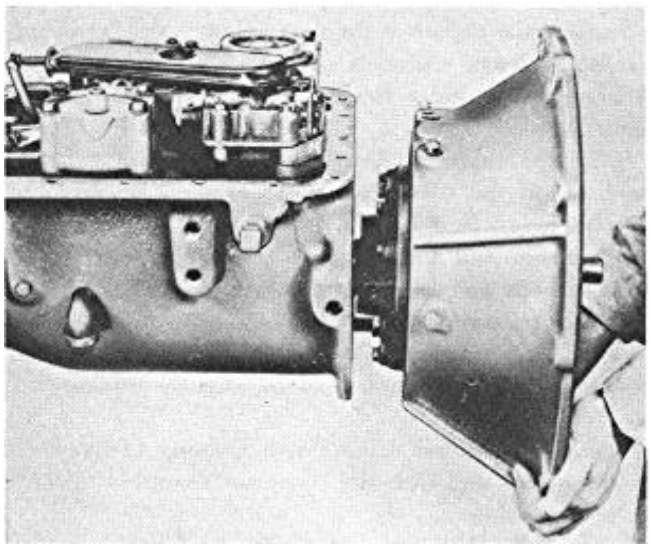


FIGURE 14—*Removing the Bell Housing and Front Oil Pump Assembly*

Remove the front pump assembly from the bell housing.

Place the selector lever on the side of the case in the "Park" position to lock the output shaft. Then remove the output shaft flange bolt (Fig. 15).

Remove the rear housing oil seal with Tool J-2619 and J-4830. Then remove the rear housing to case attaching screws and washers and remove the rear housing assembly.

Extract the rear housing spacer from the inside of the parking gear hub (Fig. 16).

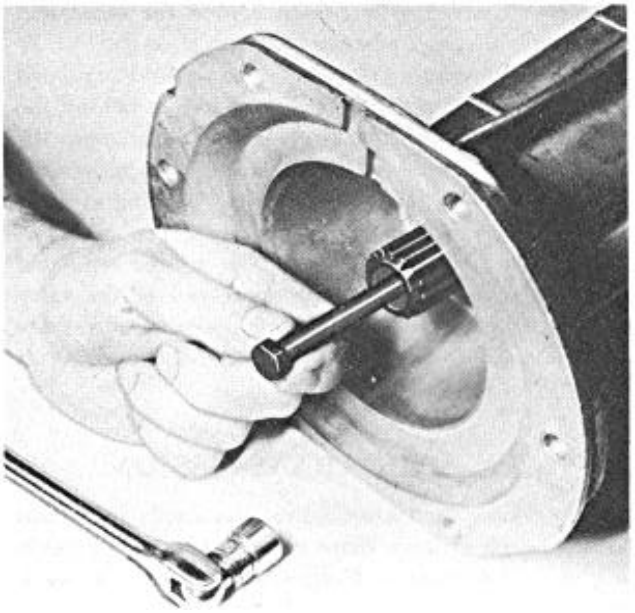


FIGURE 15—*Removing Output Shaft Flange Bolt*

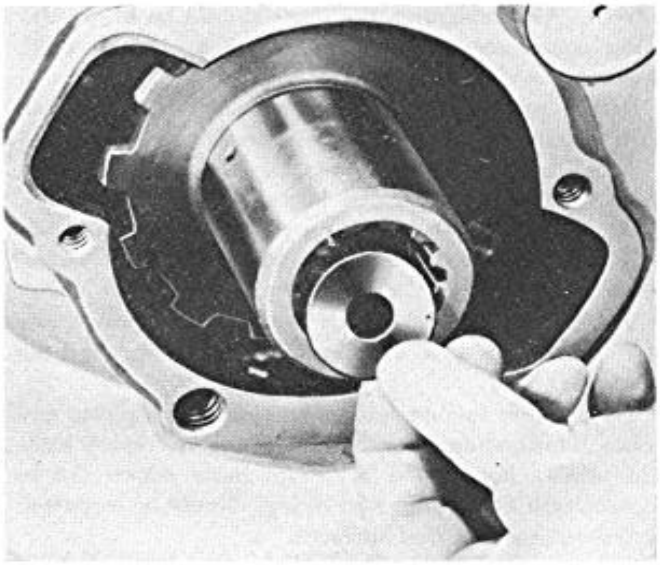


FIGURE 16—*Extract the Rear Housing Spacer*

Rotate the parking gear so that the governors are aligned with the opening in the case. Then lift out the parking gear and governor assembly (Fig. 17).

Loosen the brake band adjusting screw lock nuts and then back out and loosen both the low and reverse band adjusting screws (Fig. 18).

Remove the oil pump screen and pull out the rear oil pump suction tube. The tube can be lifted out with snap ring pliers (Fig. 19).

Remove the manual valve lever to link clevis split pin (Fig. 20).

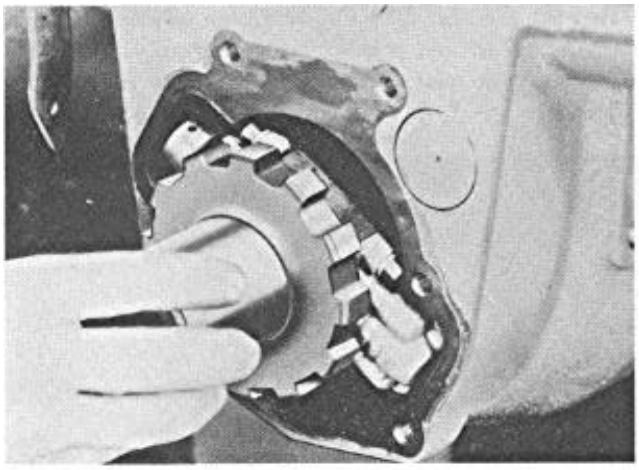


FIGURE 17—*Removing Parking Gear and Governor Assembly*

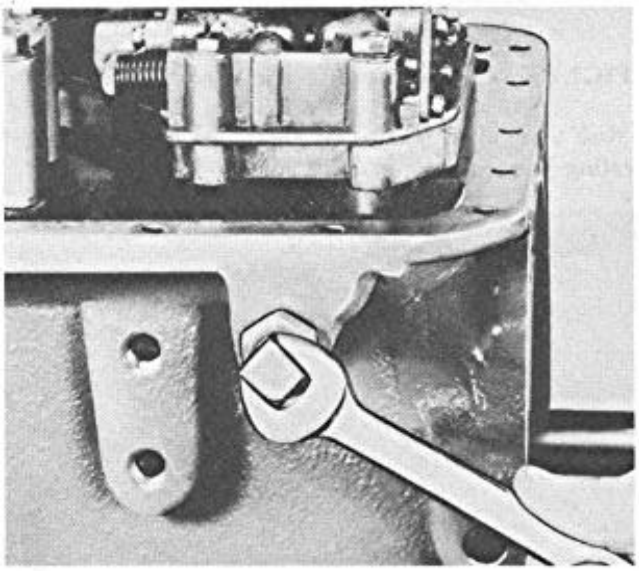


FIGURE 18—*Loosening Brake Band Adjusting Screws*

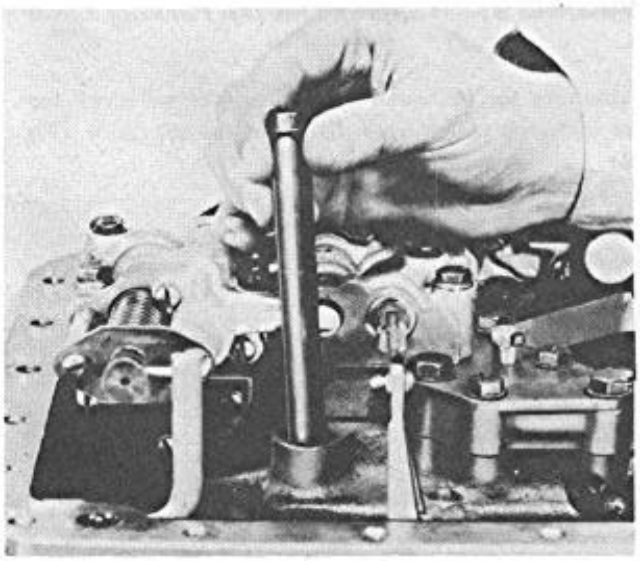


FIGURE 19—*Removing Rear Oil Pump Suction Jumper Tube*

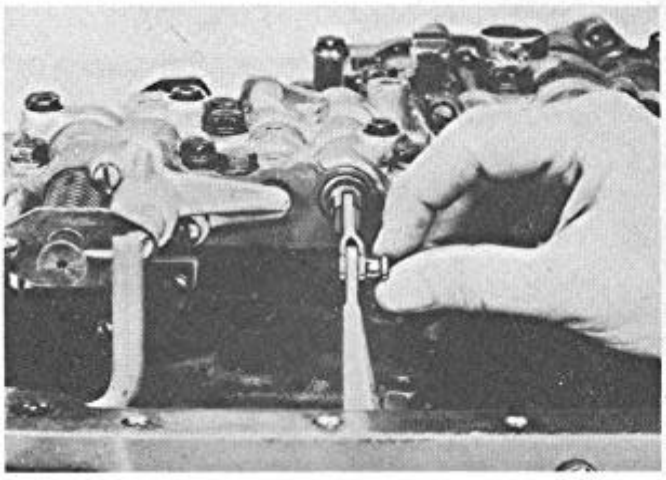


FIGURE 20—*Removing Manual Valve Lever Clevis Pin*

Remove the five cap screws (Item "A" Fig. 21) which hold the valve control to the case and the four cap screws ("B") which hold the reverse brake to the case. Then lift off the controls and brake as an assembly.

Remove the three low range brake cap screws and remove the brake assembly.

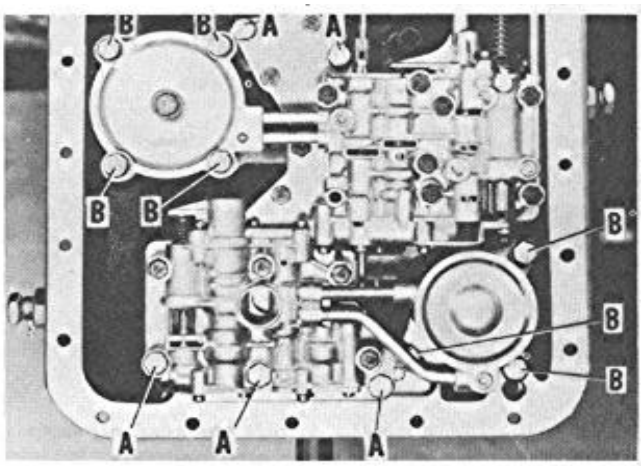


FIGURE 21—*Location of Control and Brake Assembly Retaining Screws*

Remove the high range clutch assembly from the front of the case (Fig. 22).

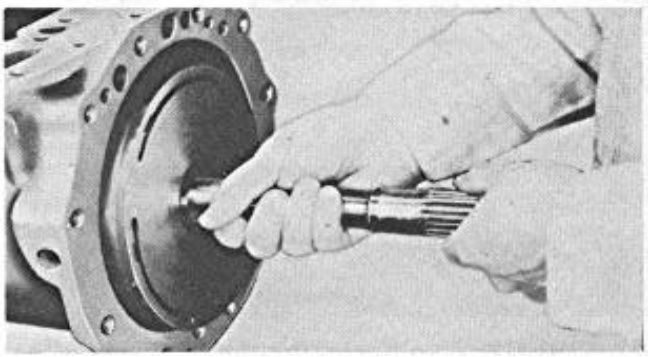


FIGURE 22—*Removing the High Range Clutch*

Remove the low range brake band (Fig. 23).

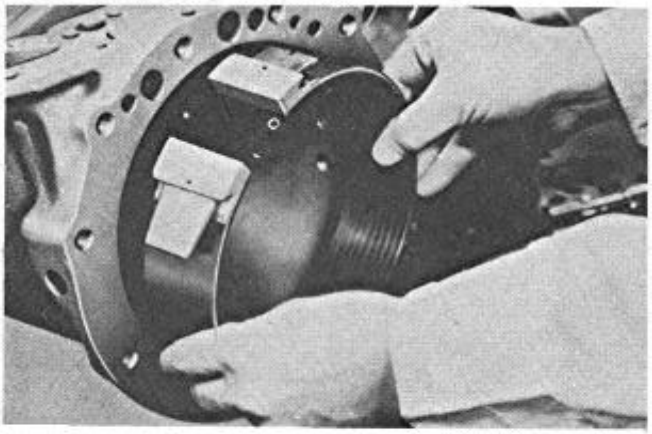


FIGURE 23—*Removing the Low Range Brake Band*

Use a dummy input shaft to lift out the planetary assembly and reverse brake band

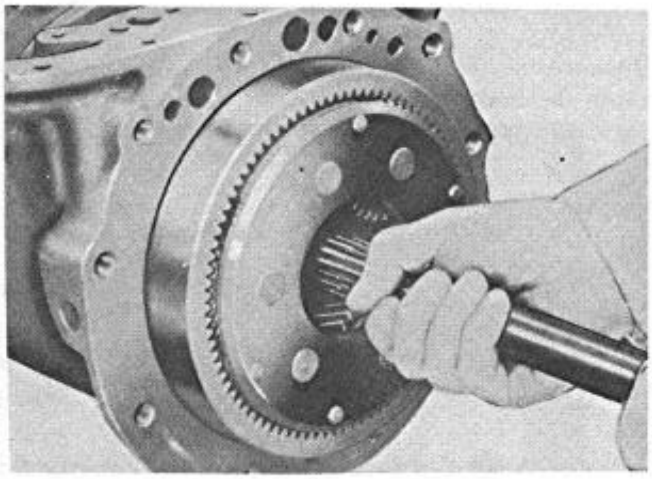


FIGURE 24—*Removing the Planetary Assembly*

Use snap ring pliers to extract the rear oil pump governor and discharge jumper oil tubes

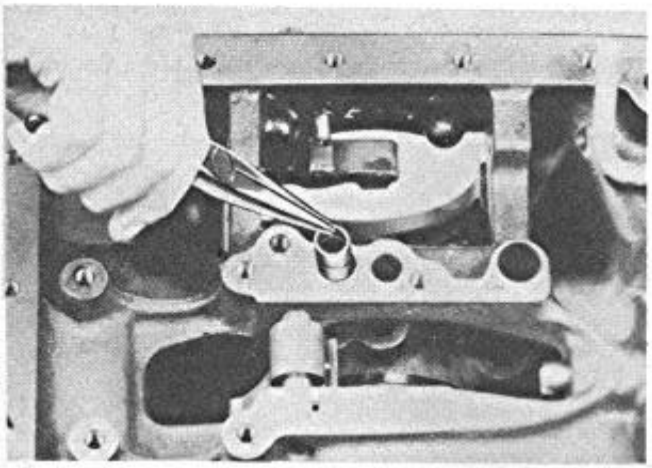


FIGURE 25—*Removing the Governor Jumper Tube*

Remove the rear oil pump retaining screws and lock washers and lift out rear oil pump assembly. Note the planetary ring gear thrust washer on the pump hub (Fig. 26).

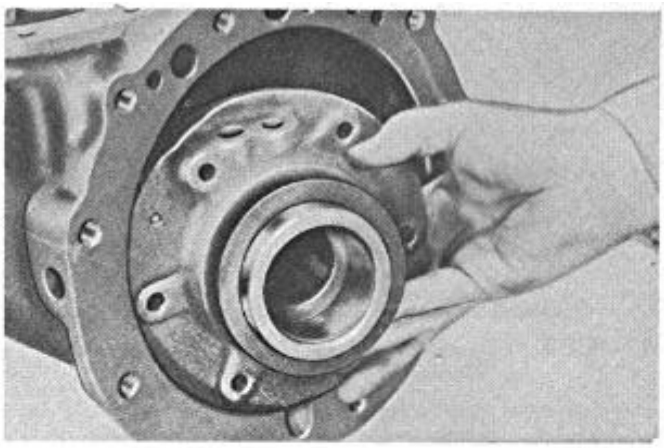


FIGURE 26—*Removing the Rear Oil Pump*

Use a small punch to tap out the parking lock operating lever index pin (Fig. 27).

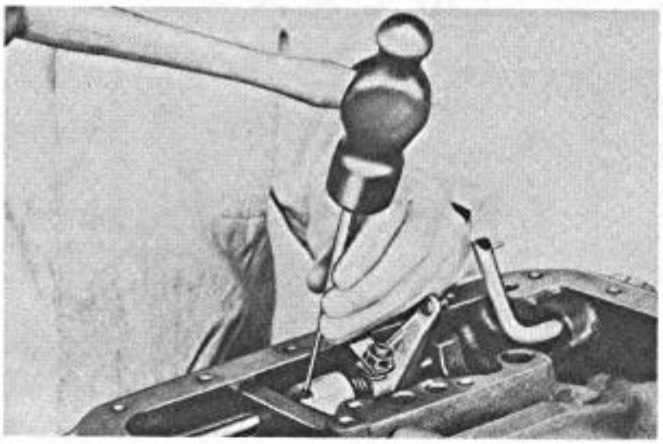


FIGURE 27—*Tapping Out the Parking Lever Index Pin*

Remove the manual valve inner lever set screw lock nut and stop plate. Then back out the set screw (Fig. 28).

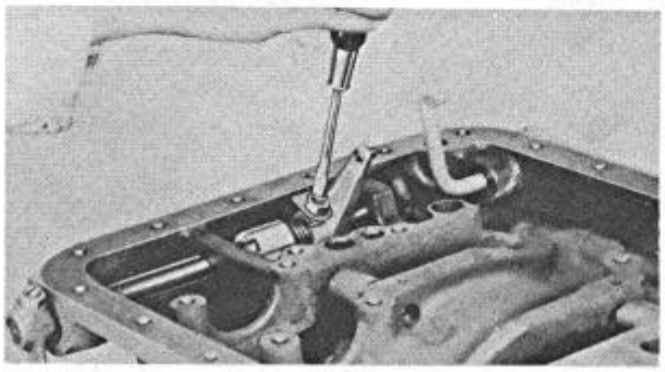


FIGURE 28—*Loosening Manual Valve Lever Set Screw*

Remove the manual valve outer lever set screw and bracket from the end of the shaft on the outside of the case. Use a long punch; tap the inner end of the shaft to start the shaft and seal out of the case (Fig. 29.

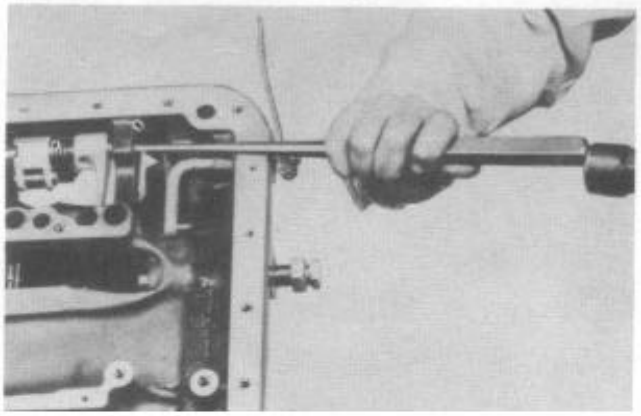


FIGURE 29—*Tapping the Manual Valve Lever Shaft at Inner End*

After starting the shaft out of the case hold the inner lever, spring, and operating lever and pull out the shaft, seal, washer, and retaining ring (Fig. 30) .

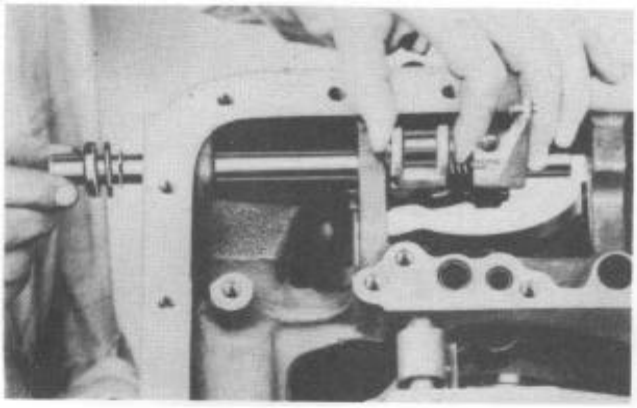


FIGURE 30—*Removing the Manual Lever Shaft*

Remove the parking lock lever by working through the front of the case using "Tru-arc" pliers to release the lever support retaining lock ring (Fig. 31).

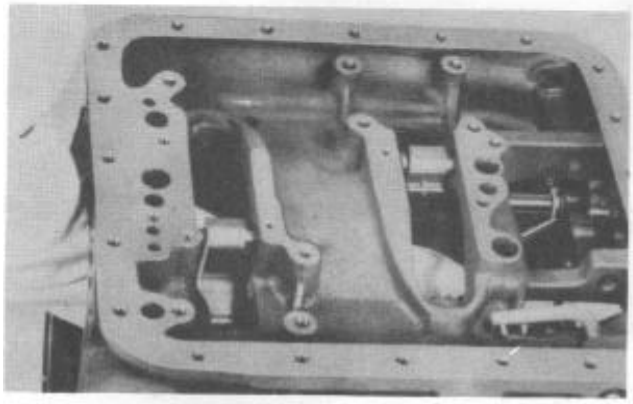


FIGURE 31—*Releasing the Lever Support Lock Ring*

Use a long punch; tap the front end of the lever support to start it out of the case. Then remove the support, lever, and spring (Fig. 32).

FIGURE 32—*Removing the Parking Lock Support, Lever and Spring*

Tap the inner end of the throttle lever to push the seal out of the case. Then remove the seal, washer,, and retaining ring (Fig. 33).

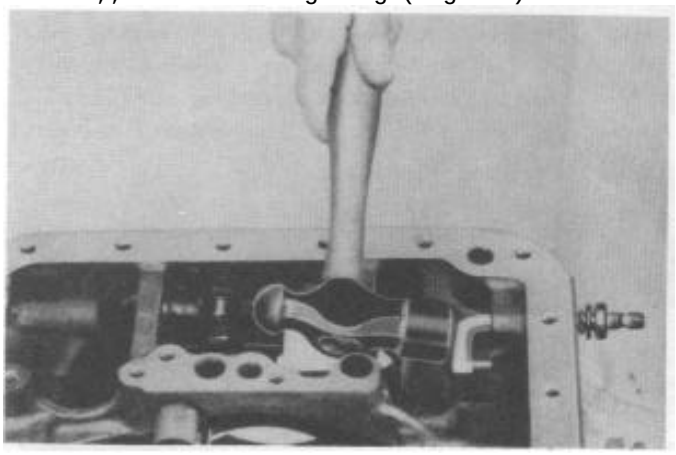


FIGURE 33—*Tapping the Throttle Valve Inner Lever*

Back out the brake band adjusting screws and remove the anchor pins from the inside of the case. Remove the breather from the side of the case.

DISASSEMBLY OF CONVERTER

The torque converter assembly is accurately balanced as a unit after factory assembly. Balancing is accomplished by welding lugs to the direct drive clutch housing. So that this balance can be maintained, it is important that various parts be marked on disassembly to insure their being installed in their related positions on reassembly.

All service replacement converter pumps are individually balanced and may or may not have balance lugs attached to the flange with drive screws. A new pump with a balance lug may be installed with the lug at any position in relation to the lug on the direct drive clutch housing without affecting converter assembly balance.

To disassemble the converter, place it on a bench with the pump end up. Using a scratch-awl, or some other sharp instrument, scribe marks on the pump flange and the clutch housing (Fig. 34).

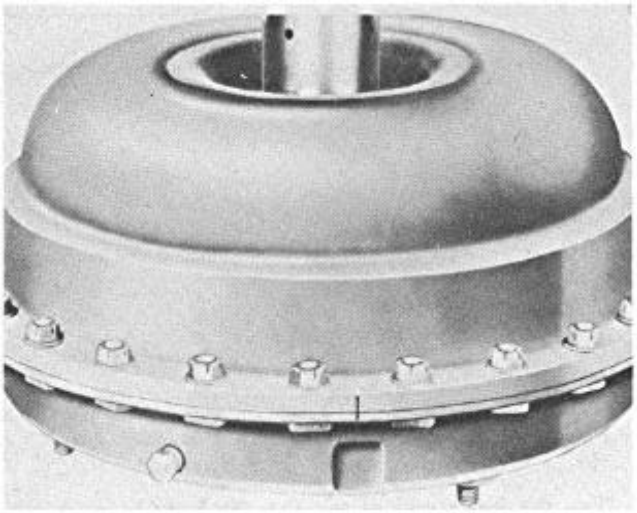


FIGURE 34—*Scribe Marks on Flanges of Torque Converter Assembly*

Use a dial indicator to measure the first turbine and reactor shaft end play. Make a note of the indicator reading to be used as a reference when inspecting and reassembling the unit. The specified end play is .010" to .017" (Fig. 35).

FIGURE 35—*Measure Reactor Shaft End Play*

Remove the converter pump to direct drive clutch housing nuts, washers, and bolts. Tap the pump with a plastic hammer to loosen it, then remove the pump and the reactor thrust spacer. Remove the large rubber "0" ring from the pump (Fig. 36).

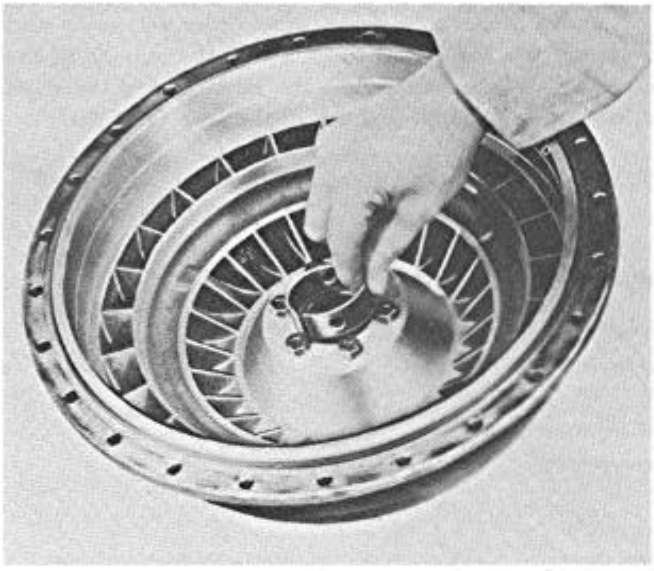


FIGURE 36—*Removing Reactor Shaft Thrust Spacer*

Remove the second turbine to first turbine cap screws and washers and lift off the second turbine (Fig. 37).

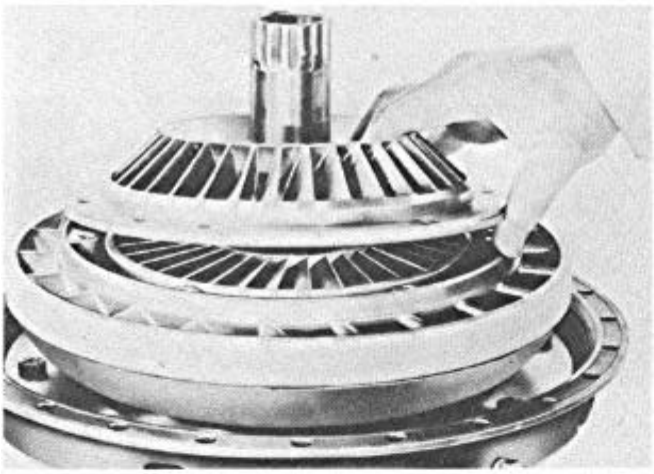


FIGURE 37—*Removing the Second Turbine*

Remove the reactor rear thrust washer (Fig. 38.

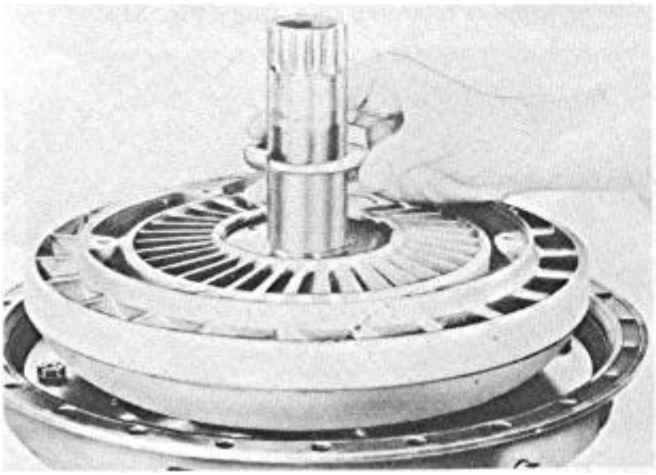


FIGURE 38—*Removing the Reactor Washer*

Remove the reactor shaft and the reactor as an assembly (Fig. 39).

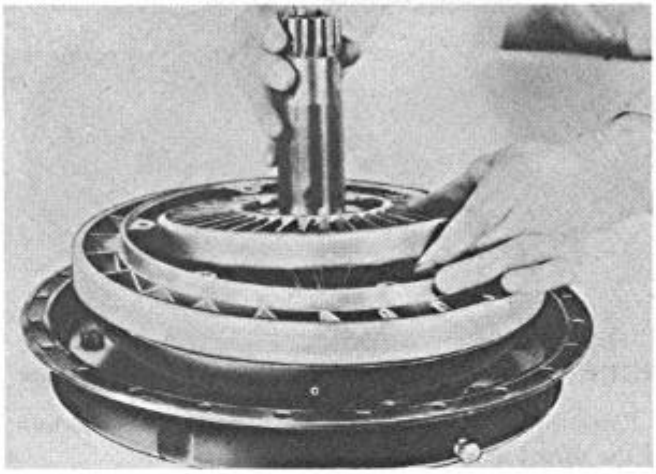


FIGURE 39—*Removing the Reactor and Shaft*

Remove the reactor shaft front thrust washer (Fig. 40).

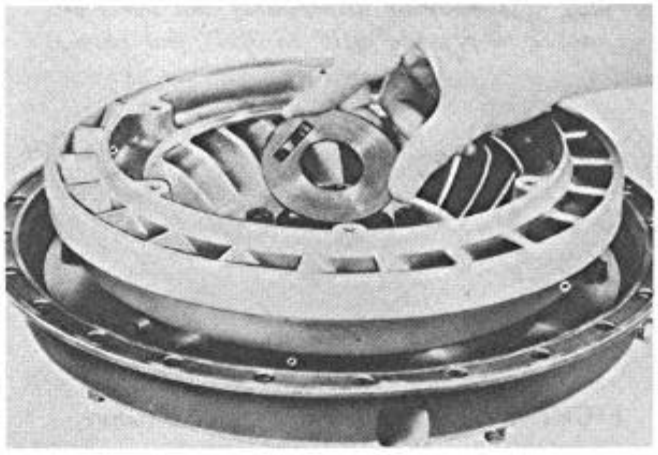


FIGURE 40—*Removing Reactor Shaft Front Thrust Washer*

Remove the first turbine and first turbine hub thrust washer (Fig. 41).

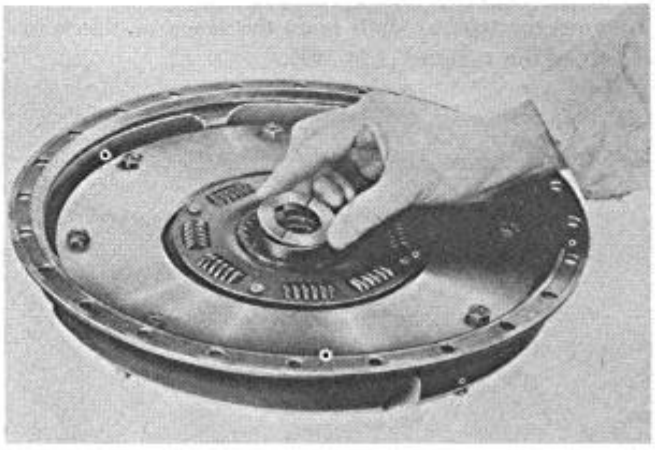


FIGURE 41—*Removing First Turbine Hub Thrust Washer*

Disassembly of Direct Drive Clutch

Use a scratch-awl and scribe marks on the clutch housing and the pressure plate as shown in Figure 42. Then remove the plate retaining screws and lift out the pressure plate and the driven plate.

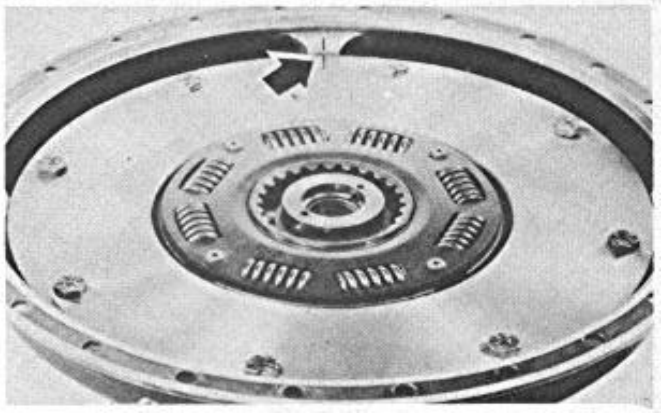


FIGURE 42—*Note Scribe Marks*

Scribe a mark on the clutch piston to line up with the mark on the clutch housing as shown in Figure 43.

Lift out the four pressure plate spacers, indicated by arrows in Figure 43, and then lift out the clutch piston.

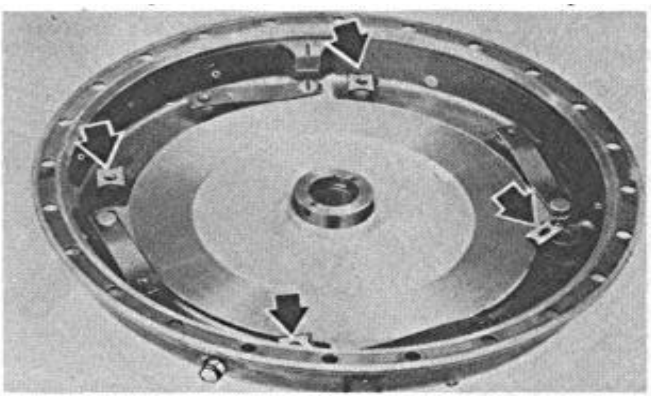


FIGURE 43—*Pressure Plate and Driven Plate Removed*

Remove the four large piston rings from the piston and the small inner ring from the hub of the clutch housing (Fig. 44).

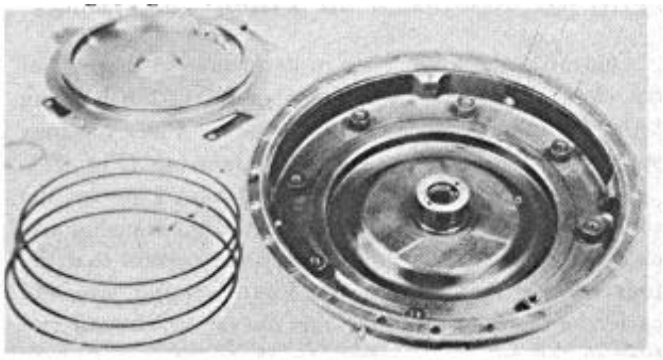


FIGURE 44—*Clutch Piston Rings Removed*

Assembly of Direct Drive Clutch

Insert the direct drive clutch piston inner ring into the piston bore and check the ring gap. The specified ring gap is .001" to .018" (Fig. 451. Install the ring in its groove on the hub of the direct drive clutch housing and make certain it is free in the groove.

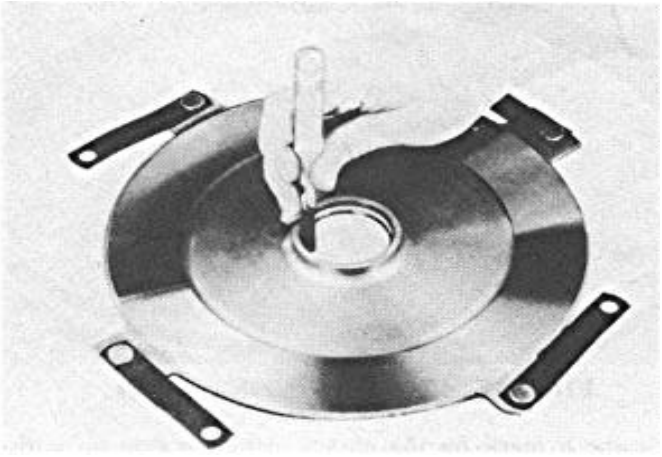


FIGURE 45—*Check the Piston Ring Gap*

Install the four piston outer rings on the piston. The rings should be rotated so that the gaps are approximately 90° apart (Fig. 46).

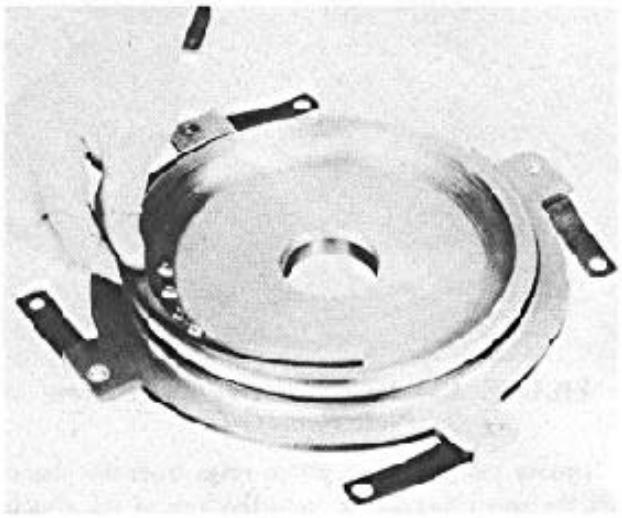


FIGURE 46—*Install the Piston Outer Rings*

Centralize the inner ring in its groove in the hub of the clutch housing. Push the piston into the housing lining up the previously scribed marks. Place the four spacers on the bosses in the clutch housing (Fig. 47).

Place the driven plate on the piston. Line up the scribe marks on the pressure plate and the housing and place the plate in the housing making certain that the four spacers are in position. Four locating pins can easily be made to facilitate this operation. Install and tighten the retaining screws to 18 to 20 foot pounds torque.

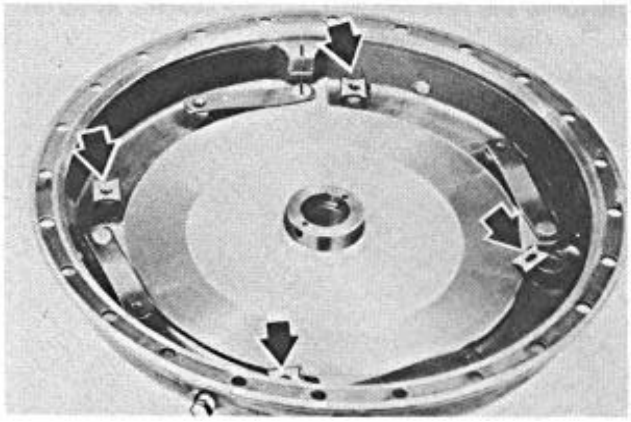


FIGURE 47—*Place the Spacers on the Bosses*

Place the first turbine hub thrust washer on the hub of the direct drive clutch housing (Fig. 48).

NOTE: *This is the thrust washer which controls reactor shaft end play. Thrust washers are available in graduations ranging from .062" to .110". Refer to the reactor shaft end play note made on disassembly and select a washer to provide .010" to .017" end play.*

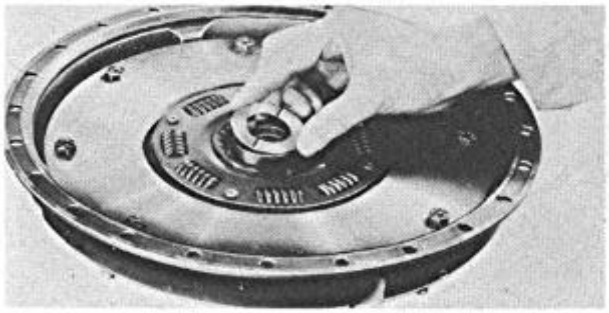


FIGURE 48—*Place the Thrust Washer on the Hub*

Centralize the driven plate in the clutch housing and insert the first turbine splined hub into the driven plate hub.

Disassembly of Reactor Assembly

Remove the reactor shaft from the reaction clutch in the hub of the reactor (Fig. 49I.

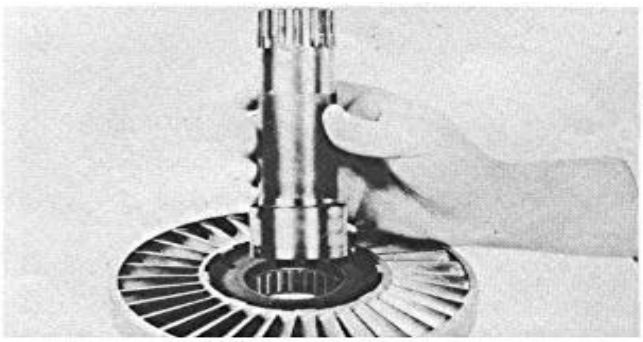


FIGURE 49—*Removing the Reactor Shaft*

Remove the reaction clutch retaining ring with a screw driver (Fig. 50).

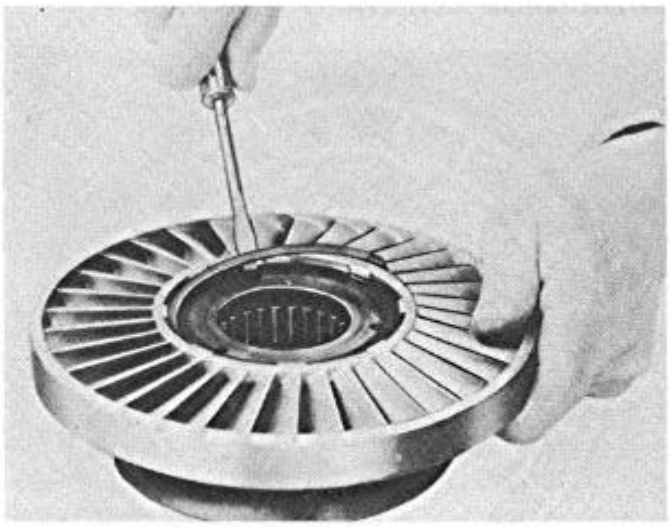


FIGURE 50—*Removing Reaction Clutch Retaining Ring*

Remove the reaction clutch bearing plates, washers, sprag springs, sprags, and reaction clutch outer race, (Fig. 51).

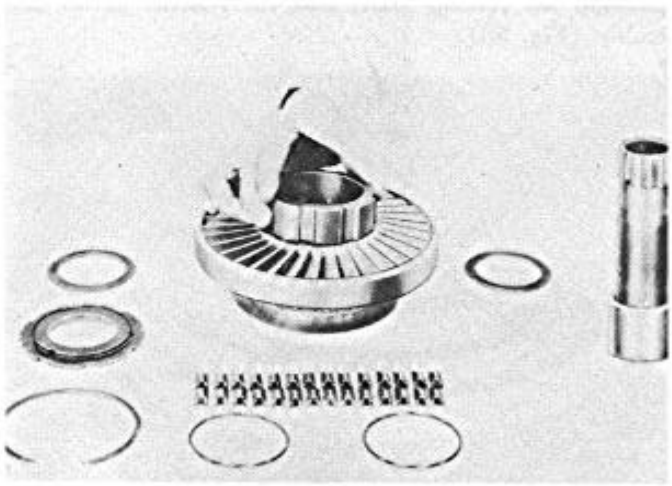


FIGURE 51—*Reaction Clutch Details*

Assembly of Reactor Assembly

Install a reaction clutch bearing plate and a retaining ring in the hub of the reactor at the coned or forward end. Place the reactor in the bench, coned end downward, and insert the outer race as shown in Figure 51. Place one of the washers in the race and then place one of the circular springs on top of the washer (Fig. 52).

Note that the center line of the spring groove in the sprag is at an angle less than 90° in relation to the flat back portion of the sprag. In other words, the groove is pointing toward the left when viewed in the position shown (Fig. 53).

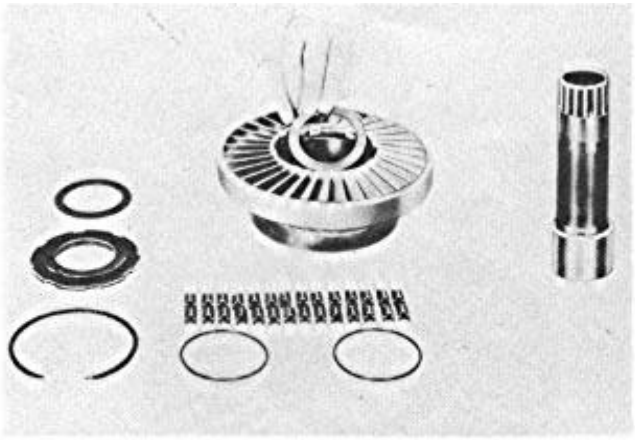


FIGURE 52—*Insert a Washer through the Race*

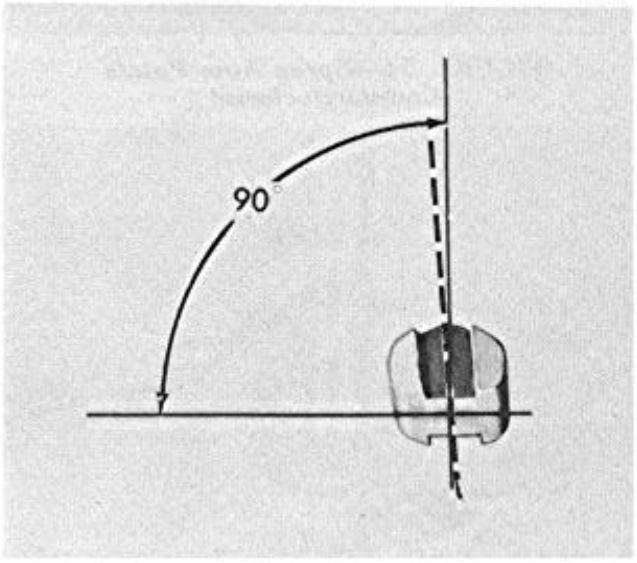


FIGURE 53—*Note the Center Line of the Groove*

Place the first sprag in the race at approximately a three o'clock position with the bottom groove over the spring, the top groove pointing inward toward the left or center and the nose of the sprag pointing in a counter-clockwise direction. Follow this procedure to install the rest of the sprags. Figure 54 shows a sprag lifted out at the nine o'clock position. It must be remembered that the reactor be on the bench with the coned side down when the foregoing operations are performed.

Install the circular spring in the sprag grooves and place the large washer over the sprags. Install the bearing plate and the lock ring.

Insert the reactor shaft into the overrunning clutch. If the shaft cannot be inserted into the clutch, one or more sprags have been installed incorrectly. (Fig. 551.

When the shaft has been installed, hold the reactor and rotate the shaft. The shaft should turn freely when rotated clockwise and should lock up when rotated counterclockwise. (Fig 56).

FIGURE 54—*Sprag Nose Points Counterclockwise*

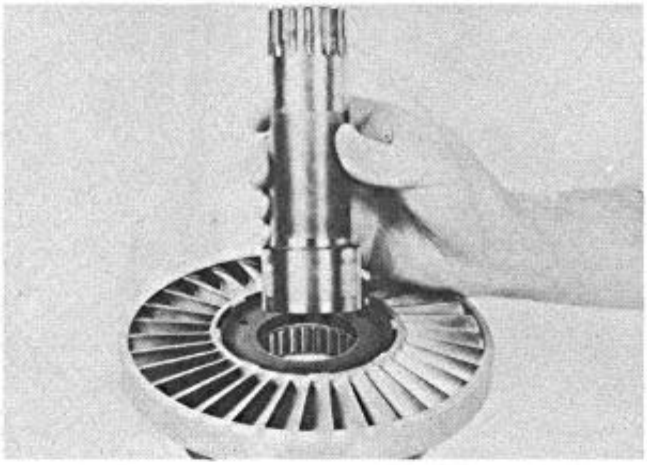


FIGURE 55—*Insert the Shaft into the Clutch*

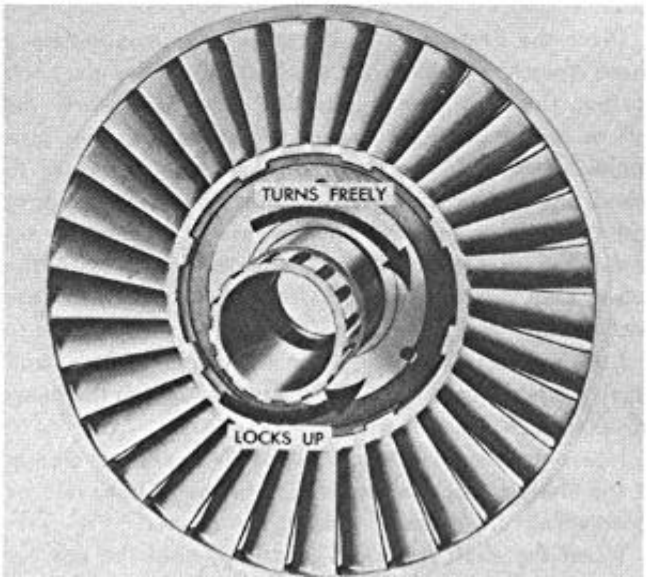


FIGURE 56—*Shaft Rotation When Properly Assembled*

ASSEMBLY OF CONVERTER

Place the reactor shaft front thrust washer on hub of the first turbine (Fig. 57).

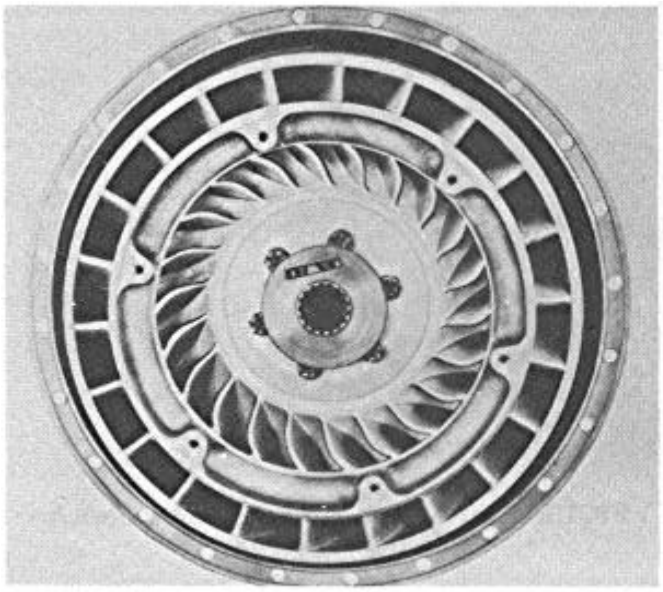


FIGURE 57—*Reactor Shaft Front Thrust Washer in Place*

Install the reactor shaft and the reactor as an assembly (Fig. 58).

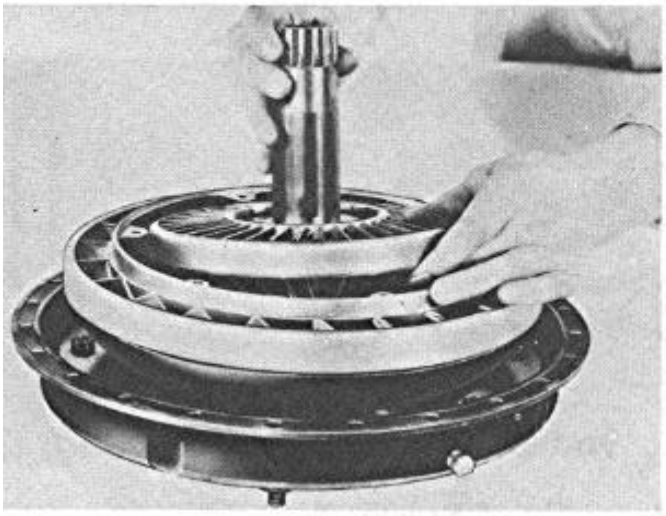


FIGURE 58—*Installing the Reactor Assembly*

Install the second turbine, attaching screws and washers. Torque tighten the attaching screws to 12 to 15 ft. lbs.

Install the reactor rear thrust washer. The tangs of the thrust washer should face up toward the splines of the reactor shaft (Fig. 59).

Place a new "0" ring around the pump flange (Fig. 60).

Place the converter pump on the clutch housing lining up the previously scribed marks. Install and tighten four retaining bolts and nuts and check reactor shaft

end play (Fig. 61). If the end play is not within the limits of .010" to .017", a new first turbine hub thrust

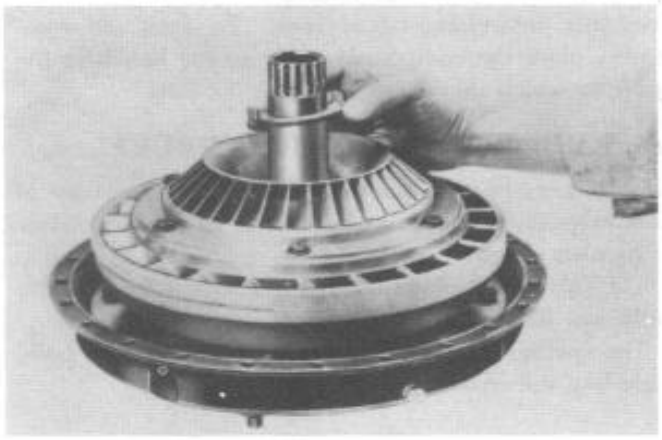


FIGURE 59—*Installing Reactor Rear Thrust Washer*

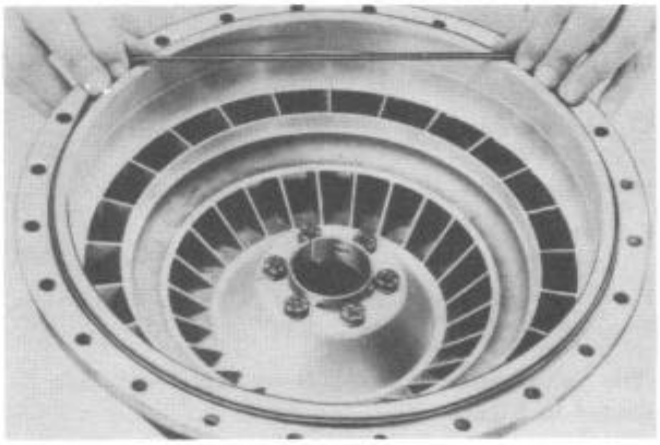


FIGURE 60—*Install New "O" Ring on Pump Flange*

FIGURE 61—*Check the Reactor Shaft End Play*

washer of the proper thickness must be installed to bring the end play within specifications. If the end play is within .010" to .017", install the remaining bolts, washers, and nuts and torque tighten to 20 to 25 ft. lbs.

DISASSEMBLY OF CONTROL VALVE

Remove the front valve body assembly retaining screws and remove the valve body assembly (Fig. 62) .

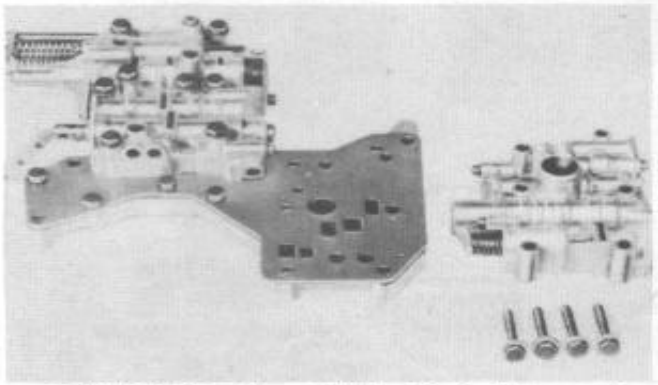


FIGURE 62—*Front Valve Body Removed*

Remove the rear lower body to rear upper valve body to manifold screws, and remove the two body assemblies (Fig. 63).

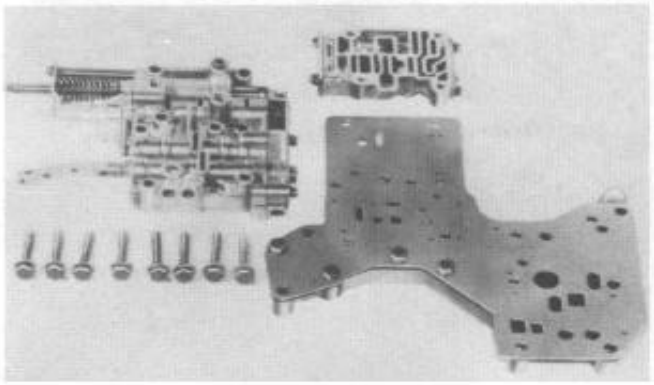


FIGURE 63—*Rear Lower and Rear Upper Valve Bodies Removed*

Remove the separator plate to manifold screws and lift off the plate and gasket. Note the front and rear check valves (arrows) in the manifold (Fig. 64).

Refer to Figure 65 which shows the rear lower valve body assembly. Arrow "A" indicates the adjusting screw which governs the throttle pressure. The setting of this screw should never be changed and should be left intact in the detent assembly housing when disassembling and assembling the controls. Special equipment is required to set the throttle pressure which must be adjusted with the transmission in the car and operating. Arrows "B" (Fig. 65) indicate the location of plugs held in place with lock rings. It is normally not

necessary to remove these plugs when servicing the valve body assembly.

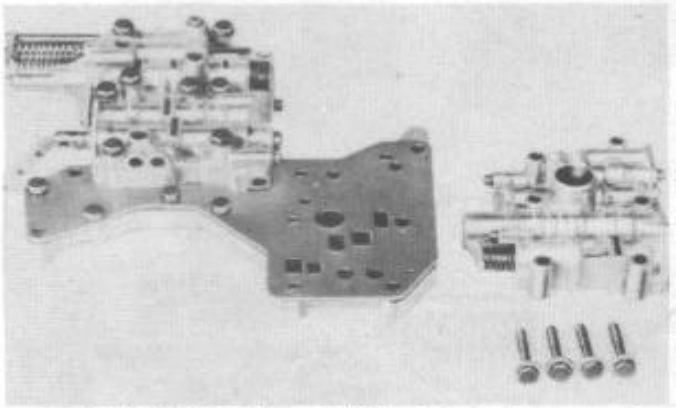


FIGURE 62—*Front Valve Body Removed*

Remove the rear lower body to rear upper valve body to manifold screws, and remove the two body assemblies (Fig. 63).

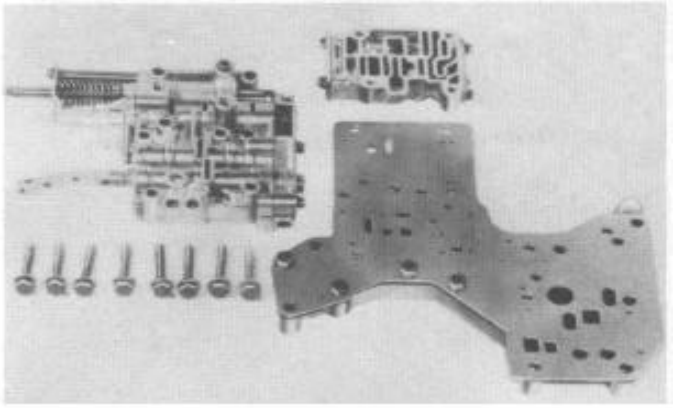


FIGURE 65—*Rear Lower Valve Body*

When servicing the controls, disassemble each subassembly and thoroughly clean, inspect, and reassemble one at a time. This will reduce the possibility of accidentally interchanging springs. To facilitate reassembly place the component parts on the bench in the order in which they were removed.

ASSEMBLY OF CONTROL VALVE

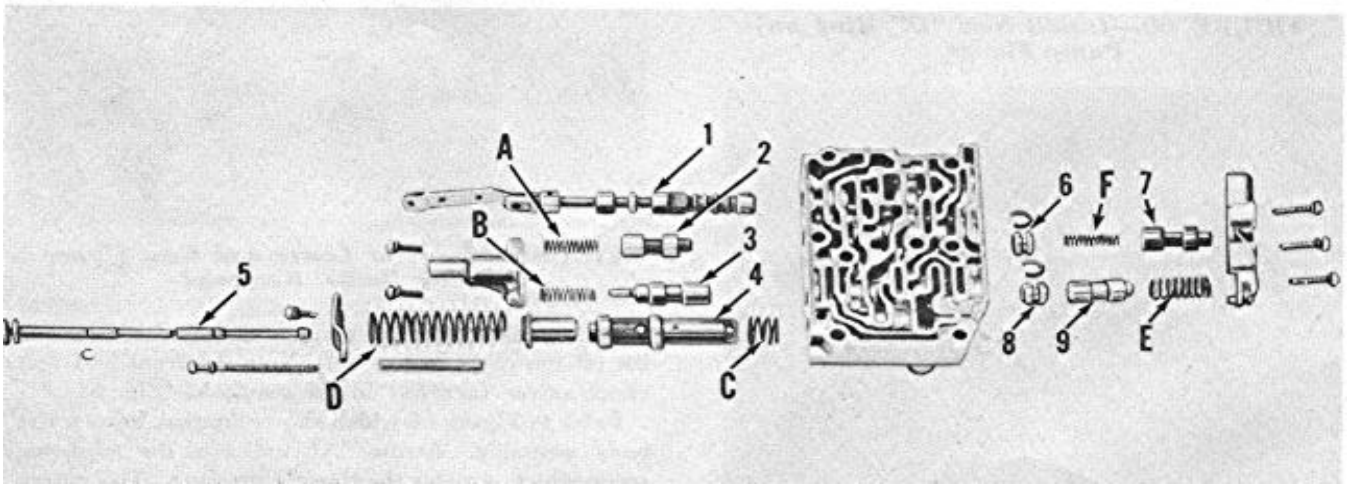
When assembling the controls, check the movement of each valve in its respective bore. The valve should slide of its own weight.

The valves and plugs located in the rear lower valve body are illustrated in Figure 66.

The springs contained in the rear lower valve body including dimensions are as follows:

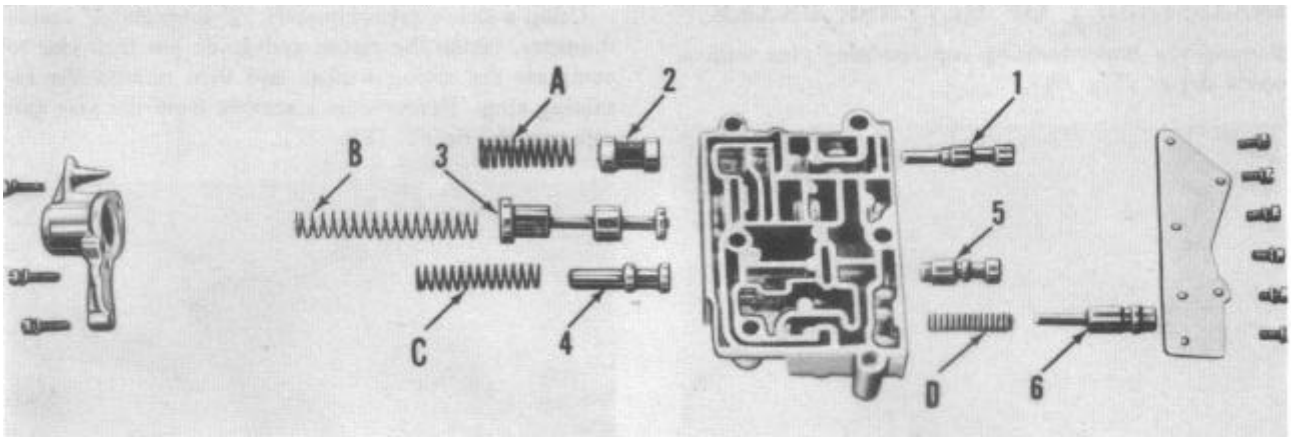
	Free Length Approx.	No. of Coils Approx.	O.D.
A. Reverse Shuttle Valve Spring	1-3/32"	13	.330"
B. Direct Shift Throttle Valve Spring	1-13/32"	13-1/2	.412"
C. Throttle Valve Idle Spring	21/32"	5	.654"
D. Throttle Valve Spring	2-25/32"	14	.784"
E. Throttle Limit Valve Spring	1-7/32"	9-1/2.	.550"
F. Modulating Valve Plug Spring	1-3/32"	13	.330"

The valves located in the front valve body are illustrated in Figure 67.



1. Manual Valve
2. Reverse Shuttle Valve
3. Direct Shift Throttle Valve
4. Throttle Valve
5. Throttle Valve Shaft Assembly
6. Reverse Shuttle Valve Plug
7. Modulating Valve Plug
8. Throttle Limit Valve Plug
9. Throttle Limit Valve

FIGURE 66—*Rear Lower Valve Body*



1. Converter Valve
2. Converter Valve Piston
3. Pump Regulator Valve
4. Shift Regulator Valve Piston
5. Shift Regulator Valve
6. Low Regulator Valve

FIGURE 67—*Front Valve Body*

The springs contained in the front valve body including dimensions are as follows:

	Free Length Approx.	No. of Coils Approx.	O.D.
A. Converter Valve Spring	1-3/4"	11-1/2"	.580"
B. Pump Regulator Valve Spring	3-21/32"	19	.650"
C. Shift Regulator Valve Piston Spring	2-3/16"	16	.477"
D. Low Regulator Valve Spring	1-17/32"	16	.400"

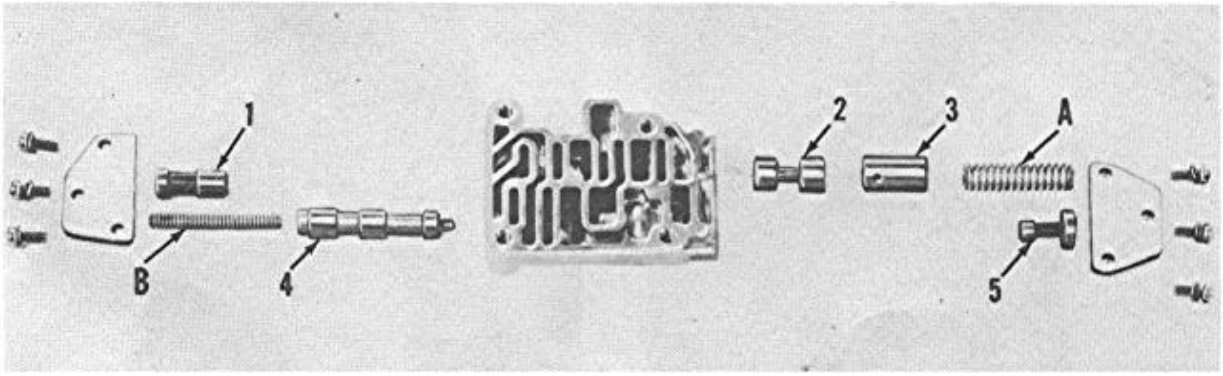
The valves that are located in the rear upper valve body are illustrated in Figure 68.

The springs contained in the rear upper valve body (Figure 68) including dimensions are as follows:

	Free Length Approx.	No. of Coils Approx.	O.D.
A. Direct Shift Valve Piston Spring	2-5/32"	17	.440"
B. Low-High Shift Valve Spring	2-5/64"	33	.250"

Place the check valves in the manifold and then assemble the gasket and separator plate to the manifold.

Assemble the valves, plugs, and springs to the valve bodies. Then assemble the valve body assemblies to the manifold but do not tighten the retaining screws at this time because they are to be torque tightened when assembled to the transmission case as shown in Figure 144



1. Direct Shift Valve Piston—Front
2. Direct Shift Valve
3. Direct Shift Valve Piston—Rear
4. Low-High Shift Valve
5. Low-High Shift Valve Piston

FIGURE 68—Rear Upper Valve Body

DISASSEMBLY OF REVERSE BRAKE

Remove the brake housing cap retaining ring with a screw driver (Fig. 69).

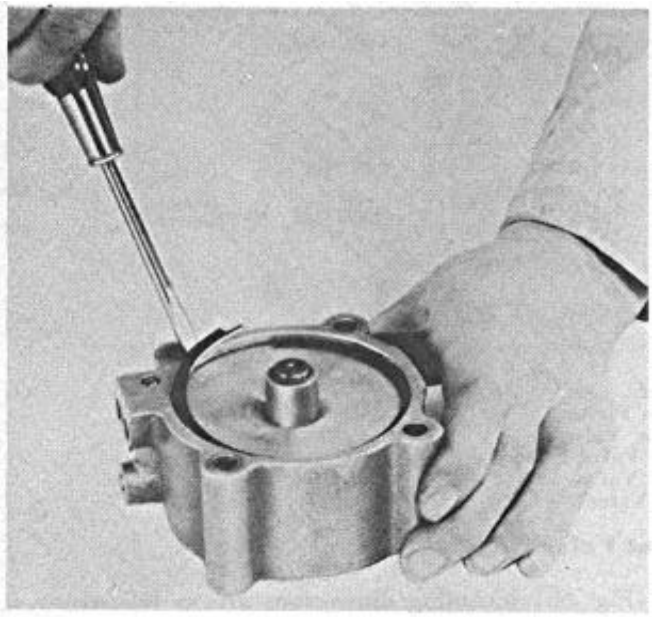


FIGURE 69—*Removing Cap Retaining Ring*

Remove the cap, piston, seal and guide pin as an assembly. If the cap sticks in the housing, invert and support the assembly on blocks and lightly tap the end of the guide pin using a brass drift (Fig. 70).

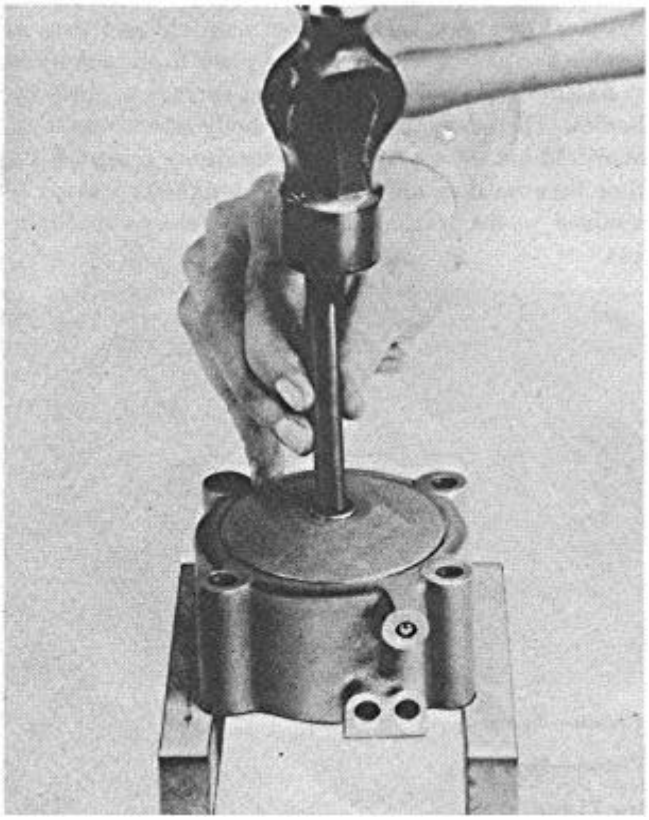


FIGURE 70—*Tap the Pin and Remove the Cap*

Using a sleeve approximately 7/8" long and 1" inside diameter, clamp the piston and guide pin in a vise to compress the spring washer and then remove the retaining ring. Remove the assembly from the vise and separate the details (Fig. 71).

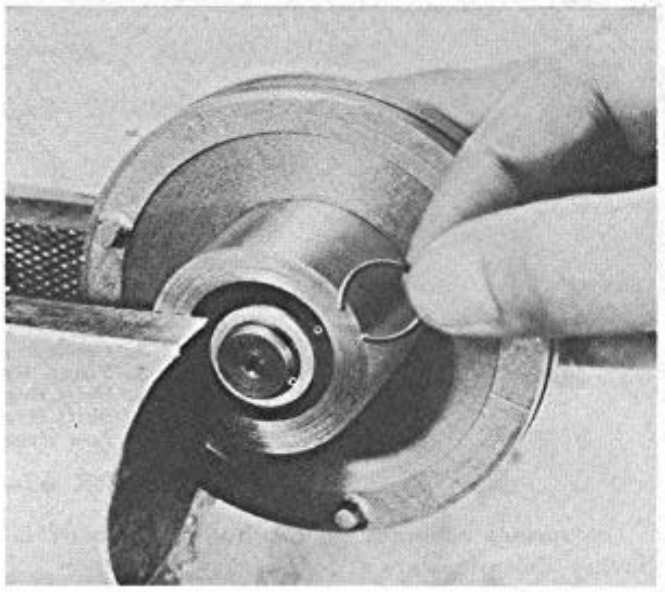


FIGURE 71—*Remove the Retaining Ring*

ASSEMBLY OF REVERSE BRAKE

Place the piston seal or ring in the housing bore and check for a .002" to .014" ring gap (Fig. 72).

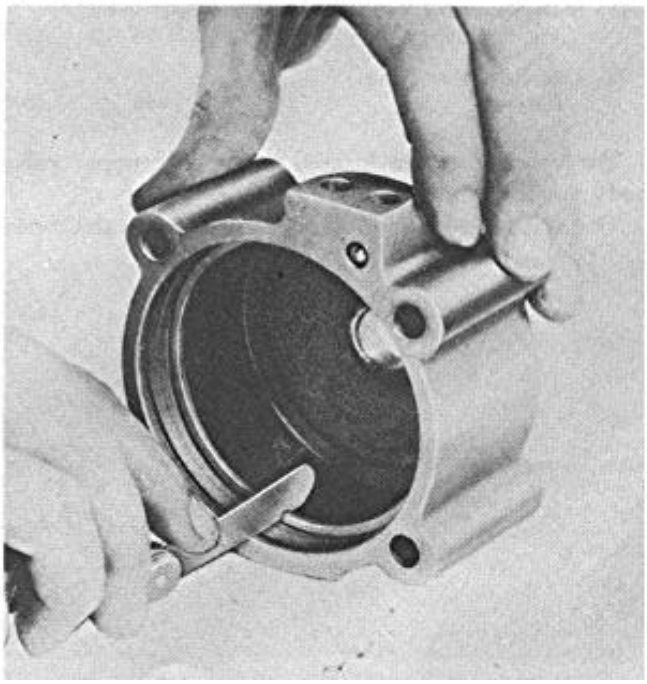


FIGURE 72—*Checking the Ring Gap*

Place the spring washer in the housing with the concave or "dished" side upward (Fig. 73).

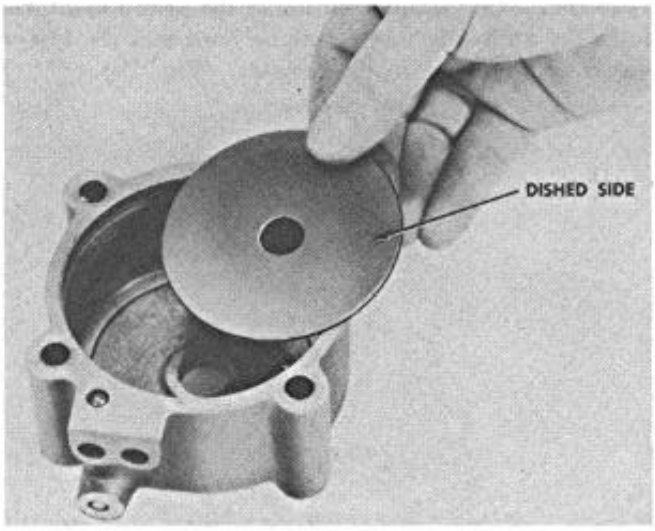


FIGURE 73—*"Dished" Side of Washer Should Be Upward*

Place the ring on the piston and make certain the ring is free in the ring groove. Install the piston and ring in the housing by tilting the piston to compress the ring while pushing the piston downward (Fig. 74).

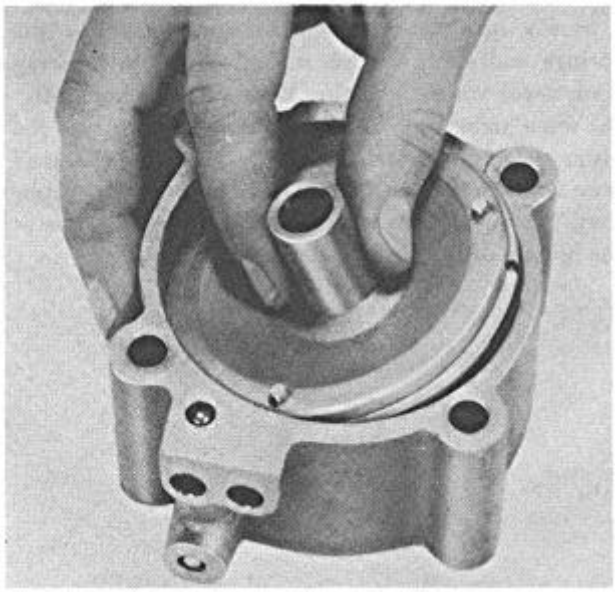


FIGURE 74—*Tilt the Piston and Push Downward*

Use a 7/8" x 1" I.D. sleeve to compress the spring washer; clamp the assembly in a vise and install the retaining ring (Fig. 75) .

DISASSEMBLY OF LOW RANGE BRAKE

To properly disassemble and assemble the low range brake assembly, tool J-5977 piston remover and replacer must be used as shown in Figure 76.

With the tool attached to a work bench so that the open lower end of the tool clears the forward edge of the bench, or held securely in a vise, place the low range brake in the

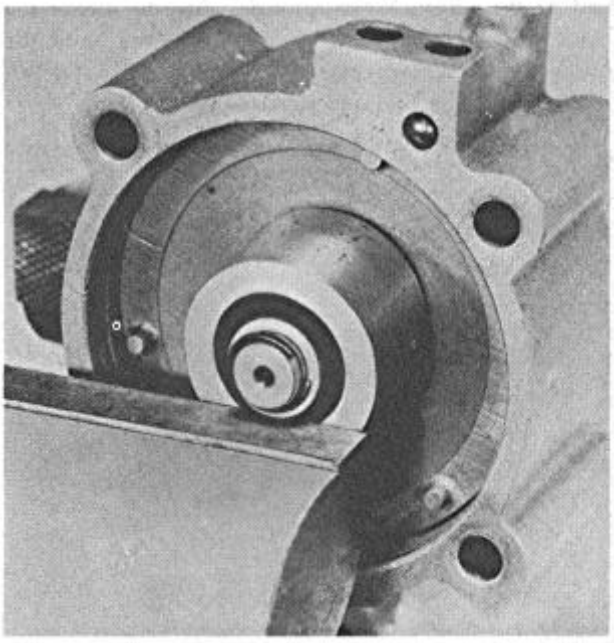


FIGURE 75—*Installing the Retaining Ring*

tool and secure it in place with the two special Allen screws.

Place the cupped adapter on the center of the brake housing cover; turn down the adjusting screw making sure that the lower end enters the hole in the adapter. Tighten the adjusting screw a turn or two to relieve the pressure from the retaining ring and then remove the retaining ring (Fig 76).

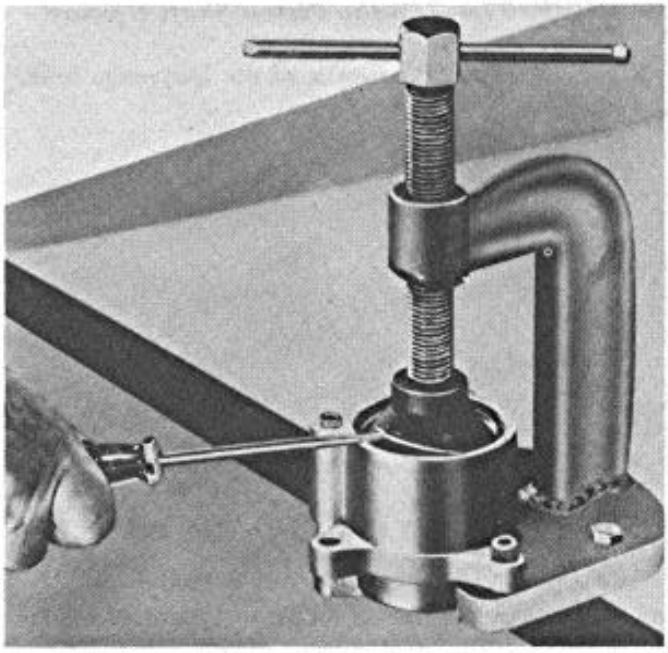


FIGURE 76—*Removing Retaining Ring*

Slowly loosen the adjusting screw taking particular note that the brake piston cover raises as the adjusting screw is loosened. If the cover is sticking in the brake housing, use a punch and hammer and tap the lower

end of the piston shaft upward lightly to loosen the cover (Fig. 77) . Slowly loosen the screw until the brake piston and springs are free. Remove the assembly from the tool and separate the details.

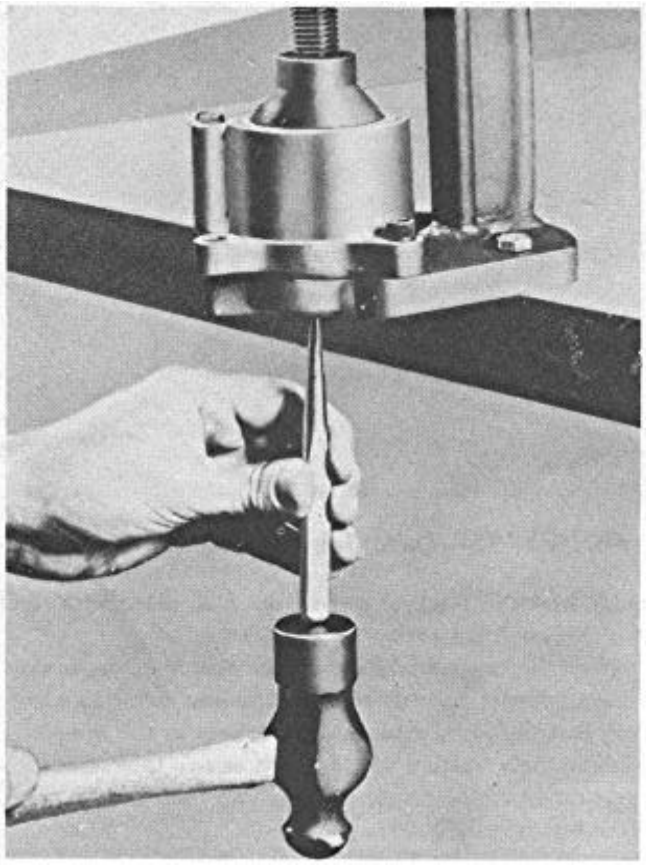


FIGURE 77—*Tap the Piston Shaft Upward*

Figure 78 shows the details of the low range brake assembly.

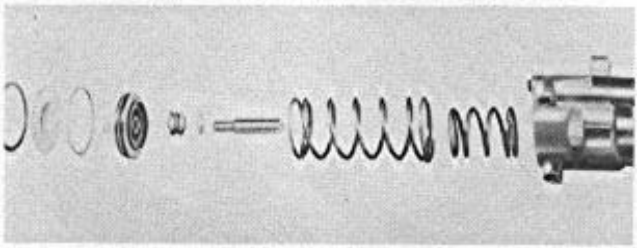


FIGURE 78—*Details of Low Range Brake*

ASSEMBLY OF LOW RANGE BRAKE

Place the piston ring in the housing bore and check the gap in the same manner as shown in Figure 72 for the reverse brake. The specified gap is .002".

Place the low range brake housing in the tool and secure it in place with the two special screws.

Install the two springs in the brake housing being sure they are level and properly located on their seats.

Place the ring compressor in the top of the brake housing. Place the brake piston on top of the springs.

Place the cupped adapter on top of the piston and turn down the adjusting screw making sure that the lower end enters the hole in the adapter. (Fig. 79).

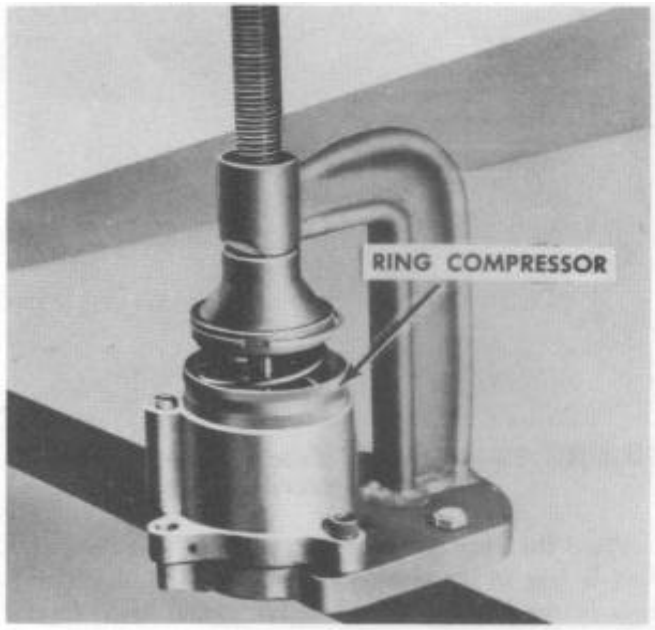


FIGURE 79—*Note Ring Compressor*

Slowly turn the adjusting screw to compress the springs and guide the piston and ring into the ring compressor while tightening the screw. Be very care- ful when tightening the screw to make sure that the lower end of the piston shaft enters freely into the small bore in the brake housing. Tighten the adjusting screw until the springs are compressed and the piston is at the bottom of the brake housing (Fig. 80).

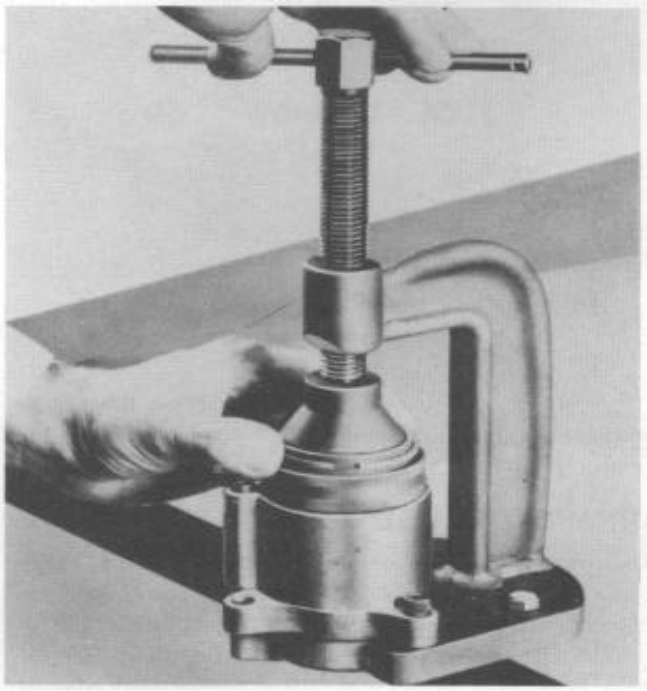


FIGURE 80—*Guide the Piston and Ring*

Install clamp on the piston shaft that now extends below the brake housing. Push the clamp upward as far as it will go and securely tighten the clamp screw (Fig. 81).

NOTE: *This is important as the clamp holds the piston down while releasing the tool to install the cover and retaining ring.*

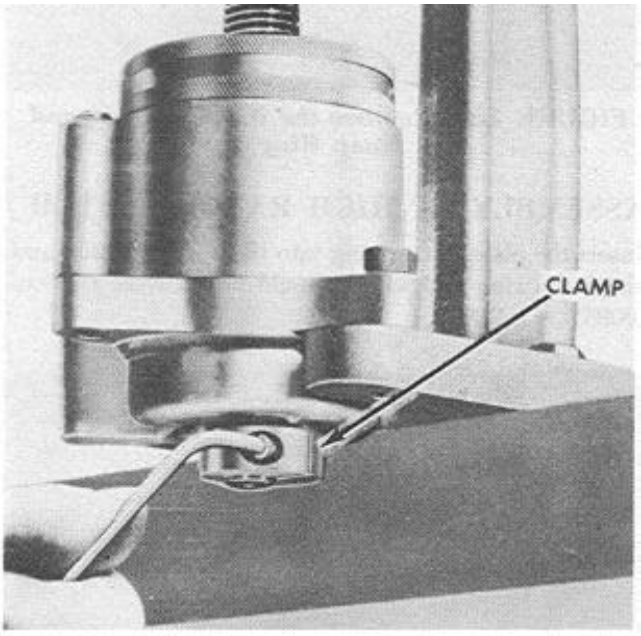


FIGURE 81—*Note Location of Clamp*

Back off the adjusting screw and remove the ring compressor.

Install the piston cover, place the cupped adapter on top of the cover and re-tighten the screw to hold the cover in place. Install the retaining ring (Fig. 82)

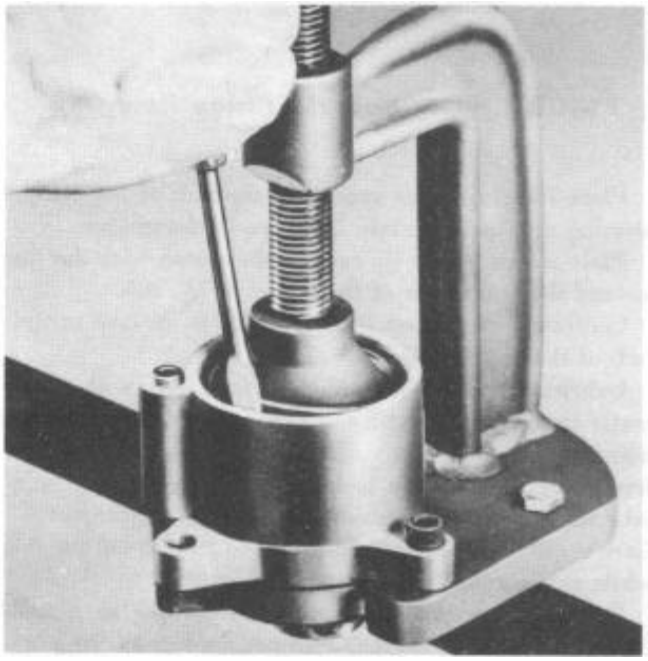


FIGURE 82—*Install the Cover Retaining Ring*

After making sure that the retaining ring is properly installed, loosen the screw in the clamp to release the piston and remove the brake assembly.

DISASSEMBLY OF HIGH RANGE CLUTCH

A 1-1/2" hole drilled in a bench will facilitate servicing the high range clutch. If a vise is used, lead jaws also should be used to prevent marring the input shaft.

Remove the planetary sun gear thrust washer.

Remove the pressure plate snap ring and then remove the plate and sun gear assembly (Fig. 83).

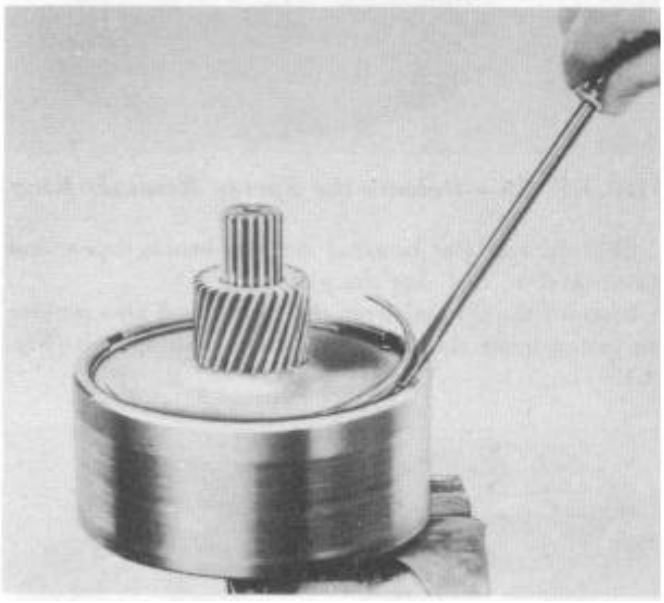


FIGURE 83—*Remove the Plate Retaining Ring*

Remove the input shaft together with the clutch hub. Invert the clutch housing to permit the plates to drop out.

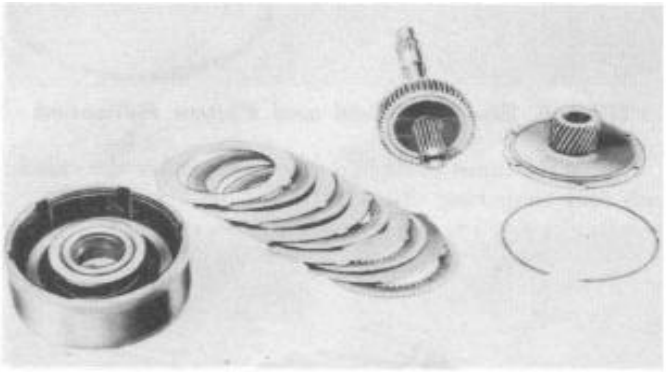


FIGURE 84—*High Range Clutch Details*

Compress the clutch spring with tool J-5943 Clutch Spring Compressor. Release the spring retainer snap ring using expanding snap ring pliers (Fig. 85).

Back the nut off the compressor screw stem and remove tool J-5943 snap ring, retainer and spring.

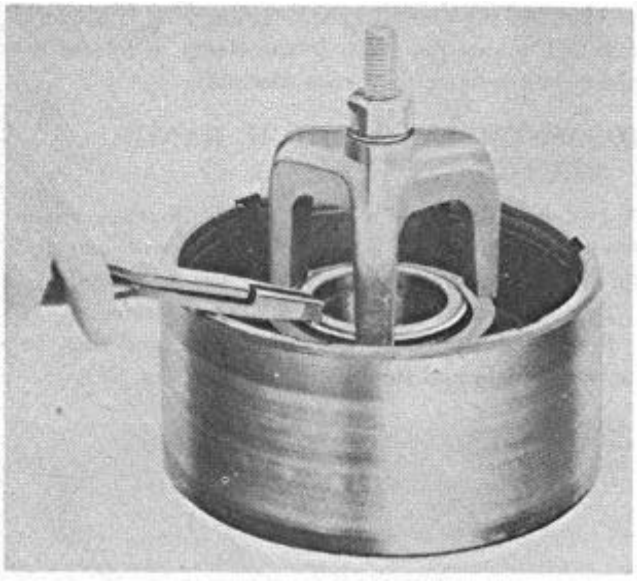


FIGURE 85—*Release the Spring Retainer Ring*

Sharply rap the housing on the bench, open end downward, to dislodge the piston.

Remove the lip seal from the piston and also remove the piston inner ring from the clutch housing hub (Fig. 86).

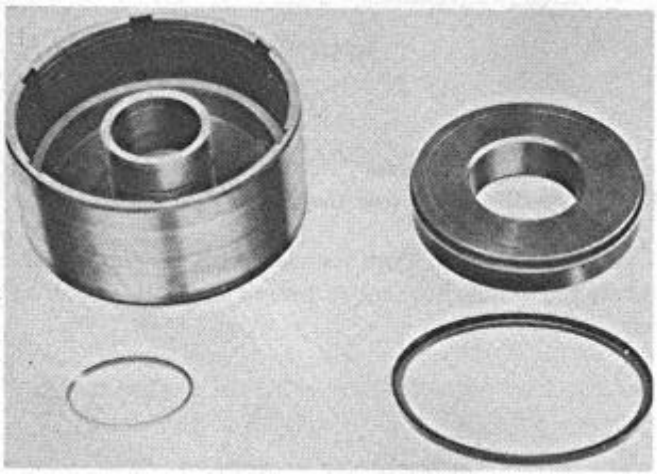


FIGURE 86—*Lip Seal and Piston Removed*

Clamp the input shaft in a vise and remove the clutch hub rear snap ring (Fig. 87) .

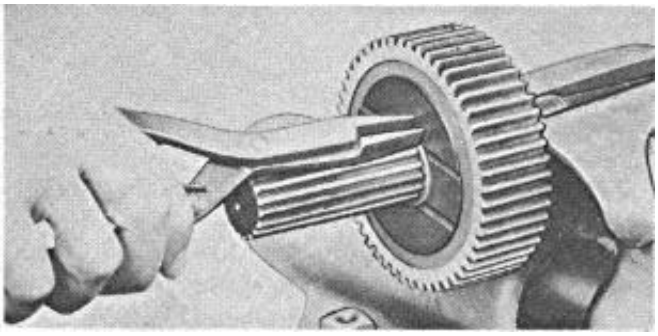


FIGURE 87—*Remove the Clutch Hub Snap Ring*

Remove the clutch hub thrust washer, hub, and front snap ring (Fig. 88).

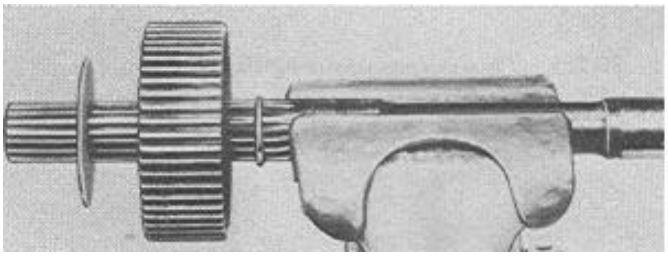


FIGURE 88—*Remove the Washer, Hub; and Snap Ring*

ASSEMBLY OF HIGH RANGE CLUTCH

Insert the piston inner ring into the bore of piston and check the ring gap which should be between .005" to .0085" (Fig. 89).

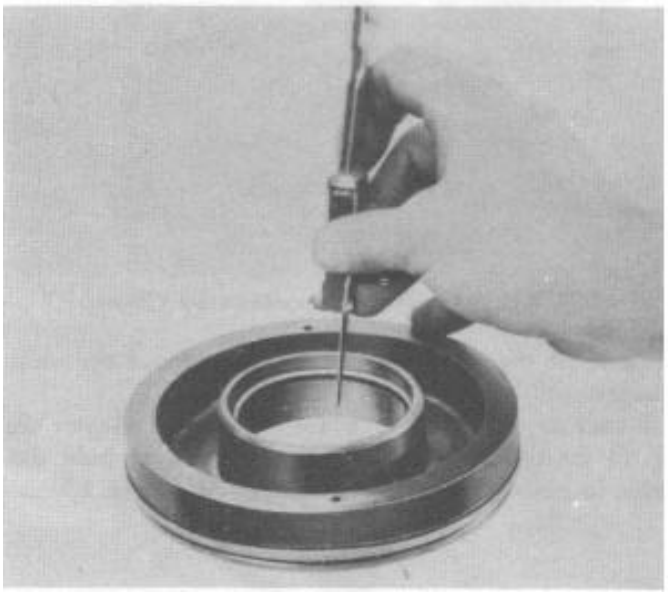


FIGURE 89—*Check 89—Check the Piston Ring Gap*

Place the ring in its groove in the hub of the clutch housing and make certain it is free in the groove.

Place a new piston lip seal on the piston with the lip toward the front face of the piston (Fig. 90).

Centralize the piston inner ring in its groove in the hub of the clutch housing.

Lubricate the lip seal and the piston bore with automatic transmission fluid and lower the piston into the housing. Push the piston downward to start it over the inner ring. Then use a feeler blade to start the lip seal into its bore while pushing downward on the piston. Care should be exercised so as not to tear or cut the lip while performing this operation (Fig. 91).

Using Clutch Spring Compressor J-5943 to install the piston return spring, retainer, and snap ring as shown in Figure 85.

FIGURE 90—*Install a New Piston Lip Seal*

FIGURE 91—*Place the Piston in the Housing*

Install the clutch hub front snap ring on the input shaft and then slide the hub on the shaft with the open end of the hub toward the snap ring (Fig. 92).

Slide the clutch hub thrust washer on the shaft against the hub and install the rear snap ring as shown in Figure 87.

Place the input shaft and hub in the clutch housing and then install the driven and drive plates. When installing the plates, first install a steel driven plate and then a waved, friction-faced drive plate and continue installing the plates in this manner (Fig. 93)

Install the sun gear and plate assembly and then lock the snap ring in place.

Install the planetary sun gear needle bearing thrust washer on the input shaft (Fig. 94).

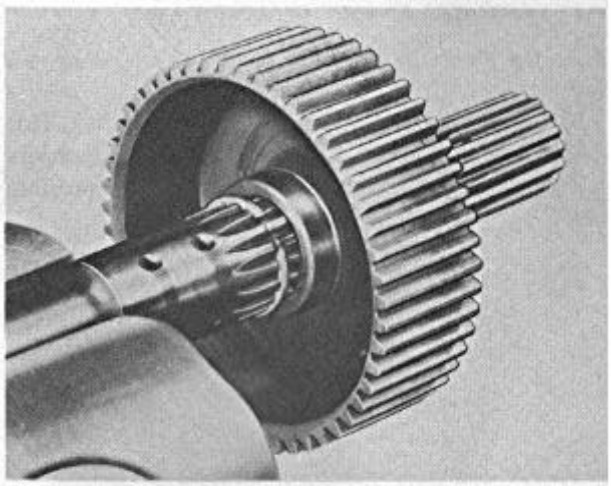


FIGURE 92—*Open End of Hub Is Toward Snap Ring*

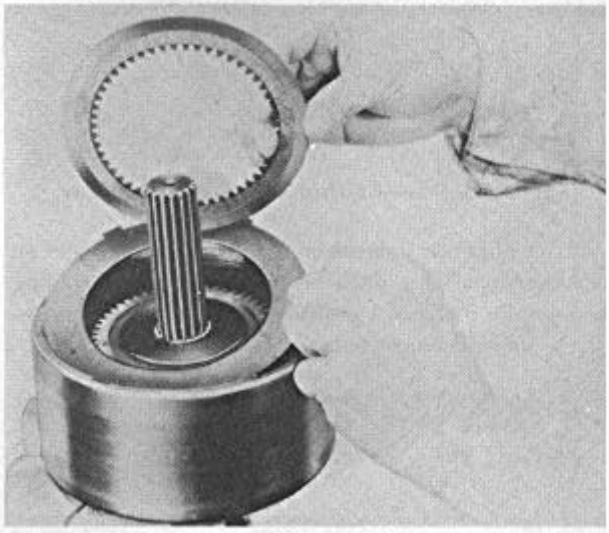


FIGURE 93—*Install the Clutch Plates*

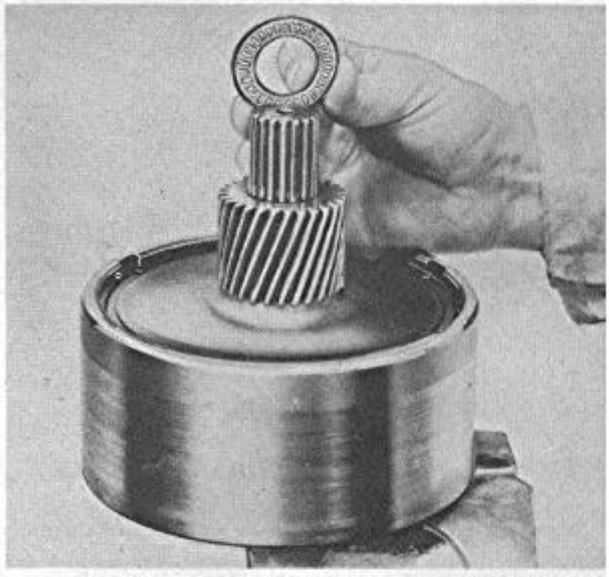


FIGURE 92—*Open End of Hub Is Toward Snap Ring*

DISASSEMBLY OF PLANETARY

Place the planetary assembly on the bench, shaft end upward.

Slowly lift off the planetary ring gear (Fig. 951. This should be done slowly so that the three cage dampers and six damper springs are not scattered and possibly lost.

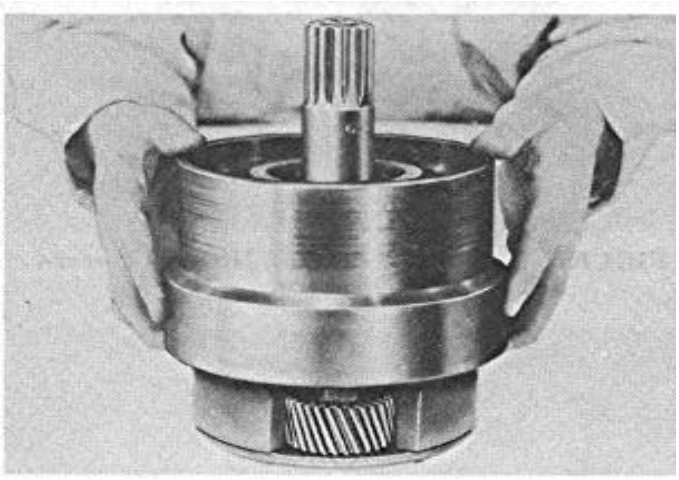


FIGURE 95—Lifting Off the Ring Gear

Scribe alignment marks on the planetary cage and on the oil scoop. This must be done to insure installing the scoop in its correct position on reassembly to maintain proper planetary balance (Fig. 961.

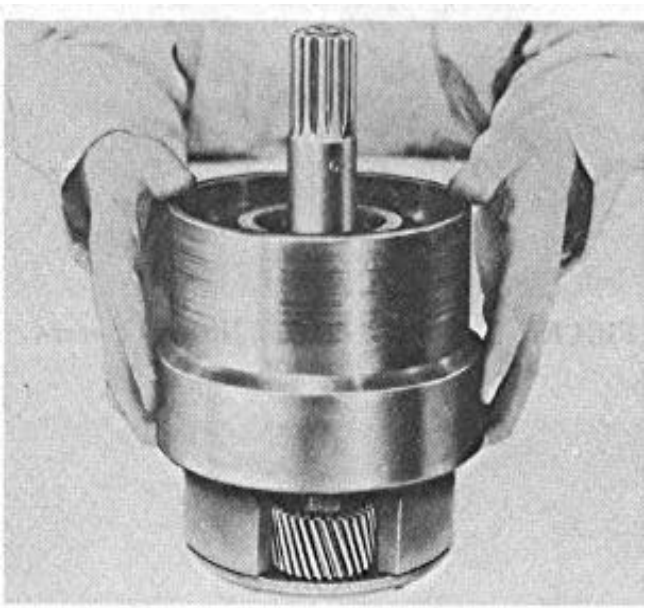


FIGURE 96—*Note the Alignment Marks*

Remove the planetary cage bolts and remove the end plate.

Use a dummy planetary pinion pin and butt one end of the pin against a pin which carries a short pinion.

Hold the thrust washers against the pinion and slide the pinion, bearings, and washers onto the dummy shaft (Fig. 97).

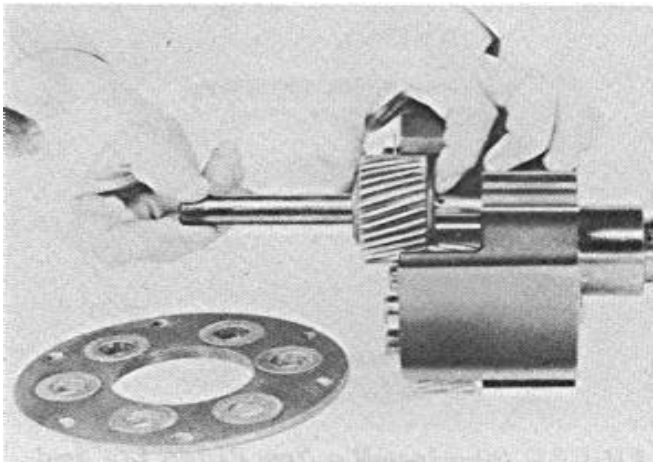


FIGURE 97—*Removing Pinion, Bearings, and Washers*

Slide the pinion, bearing, and washers off the dummy shaft into a clean container exercising care not to lose any of the rollers. Remove the other two pinions in the same manner.

Remove the planetary rear sun gear (Fig. 98).

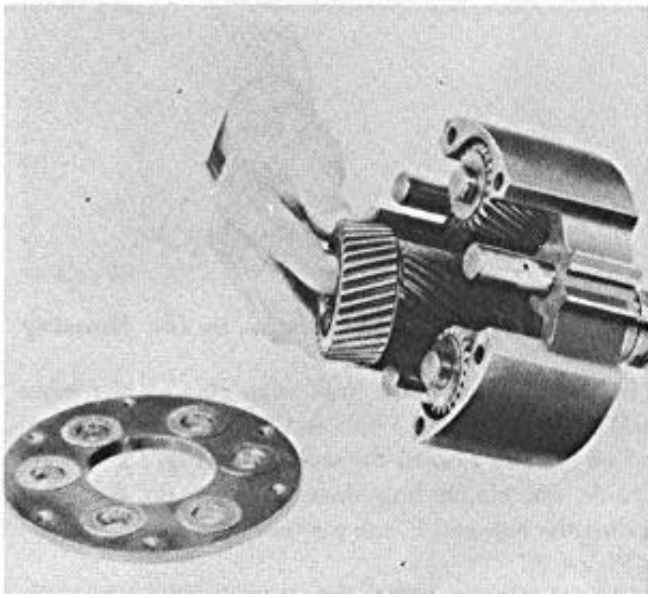


FIGURE 98—*Removing the Rear Sun Gear*

Lift out the rear sun gear thrust washer (Fig. 99.

Remove the planetary long pinions following the procedure outlined for removing short pinions.

Using a pointed instrument, unhook the interlocking ends of the oil rings and slide the rings off the shaft (Fig. 100).

NOTE: ***It is seldom necessary to remove the pinion shafts from the cage; however, they can be removed by tapping the shafts and Woodruff Keys out toward the splined shaft.***

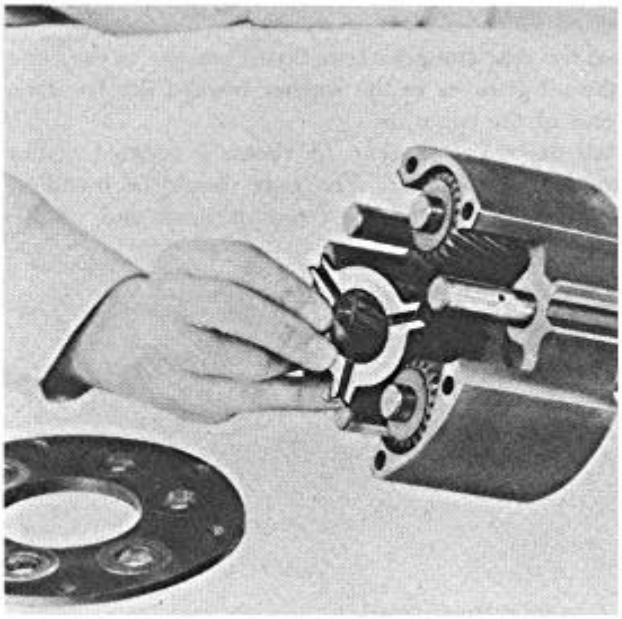
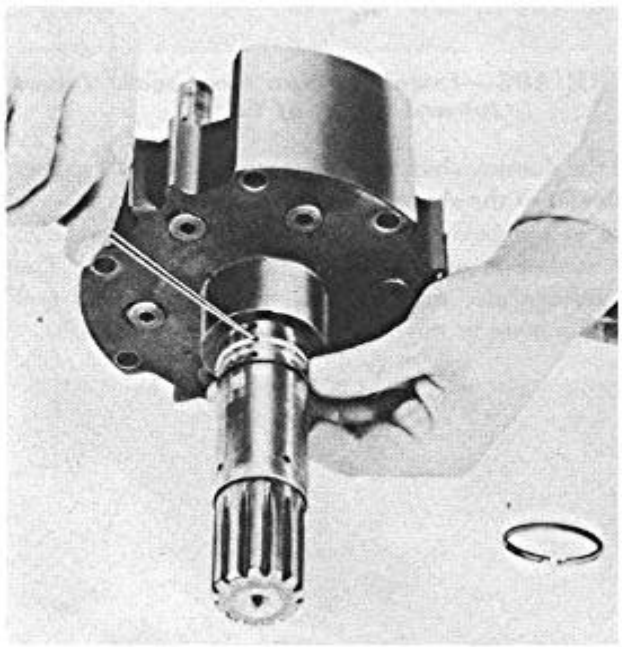


FIGURE 99—*Remove the Rear Sun Gear Thrust Washer*



IGURE 100—*Remove the Oil Rings*

ASSEMBLY OF PLANETARY

Slide the planetary cage shaft oil rings on the shaft and into the ring grooves. To lock the ends of the rings, push one end down into the groove and push upward on the opposite side of the ring to raise the other end while pushing inward toward the shaft (Fig. 101).

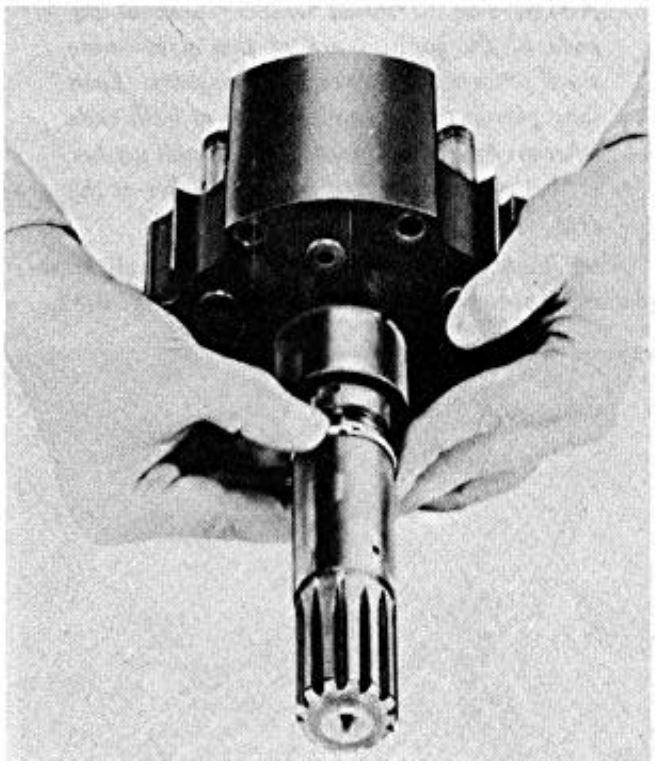


FIGURE 101—*Install the Oil Rings*

Assemble the planetary pinions and bearing rollers and install on their shafts in the cage.

NOTE: ***In each pinion 38 bearing rollers are used. The pinions have 19 rollers at each end separated by a spacer. A dummy pinion shaft should be used to facilitate assembly of the rollers in the pinions.***

Insert the dummy pinion shaft and spacer into the long pinion and then insert 19 rollers (Fig. 102).

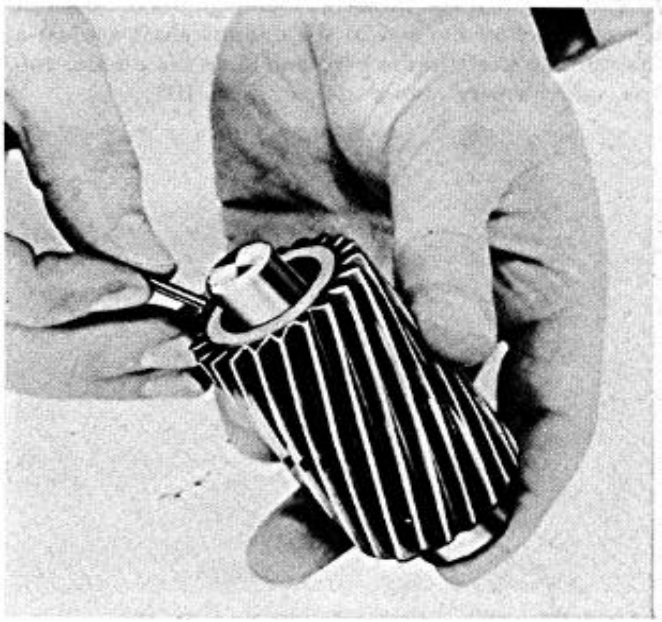


FIGURE 102—*Insert the Pinion Rollers*

NOTE: *The 12 thrust washers used at the ends of the pinions are of two sizes—nine small washers and three large washers. Each long pinion uses a small washer at both ends whereas each short pinion uses a small washer at the forward end and a large washer at the rear or cage end.*

After inserting the rollers, install a small washer placing it over the dummy pinion shaft (Fig. 103).

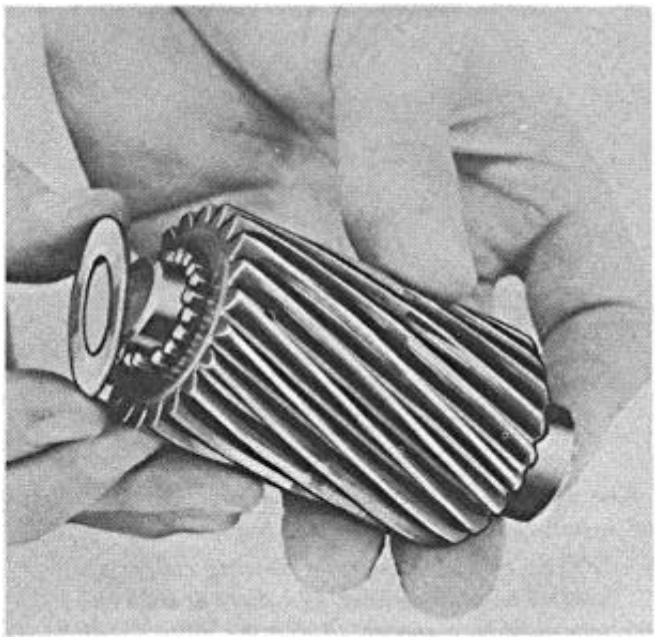


FIGURE 103—*Installing Small Washer on Dummy Pinion Shaft*

Working from the opposite end of the pinion, insert 19 rollers. Add another small washer at this end.

While holding the thrust washers against the ends of the pinion, butt the end of the dummy shaft against a long pinion shaft in the cage and slide the pinion, rollers, and washers onto the shaft (Fig. 104).

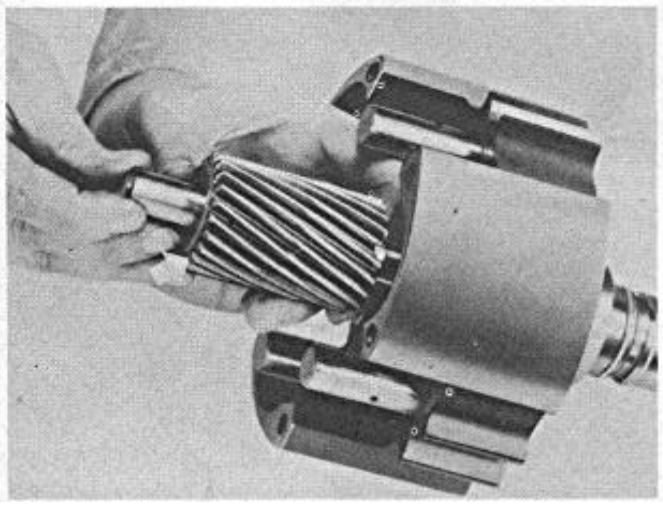


FIGURE 104—*Slide the Pinion, Rollers, and Washers onto the Shaft*

NOTE: *The beveled end of the pinion, indicated by the arrow, should be toward the plate or cover end of the cage as shown. Assemble the two remaining long pinions in the same manner as described in the foregoing paragraphs.*

Place the rear sun gear rear thrust washer in the cage with the oil grooves in the washer toward the front or open end of the cage.

Install the rear sun gear. A recess is located at the forward end of the gear. The gear should be installed with this recess toward the front or open end of the cage (Fig. 105) .

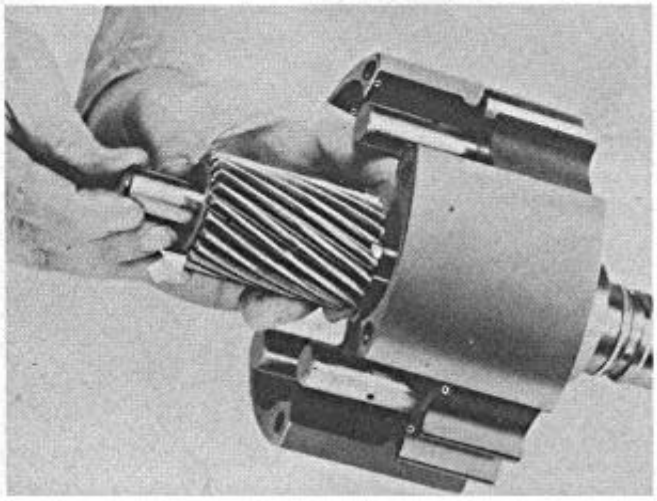


FIGURE 105—*Installing Sun Gear with Recess toward Front of Cage*

Use the dummy shaft and spacer and insert 19 rollers in each end of the short pinions. A small thrust washer is used at the beveled end of the pinion and a large thrust washer is used opposite the beveled end. The short pinions also are installed with the beveled end toward the plate or cover end of the cage (Fig. 106)..

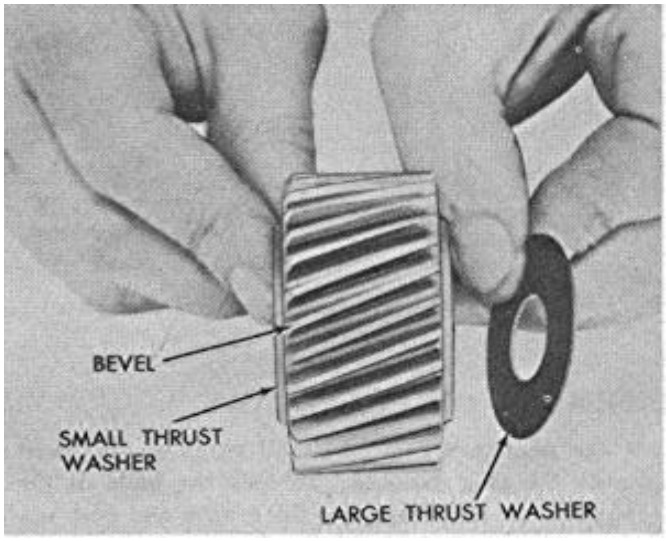


FIGURE 106—*Note Location of Washers*

Line up the alignment marks on the cage and end plate and install the end plate on the pinion shafts (Fig. 107).

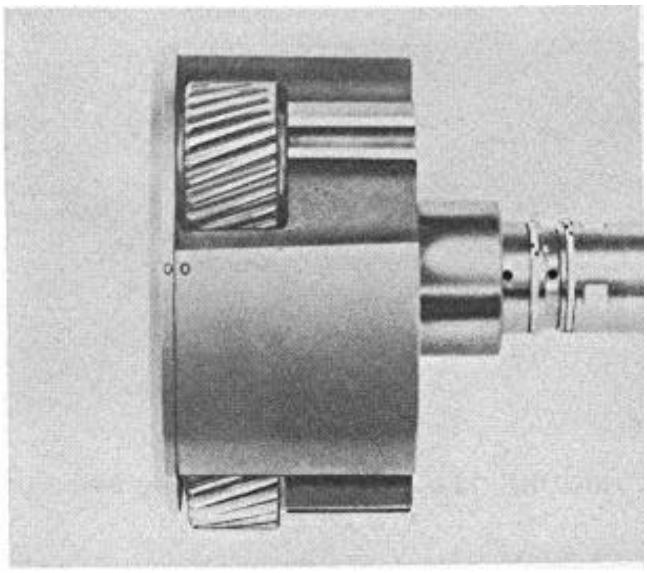


FIGURE 107—*Note the Alignment Marks*

Position the oil scoop on the cage so that the previously scribed marks on the scoop and the cage are in alignment. Install and torque tighten the %retaining bolts to 15 to 18 ft. lbs.

Start the planetary cage into the ring gear. The planetary cage damper groove has a lip on one side as indicated by the arrow in Figure 108.

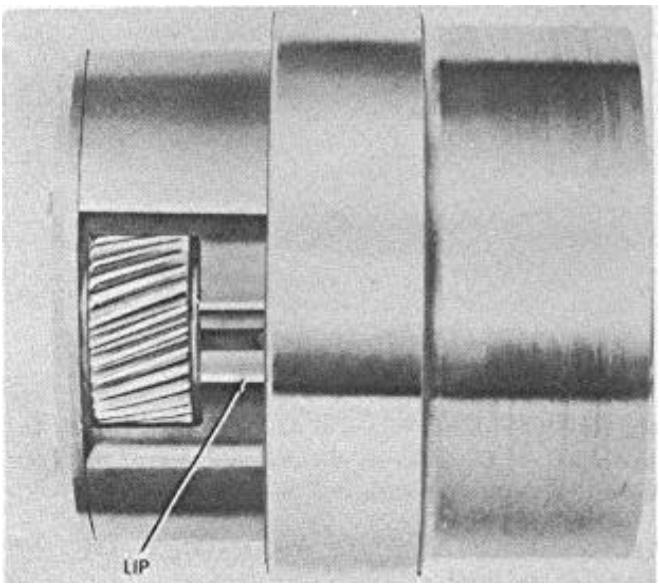


FIGURE 108—*Note the Lip Side of the Groove*

Place two damper springs into the lip side of the groove (Fig. 109).

Tilt the planetary cage and slide a damper into the groove and on top of the springs (Fig. 110)

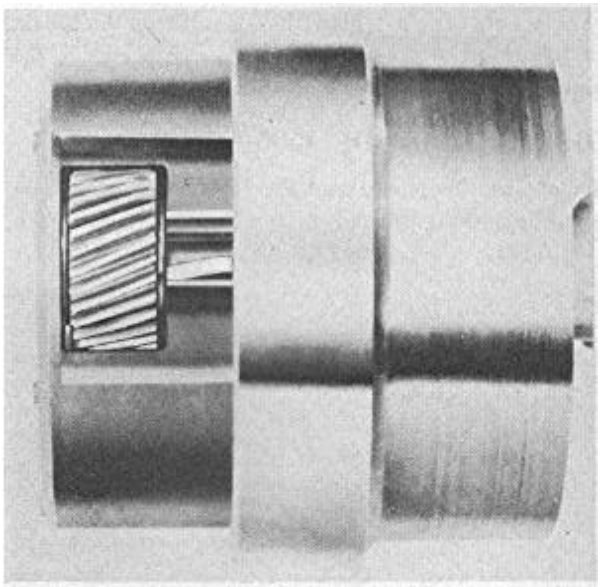


FIGURE 109—*Install Two Damper Springs*

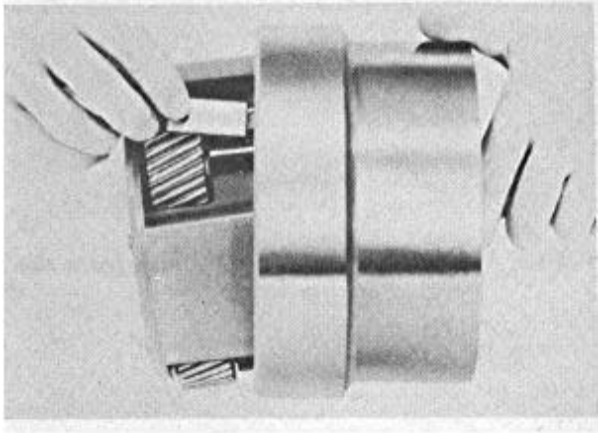


FIGURE 110—*Tilt the Cage and Install a Damper*

Figure 111 illustrates the springs and damper in position. The remaining springs and dampers are installed in the same manner. After all springs and dampers are

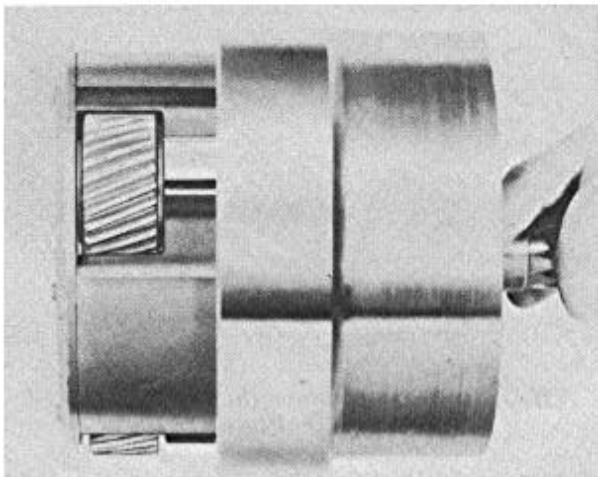


FIGURE 111—*Springs and Damper in Position*

dampers are installed, place the assembly on the bench, shaft upward and rotate the ring gear to engage the pinions and seat the ring gear.

DISASSEMBLY OF GOVERNOR

Remove the low speed and the high speed governors from the parking gear assembly using an Allen wrench (Fig. 112) .

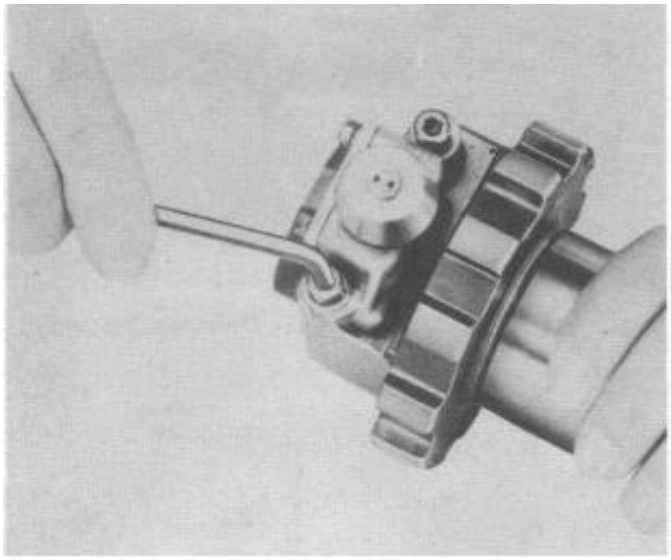


FIGURE 112—*Remove the Governors from the Parking Gear*

Remove the high speed governor plate I Fig. 113).

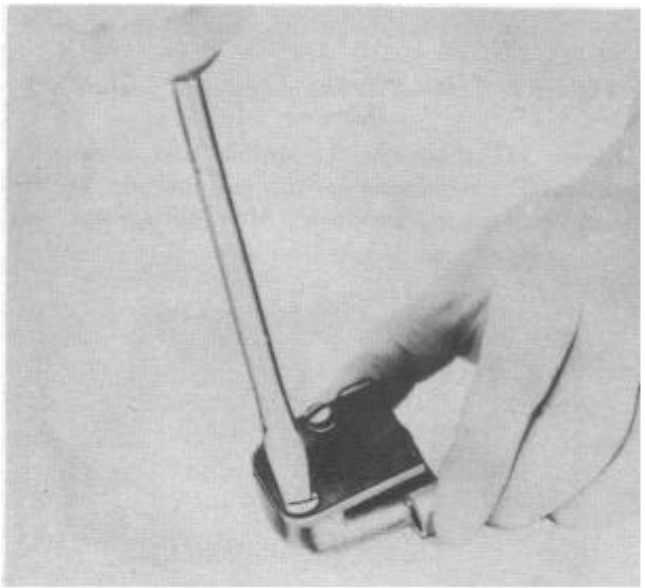


FIGURE 113—*Remove the High Speed Governor Plate*

Press inward and tilt the spring seat to release it and
remove the seat, spring, and valve (Figs. 114 & 115).

The low speed governor is serviced as a unit

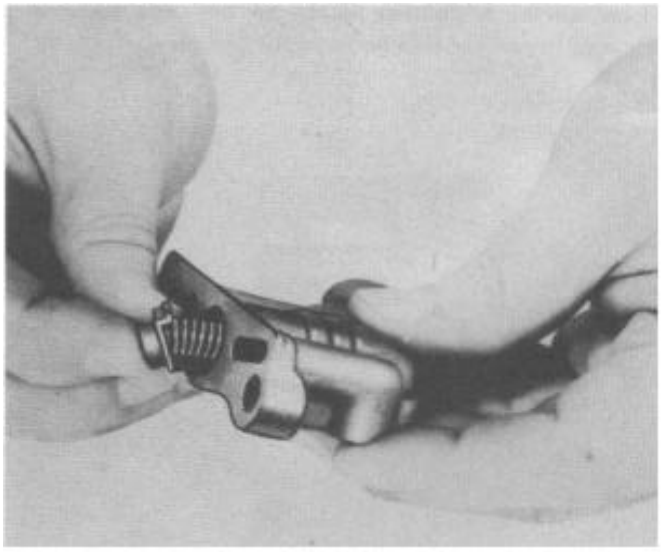


FIGURE 114—*Remove the Spring Seat and Spring*

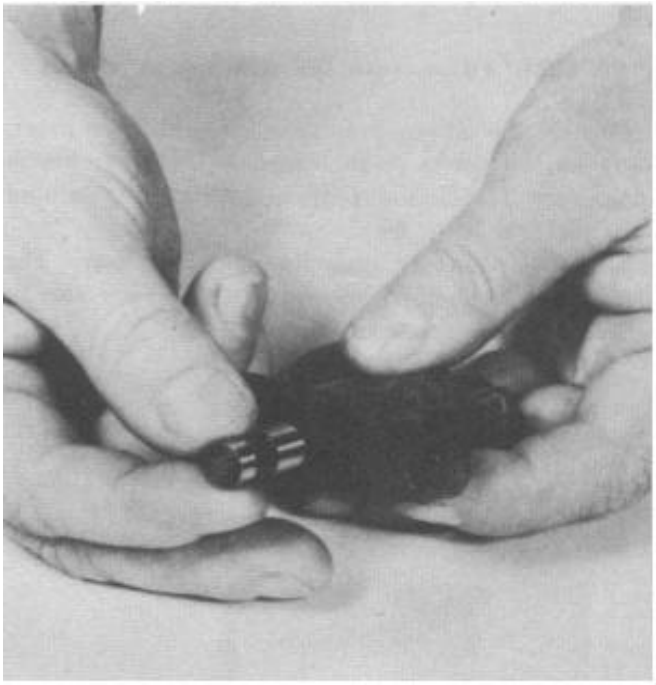


FIGURE 115—*Remove the High Speed Governor Valve*

and should not be disassembled if the valve works freely in the body. If the valve is sticking because of dirt, remove the plate and wash out the passages.

DISASSEMBLY AND ASSEMBLY OF OIL PUMP

Remove the rear oil pump cover plate and rotors (Fig. 116).

Remove the front oil pump cover plate, rotors, and inner rotor spacer ring (Fig. 117).

Place the rear oil pump rotors in the rear pump body and check the rotor tooth clearance, which should not exceed .008".

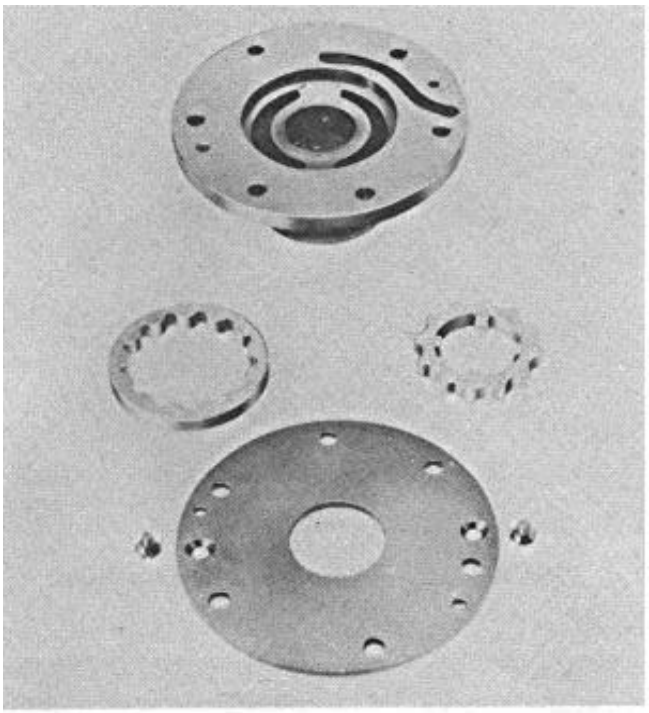
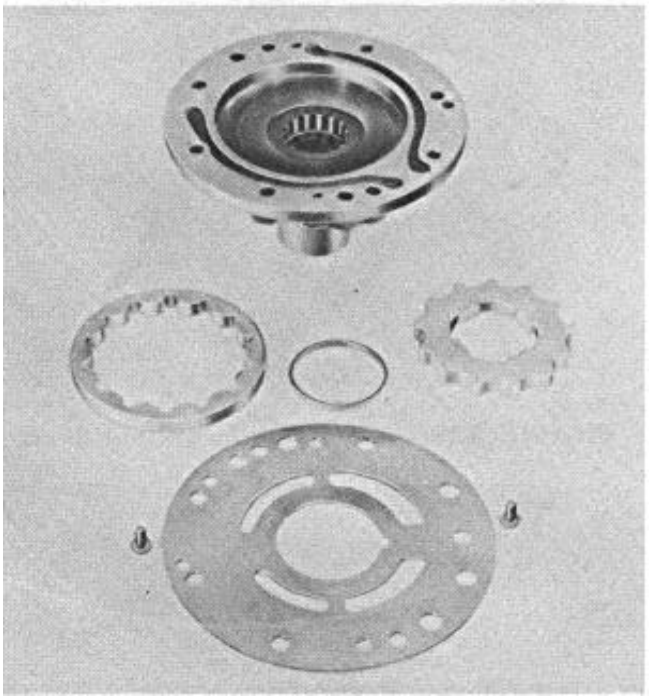


FIGURE 116—*Rear Oil Pump*



IGURE 117—*Front Oil Pump*

NOTE: *One side of the inner rotor has an undercut and this side should be installed toward the front or hub end of the pump body.*

Check the side clearance between the outer rotor and the pump body bore. The clearance should not exceed .011" (Fig. 119).

Check the rotor end clearance using a straight edge. The clearance should not exceed .006" (Fig. 120).

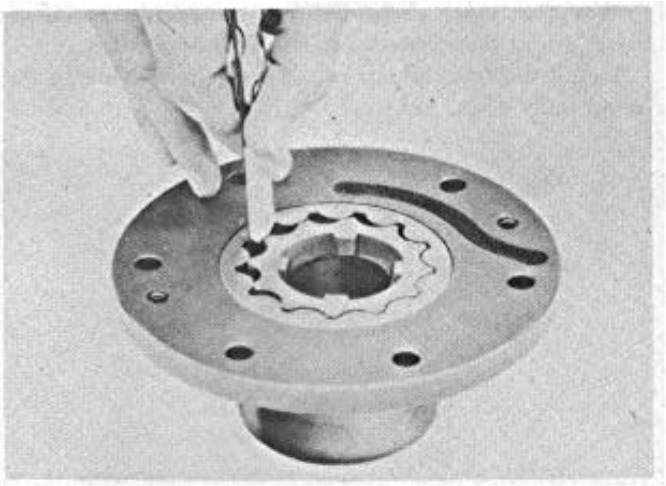


FIGURE 118—Checking Rotor Tooth Clearance

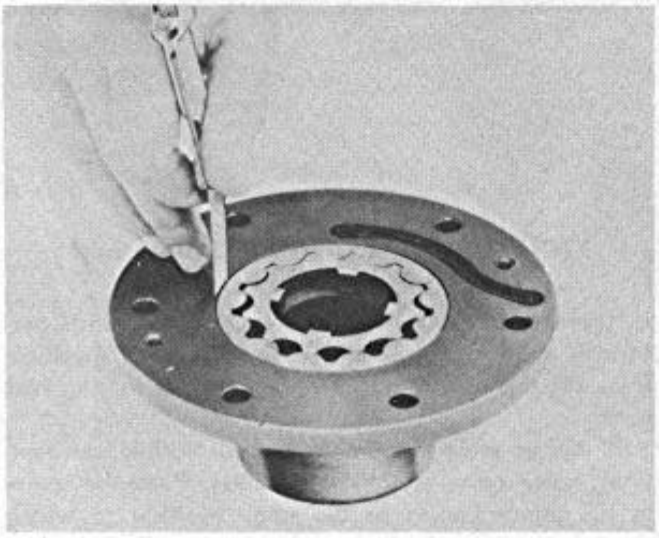


FIGURE 119—Check the Rotor Side Clearance

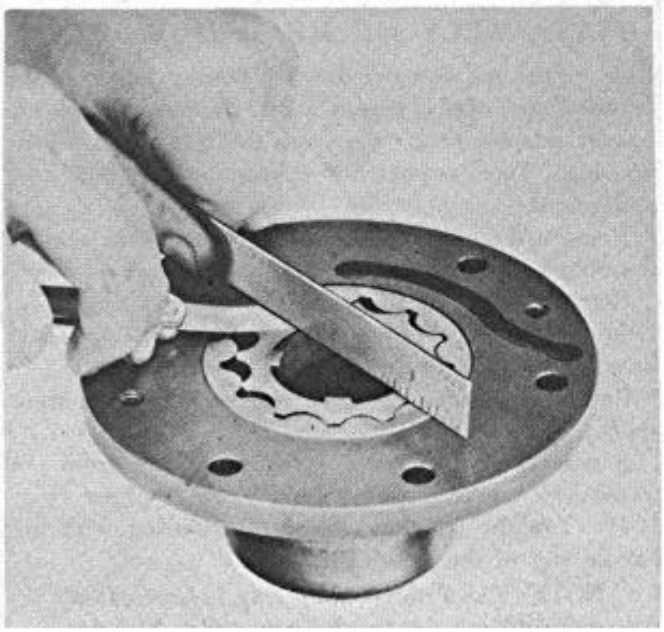


FIGURE 120—Checking Rotor End Clearance

If one or more clearances are not within specifications, a new pump assembly should be installed.

Install the front pump rotors and spacer ring in the pump body (Fig. 121).

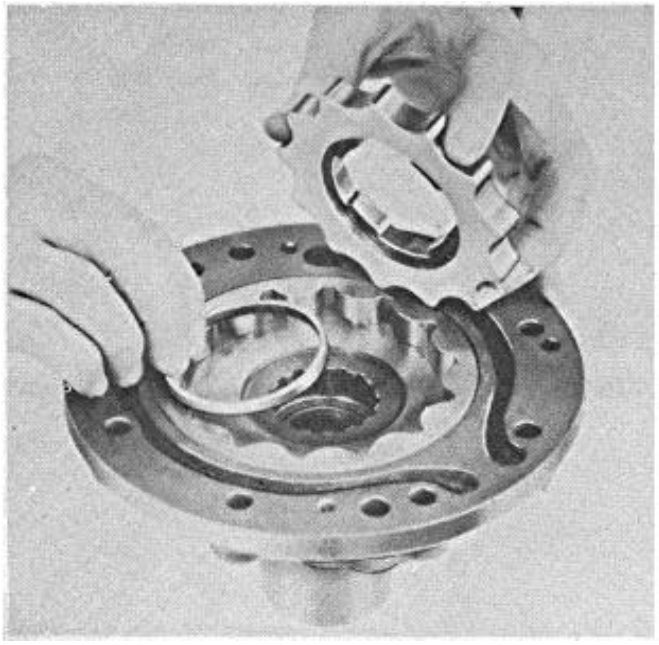


FIGURE 121—*Install the Rotors and Spacer Ring*

Repeat the rotor clearance checks that were performed on the rear pump. Rotor clearance specifications for the front pump are the same as for the rear pump.

If one or more clearances are not within specifications, a new pump should be installed. Place the rotors in the pump bodies in the same position in which clearances were checked and then install the cover plates.

DISASSEMBLY OF REAR HOUSING

Remove the speedometer driving gear spring from the forward end of the output shaft.

Remove the speedometer adapter snap ring from the transmission rear housing. Then remove the speedometer pinion gear and adapter assembly.

Remove the output shaft snap ring from the rear of the output shaft (Fig. 122).

Remove the shaft from the rear ball bearing (Fig. 123) by tapping the end of the shaft with a plastic hammer.

Remove the speedometer drive gear from the output shaft.

Remove the rear ball bearing snap ring from the transmission rear housing using Tru-Arc pliers (Fig. 124). Tap the bearing out of the housing with the handle end of the plastic hammer.

NOTE: *The Tru-Arc snap ring is beveled on one side and flat on the other side. The flat side goes against the bearing outer race.*

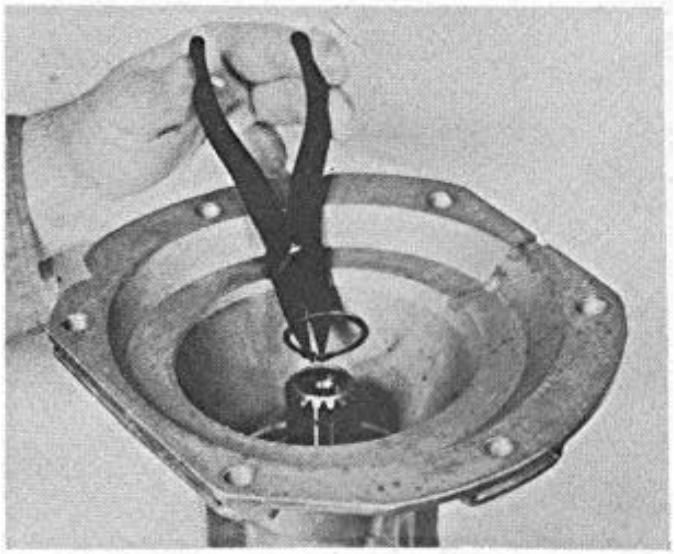


FIGURE 122—*Removing Output Shaft Snap Ring*

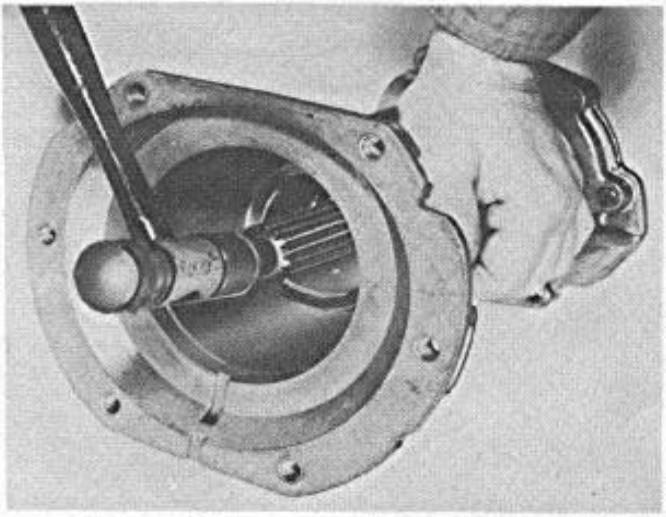


FIGURE 123—*Removing the Output Shaft*

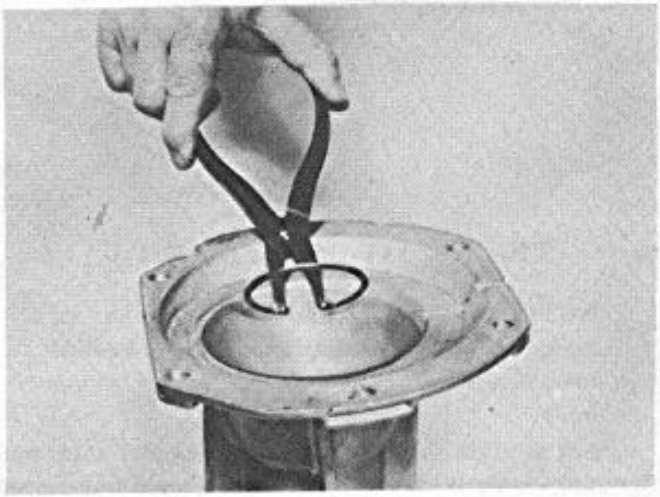


FIGURE 124—*Removing Rear Ball Bearing Snap Ring*

Remove the transmission rear housing spider front bushing retainer by tapping the retainer with the handle end of the plastic hammer (Fig. 1251.

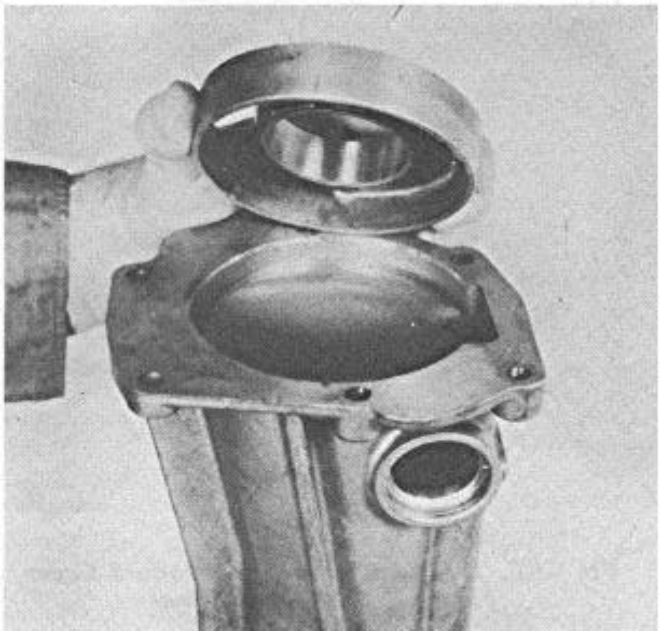


FIGURE 125—*Rear Transmission Housing Front Bushing Retainer Removed*

Slide the speedometer drive gear off the splines of the output shaft and remove the snap ring.

ASSEMBLY OF REAR HOUSING

Install the rear ball bearing and Tru-Arc snap ring. Install the speedometer drive gear snap ring on the output shaft.

With a plastic hammer tap the output shaft in the ball bearing through the front end of the housing. Then install the rear bearing snap ring on the output shaft.

Install the rear housing oil seal using oil seal installer J-1354.

Tap the front spider bushing retainer assembly in the front end of the housing. The transmission rear housing spider retainer has the word "top" cast on the retainer; this end faces toward the front of the transmission and to the top of the case. Install the speedometer drive gear and spring on the front end of the output shaft.

Install the speedometer pinion and adapter lining up the notch in the adapter with the index pin in the housing. Then install the speedometer adapter retaining ring with the ring gap toward the top of the housing.

ASSEMBLY OF TRANSMISSION

Install the breather in the side of the case with the breather cap toward the top of the case.

Place new "0" rings on the brake band anchor pins and slide the pins into the case from the inside and then start the adjusting screws into the case.

Install the throttle valve inner lever and add the retaining ring and washer. Slide the oil seal over the outer end of the shaft with the lip of the seal toward the case. Using a 1/2" socket, tap the seal into the case until it bottoms (Fig. 127). Install the outer lever, but do not tighten the clamping bolt nut.

Install the parking lock lever with the end of the spring hooked over the operating lever stop pin and tap the lever support into the case (Fig. 128). Install the lever support retaining ring.

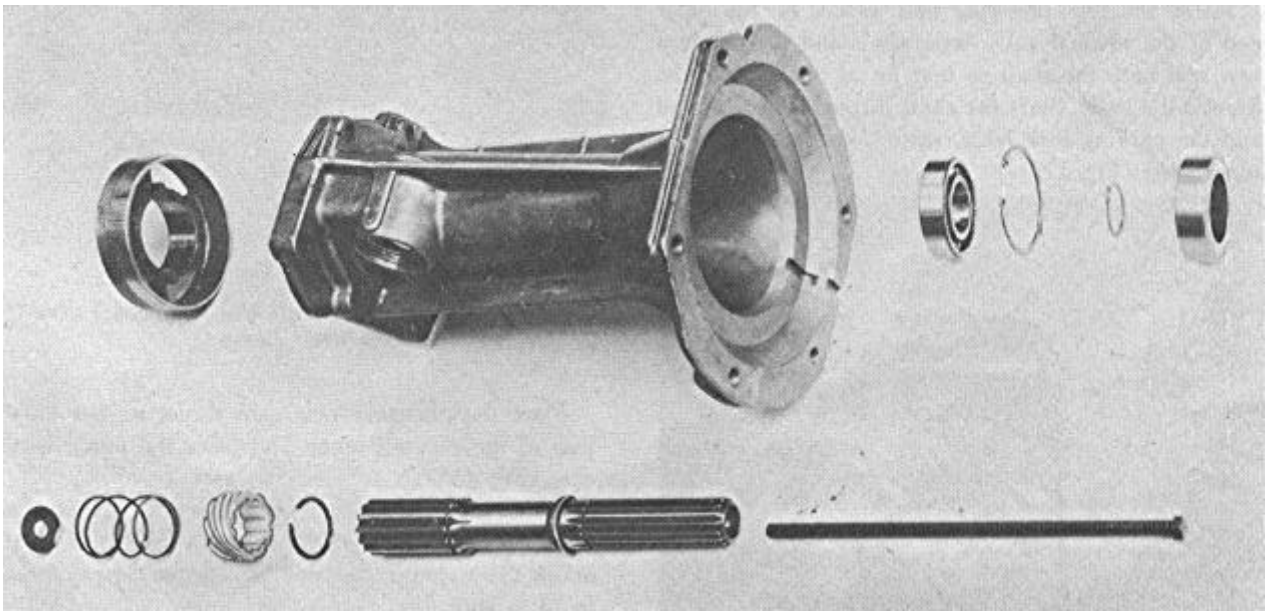


FIGURE 126—*Exploded View of Transmission Rear Housing Assembly*

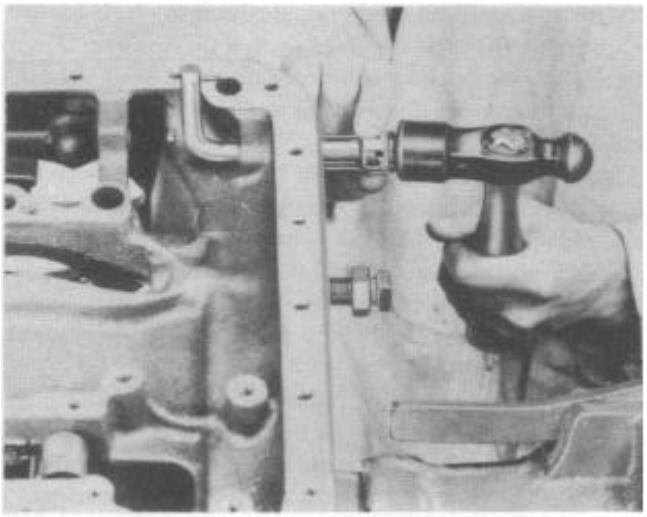


FIGURE 127—*Installing Throttle Lever Oil Seal*

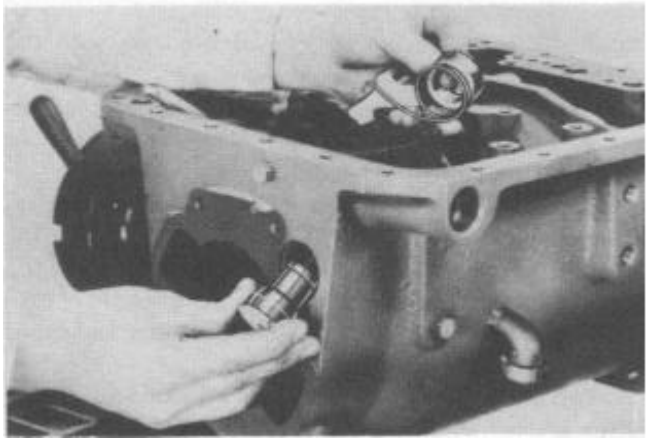


FIGURE 128—*Install the Parking Lever Support*

Install the retaining ring and washer on the outer end of the manual valve lever shaft and then slide a new seal onto the shaft so that lip of the seal will be toward the case. Start the shaft through the case and add the parking lock lever, spring, and manual valve inner lever (Fig. 129).

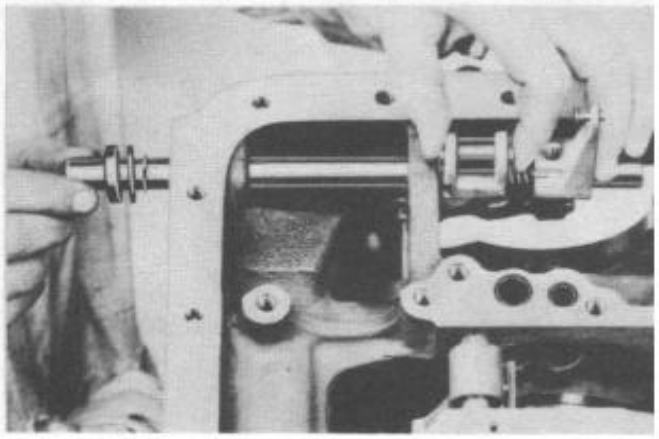


FIGURE 129—*Install the Parking Lever*

Tap the operating lever index pin into the shaft and then line up the set screw hole in manual valve lever with the hole in the shaft and install the set screw, stop plate, and lock nut. Using a 11/16" deep socket, bottom the oil seal in the case (Fig. 130).

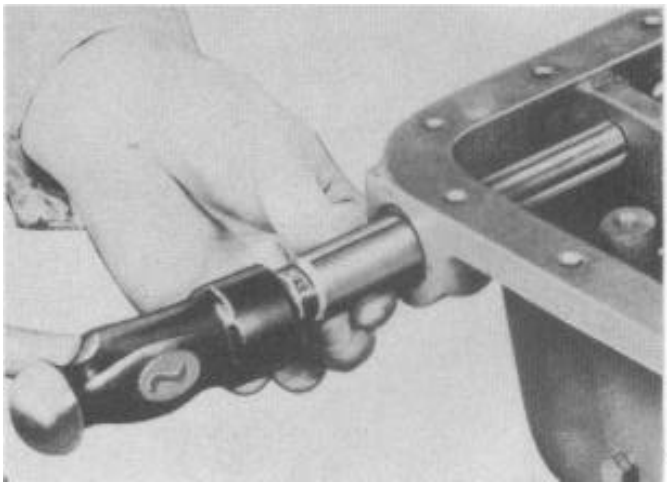


FIGURE 130—*Installing the Manual Lever Operating Shaft Oil Seal*

Attach the manual valve outer lever to the shaft so that the offset in the lever is away from the case (Fig. 131).

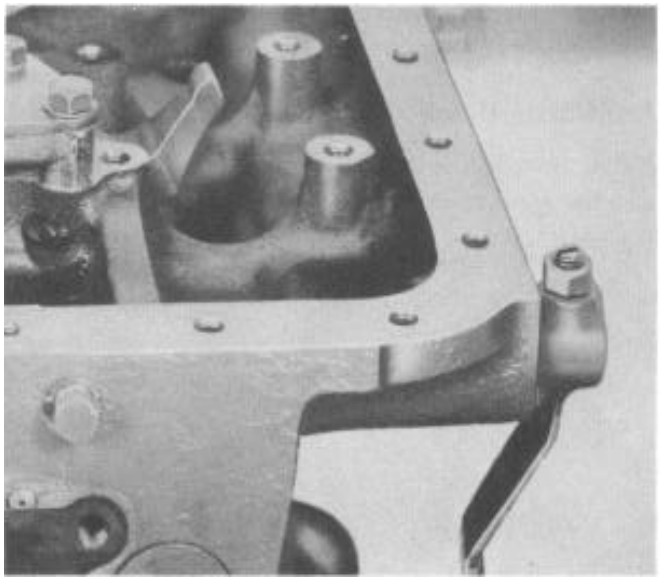


FIGURE 131—*Install the Manual Valve Outer Lever*

Place the planetary ring gear thrust washer on the hub of the rear oil pump and place the pump in the case (Fig. 132).

Install the rear pump retaining screws and washers with the long screw at the location indicated by the arrow illustrated in Figure 133. Torque the cap screws to 15 to 18 ft. lbs.

Install new "0" rings on the rear oil pump governor and discharge jumper oil tubes, lubricate the rings with automatic transmission

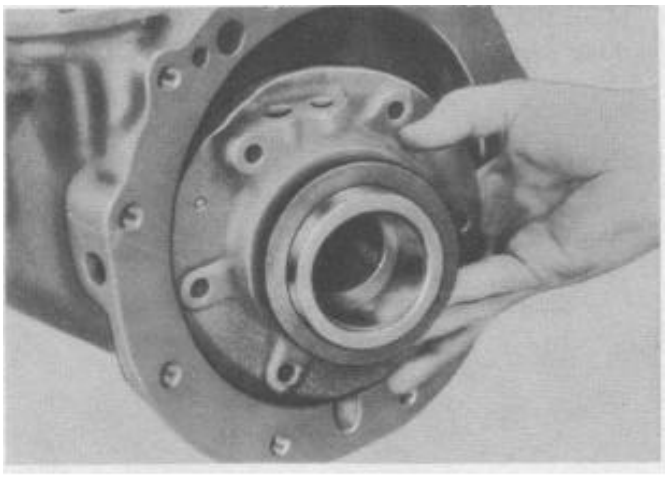


FIGURE 132—*Installing the Rear Oil Pump*

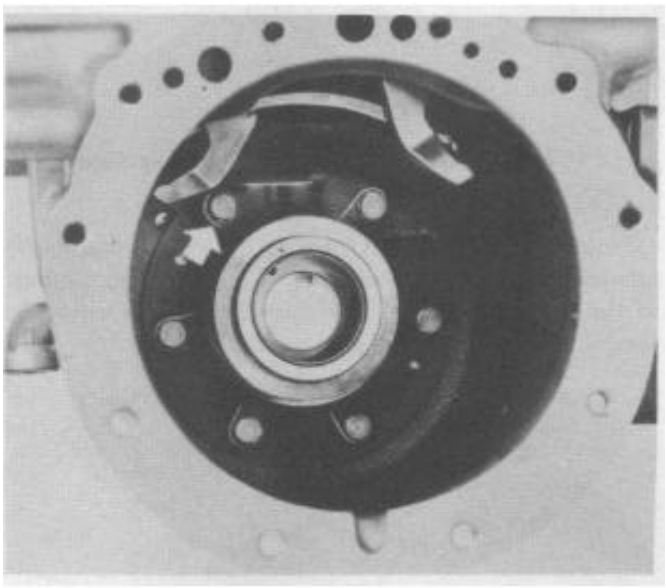


FIGURE 133—*Note the Location of the Long Screw*

fluid and press the tubes into the pump and case.

Place the reverse brake band in the case placing the band strut with the notch in it on the same side as the band operating lever (Fig. 134).

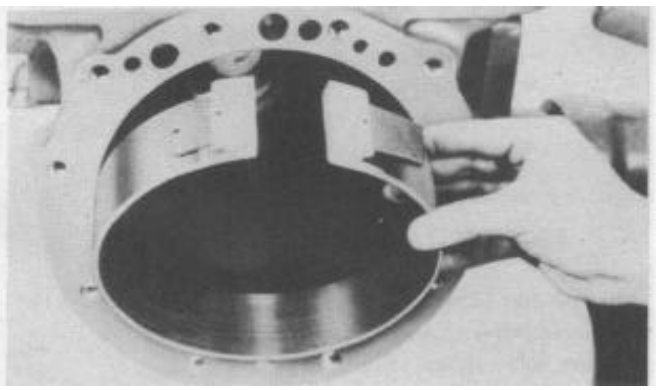


FIGURE 134—*Installing the Reverse Brake Band*

Engage the band struts in the operating lever and in the anchor pin and tighten the adjusting screw enough to hold the band in place.

Using a dummy input shaft, install the planetary assembly. Exercise care to avoid breaking the planetary shaft sealing rings when they enter the bore in the rear pump (Fig. 135).

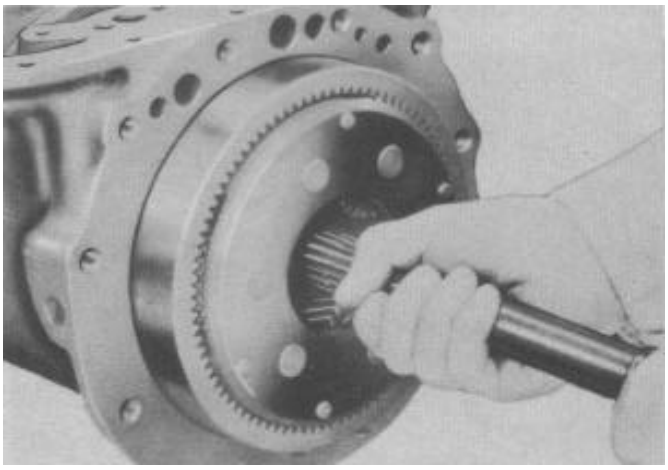


FIGURE 135—*Installing the Planetary Assembly*

Place the low range brake band in the case with the band strut with the notch in it on the same side as the band operating lever.

Engage the band struts in the operating lever and in the anchor pin. Tighten the adjusting screw enough to hold the band in place.

Install the high range clutch assembly (Fig. 136).

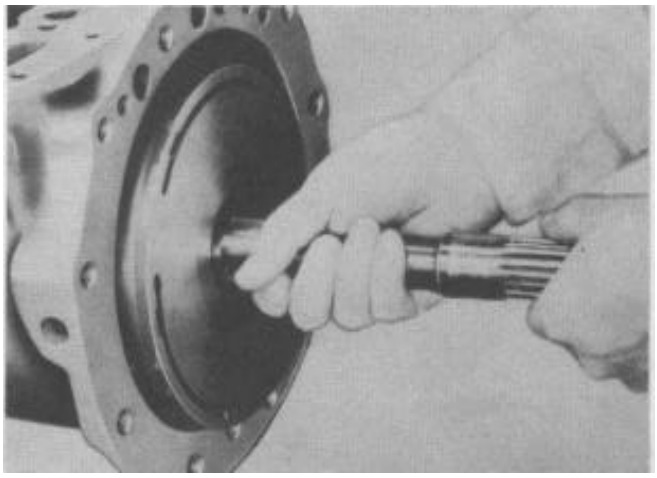


FIGURE 136—*Installing the High Range Clutch*

Assemble the front oil pump to the bell housing torque tightening the retaining screws and washers to 15 to 18 ft. lbs.

Place the high range clutch thrust washer on the huh of the pump with the ball indentations in the washer against the rear face of the pump.

Lightly apply lubriplate in three or four places around the transmission side of the bell housing to case gasket. Line up the cap screw holes in the gasket with those in the case and attach the gasket to the case.

Assemble the bell housing and front pump assembly to the case and torque tighten the screws 55 to 60 ft. lbs.

One self-locking screw is used along with eight plain screws and lockwashers. The arrow in Figure 137 shows the location of the self-locking screw.

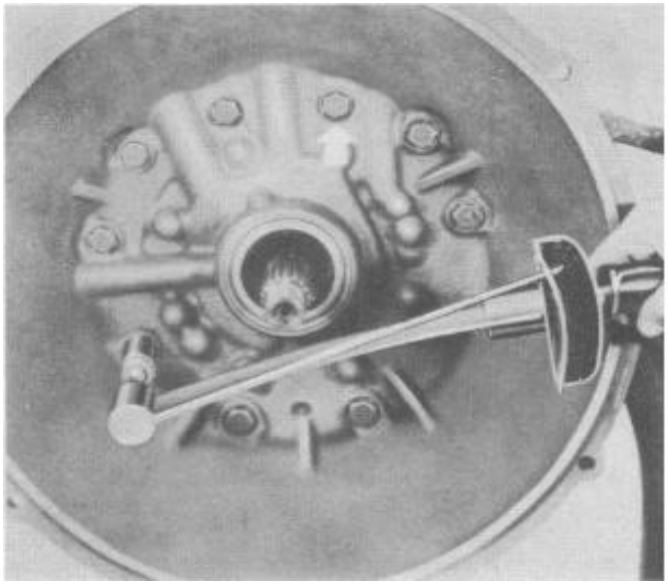


FIGURE 137—*Location of Self-Locking Screw*

Figure 138 illustrates the snap ring that was not removed from inside of the hub of the parking gear on disassembly. If a new parking gear is to be installed. transfer the snap ring from the original gear to the new one.

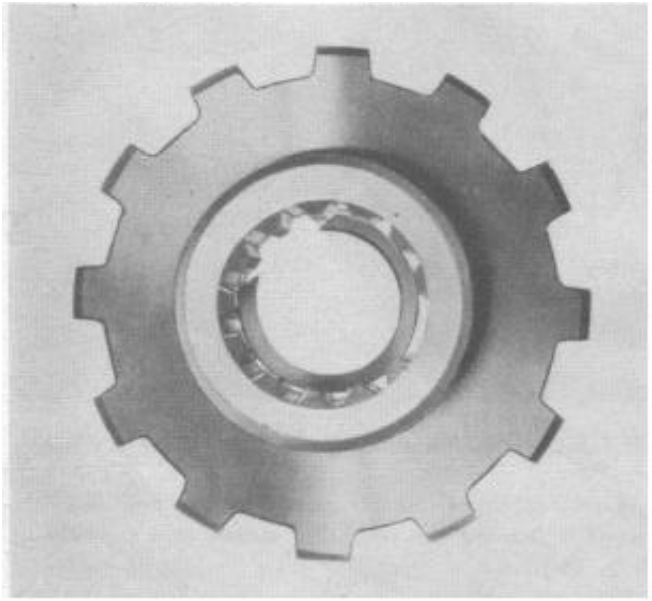


FIGURE 138—*Note the Snap Ring Inside the Gear,*

Insert the parking gear lug ring into the hub of the parking gear (Fig. 139).

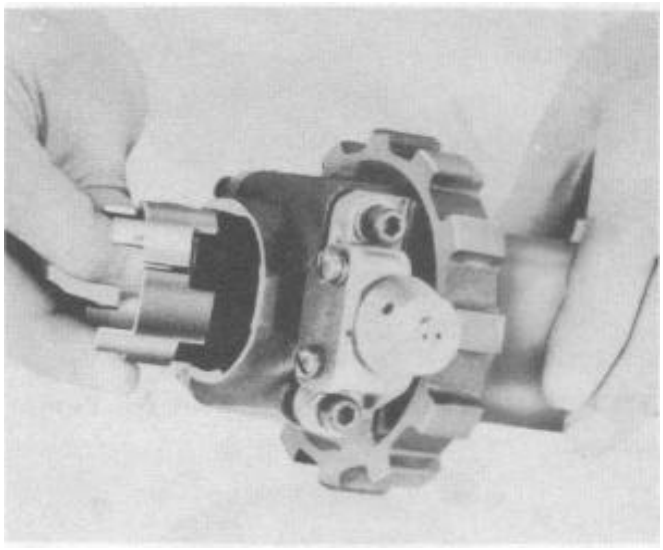


FIGURE 139—*Insert the Parking Gear Lug Ring*

Note the index pin (arrow) in the end of the planetary cage shaft and the absence of one tooth in the hub of the parking gear. These must be in line when assembling the gear to the shaft I Fig. 140 I.

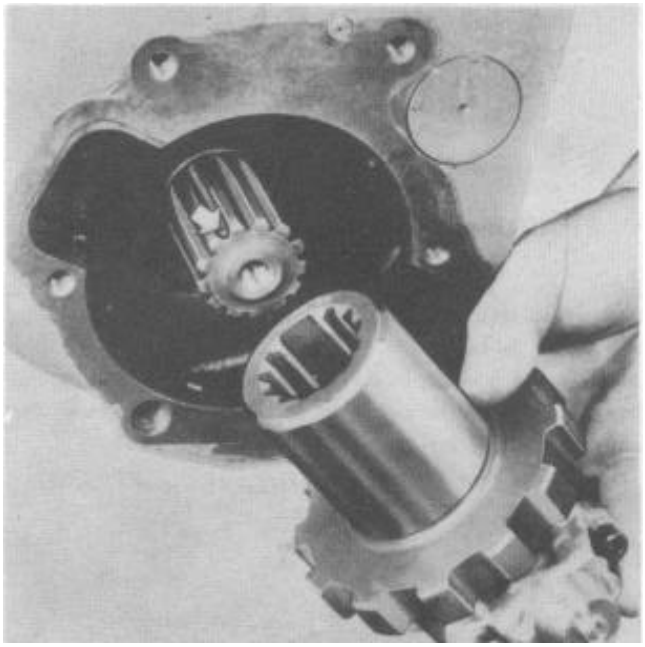


FIGURE 140—*Note the Index Pin*

Rotate the planetary cage shaft so that the parking gear assembly can slide onto the shaft when the governors are in position (Fig. 141).

Place the rear housing spacer in the hub of the parking gear (Fig. 142).

Use a new gasket and assemble the complete rear

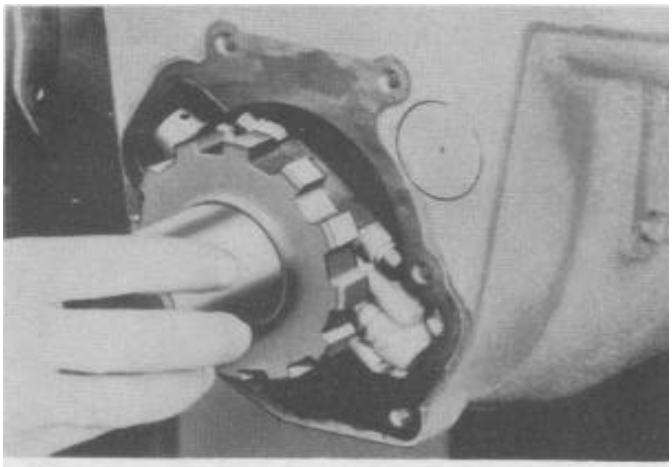


FIGURE 141—*Note the Position of the Governors*

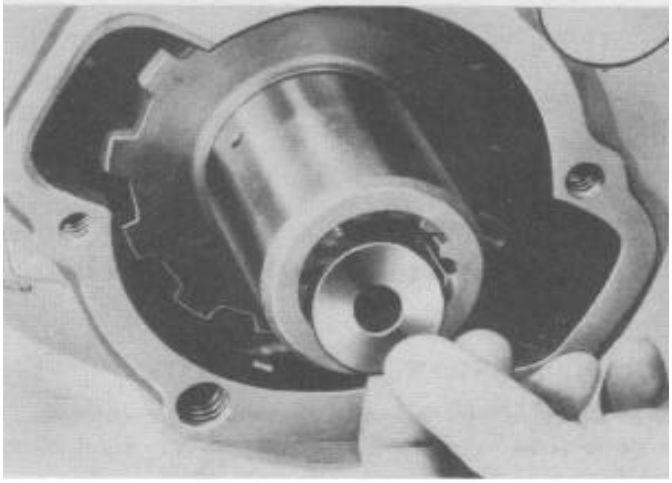


FIGURE 142—*Place the Spacer in the Parking Gear Hub*

housing assembly to the case and install and tighten two or three retaining screws. Also install the long output shaft bolt and tighten the bolt.

Attach dial indicator clamp to the input shaft with the indicator against the bell housing flange. Check the high range clutch and planetary end play by using a screw driver behind the high range clutch housing. Push the input shaft toward the rear and set the indicator dial and then pry the clutch housing forward and note the indicator reading. The specified end play is .023" to .036" (Fig. 143).

If the end play is not within specifications, it will be necessary to change the rear housing spacer shown in Figure 142. Spacers are available in thicknessess ranging from .020" through .085" in .013" graduations. Select and install a spacer which will bring the end play within the specified limits and recheck the end play.

When the proper end play exists, install all of the rear housing retaining screws and lockwashers torque tightening the screws to 15 to 18 ft. lbs. Tighten the long output shaft bolt to 35 to 40 ft. lbs. torque.

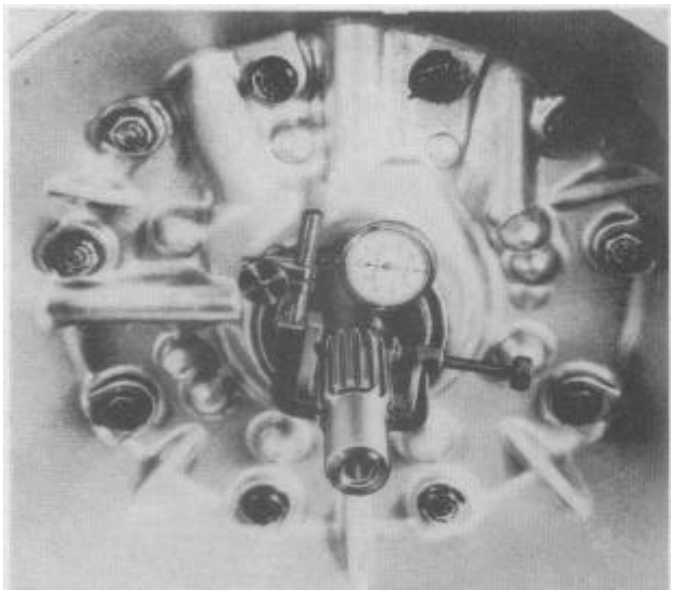


FIGURE 143—*Checking the High Range Clutch and Planetary End Play*

Position the low range and reverse brake operating levers on the band struts. Install the low range brake assembly to the case and torque tighten the three cap screws "B" (Fig. 144) to 9 ft. lbs. Attach the control valve assembly to the case lining up the throttle valve lever pin with the throttle valve and start the low range brake jumper tubes in the front valve body. Lightly tap the valve body toward the low range brake tubes and insert the five valve body to case cap screws "A". Then install the reverse brake assembly and jumper tubes. Install the four cap screws "B" and torque tighten to 9 ft. lbs.

As illustrated in Figure 144, torque tighten screws "A" and "B" to 9 ft. lbs. and the remaining screws to 5 ft. lbs.

Torque tighten both the reverse and low range brake band adjusting screws to 20 ft. lbs. Then back the

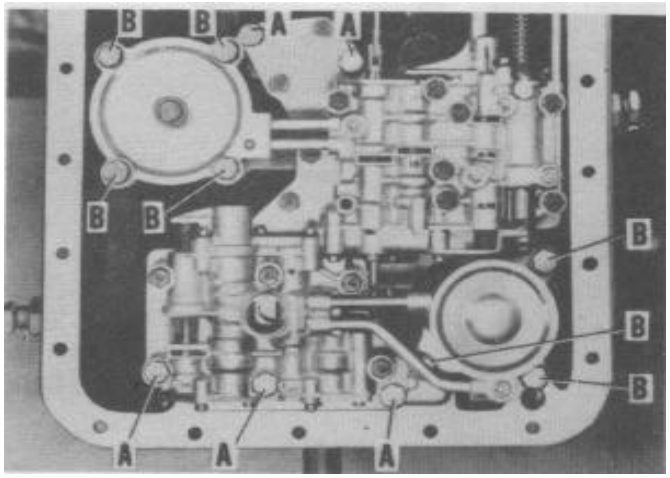


FIGURE 144—*Screws "A" and "B" 9 ft. lbs. Torque All others 5 ft. lbs.*

screws out 1:-4 turns and tighten the lock nuts.

Connect the manual valve link to the shaft inner lever and spread the split end of the pin. Lubricate the "0" ring on the rear oil pump suction jumper tube and install the tube Fig. 145).

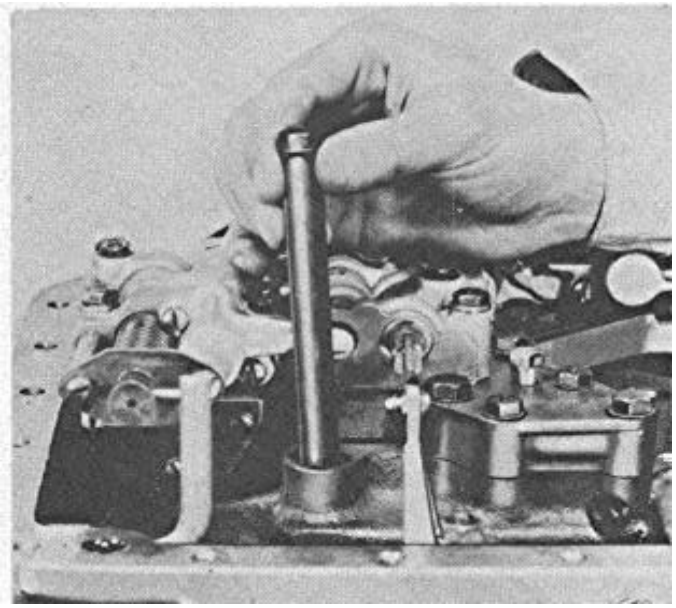


FIGURE 145—*Install Rear Oil Pump Suction Tube*

Install the oil strainer and clip. Then install the oil pan using a new gasket. Torque tighten the oil pan retaining screws to 10 to 12 ft. lbs.

Install the front pump oil transfer tubes and the tube adapters. The adapter with the small metering hole should be installed in the opening toward top of case Fig. 146).

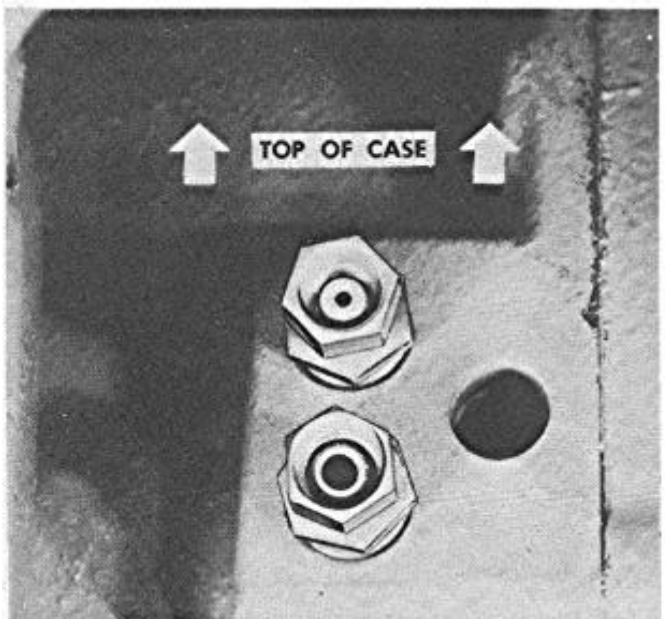


FIGURE 146—*Metering Hole toward Top of Case*

Using a screw driver in the end of the throttle valve shaft, rotate the shaft counter-clockwise until the valve reaches its stop. With the valve against its stop, use a straight-edge to position the outer lever and tighten the clamp screw nut (Fig. 147).

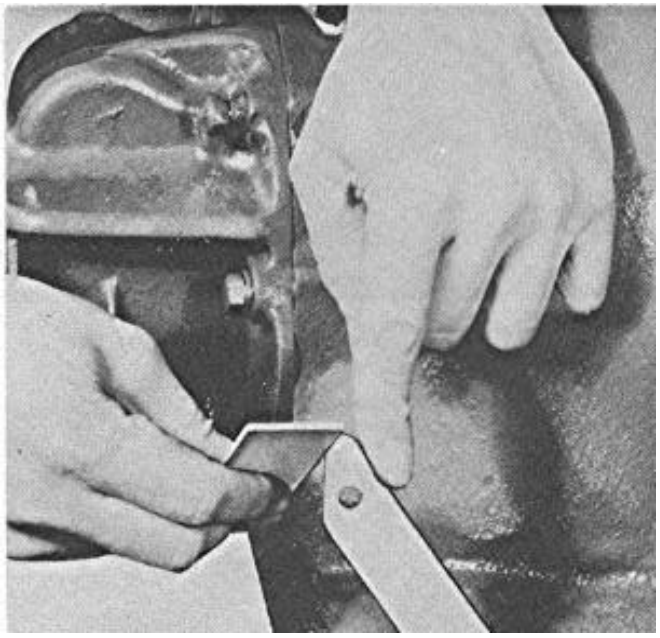


FIGURE 147—*Use Straight-edge to Adjust Lever*

TRANSMISSION INSTALLATION

Wire the converter assembly to the bell housing to prevent it from accidentally sliding off the input shaft while moving the transmission.

Transfer the transmission from the reconditioning stand to a transmission lift or jack. Move the transmission under the car and raise until the pilot of the front of the direct drive clutch housing is in line with the bore in the crankshaft.

Move the transmission forward so that the pilot enters the crankshaft while at the same time the four studs on the clutch housing enter the holes in the flywheel. Start two of the converter to flywheel retaining nuts and remove the wire holding the converter to the bell housing.

Raise the transmission until the pilot around the top of the bell housing flange is right to the top of the flywheel housing. Install the lower flywheel housing cover and starting motor. Install all bell housing to flywheel housing retaining bolts and tighten the bolts to 25 to 30 ft. lbs. torque.

Install the two remaining converter to flywheel retaining nuts and torque tighten all nuts to 25 to 30 ft. lbs.

Attach the rear cross member to the engine supports and side sills. Connect the torque tube and universal joint to the rear transmission housing and output shaft. Remove the support from under the engine and lower

the jack or lift from under the transmission.

Connect the oil cooler lines and the speedometer cable.

Connect the selector control linkage at the left side of the transmission. Connect the throttle control linkage at the right side of the transmission. Refer to MAINTENANCE for linkage adjustments.

Attach the oil filler and level checking tube.

When filling the transmission, use type "A" automatic transmission fluid which has an AQ-ATF number embossed on the top of the container.

To fill the unit, pour seven quarts of fluid through the filler tube in the engine compartment.

Start the engine and allow it to run at FAST IDLE for five minutes with the selecter lever in the Neutral "N" position.

Reduce the engine speed to low idle and add only enough fluid to bring the level to the "FULL" mark on the dip stick.

The fluid capacity of the transmission is approximately 12 qts. for a "dry fill" such as on the initial filling or when filling after the unit has been completely disassembled. The "wet fill" is approximately 11 qts. after draining the unit and the converter when changing oil.

If at any time it is doubtful as to whether the fluid is at the proper level, such as might be in the case if the filler tube were distorted by accident, the following check can be made:

Place the car on a level floor or hoist and allow the engine to run at idle for five minutes in Neutral "N".

Place a container under the rear end of the transmission and then remove the bronze plug in the rear of the transmission case. If oil runs out of the opening, add oil until it begins to run out, install the plug, and then add ONE QUART of oil. This will bring the oil to its proper level. If upon removing the bronze plug oil does run out, allow it to drain to the plug opening level and then install the plug and add ONE QUART of oil.

MAINTENANCE

Throttle Linkage Adjustment

Check the operation of the linkage to make certain it is operating freely and not binding. Check for excessive wear at the pivot points. Proper adjustments cannot be made with binding or excessively worn linkage.

The engine should be thoroughly warmed up and the low or curb idle set at 400 RPM with the selector in the Drive (D) position. After stopping the engine, it is suggested that the carburetor choke valve be blocked open to prevent the carburetor linkage from returning to fast idle while the transmission throttle linkage adjustments are being made.

To adjust the linkage, disconnect the throttle rod at the throttle valve shaft outer lever at the side of the transmission. Move the lever to the rear to its stop. Hold a straight edge across the milled surface at the rear of the transmission case. The taper on the end of the lever should just contact the straight edge as shown in Figure 147.

If adjustment is necessary, loosen the lever clamp screw nut and turn the shaft to the left (counterclockwise) until the valve has reached its stop. With the shaft held in this position, rotate the lever on the shaft so that the taper on the lever lines up with the milled surface on the case when checked with a straight edge and then tighten the clamp screw nut. Reconnect the rod to the lever.

Raise the hood and remove the carburetor air cleaner. Disconnect the upper throttle rod from the center hole of the throttle cross shaft lever at "A", Figure 148.

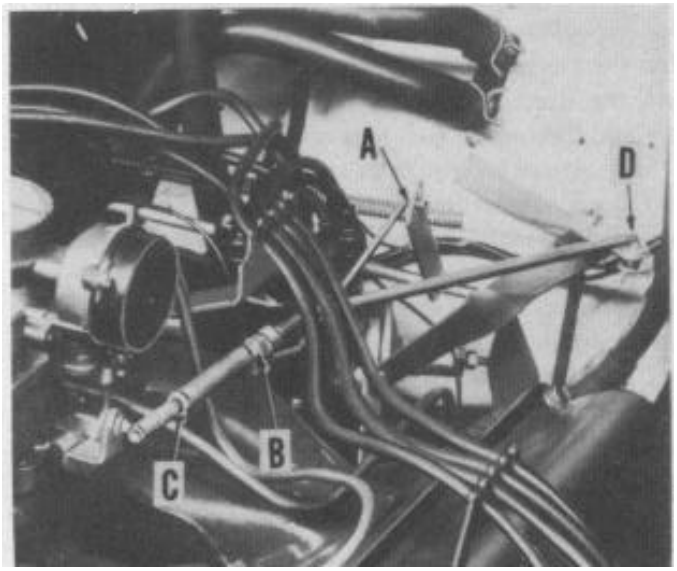


FIGURE 148—*Throttle Linkage Adjusting Points*

Lightly hold the cross shaft lever forward at point "A" so that the throttle valve in the transmission is against its stop. Do not spring the linkage.

Adjust the throttle rod by loosening the two lock nuts at "B" so that the end of the rod will enter the center hole in the cross shaft lever. Then reconnect the rod in the center hole in the cross shaft lever.

Adjust accelerator rod at "C" so that the rod is 151/2" between the ball joint at the carburetor lever and at point "D". Tighten the lock nut after the proper adjustment is made.

This adjustment will insure full travel of the foot accelerator and position the lever at point "D" so that the throttle return spring will not pass over center. The long end of the return spring is fastened to the lever at point "D" and the short end to the bracket at the right side of engine.

NOTE: *After setting linkage reset engine idle to 425 RPM.*

Selector Lever Control Linkage Adjustment

The selector lever has six positions as follows: "P" for parking, "N" for neutral, Dot "s" for Direct Drive, "D" for gear start drive, "L" for low, and "R" for reverse.

In order to move the selector lever in either "P" parking or "R" reverse range, the selector lever must be raised toward the steering wheel.

To properly adjust the control linkage, raise the selector lever and place the lever in the "R" position.

Disconnect the clevis pin at the transmission control lever by removing the clevis pin. The transmission control lever should be moved to the rear as far as it will go but do not force the lever as this may tend to bend the stop plate located inside the transmission on the manual control shaft lever. With the selector lever in the "R" position and the transmission lever set to the stop plate, adjust the clevis on the control rod so that the clevis pin fits freely in the hole of the clevis and the transmission lever. Then replace the cotter key and tighten the lock nuts on the control rod.

The selector lever pointer can be aligned if required, as follows: Place the selector lever in the "N" position noting the position of the pointer. Remove the shroud from the jacket tube. Remove the retaining screw at the lower end of the shroud and slide the shroud downward turning the upper end toward the right and lift out of jacket tube. Then hold the pointer shaft with pliers and move the pointer to the right or left on the shaft to line it up directly under the center of letter "N".

Transmission Fluid

The transmission fluid level should be checked at 1,000 mile intervals using the dip stick in the filler tube located in the engine compartment.

The engine should be run at approximately 800 RPM for one minute to completely fill the system and then run at low or curb idle while the level is being checked. If it is necessary to add fluid, add only enough to bring the level to the "FULL" mark on the dip stick.

When adding fluid, use type "A" automatic transmission fluid which has an AQ-ATF number embossed on the container.

The transmission and converter should be drained, the oil strainer and the oil pan cleaned, and new fluid installed at 25,000 mile intervals. Draining and refilling is accomplished as follows:

Remove the flywheel housing lower cover and rotate the flywheel to locate one of the converter drain plugs at the bottom.

Place a container under the converter and the transmission oil pan and then loosen but do not remove the converter drain plug.

Rotate the flywheel one-half turn to locate the other converter drain plug to the bottom. Remove this plug and the oil pan drain plug to drain the fluid.

Remove the oil filler tube, oil pan, and oil strainer. Clean the oil pan. Clean the oil strainer by scrubbing with a wire brush, rinsing in cleaning solvent and then blowing compressed air through it from the inside out.

Reinstall the strainer, new oil pan gasket, oil pan, and the oil filler tube.
Reinstall and tighten the converter and oil pan drain plugs. Rotate the flywheel one-half turn and tighten the converter drain plug which previously was loosened to vent the converter while it was draining.

Install the flywheel housing lower cover and torque tighten the retaining screw to 15 to 18 foot pounds.

To fill the unit, install seven quarts of AQ-ATF automatic transmission fluid through the filler tube in the engine compartment.
Start the engine and allow it to run at FAST IDLE for five minutes with the selector lever at neutral
(“N").

Reduce the engine speed to low or curb idle. Add approximately three quarts of fluid continuing to add fluid slowly to bring the level to the "FULL" mark on the dip stick.

Servicing Governors

Both the low speed and the high speed governors can be removed for replacement or for cleaning by removing the oil pan.

Rotate the propeller shaft to gain access to the governor retaining screws and remove the screws using special governor wrench J-5976 (Fig. 149).

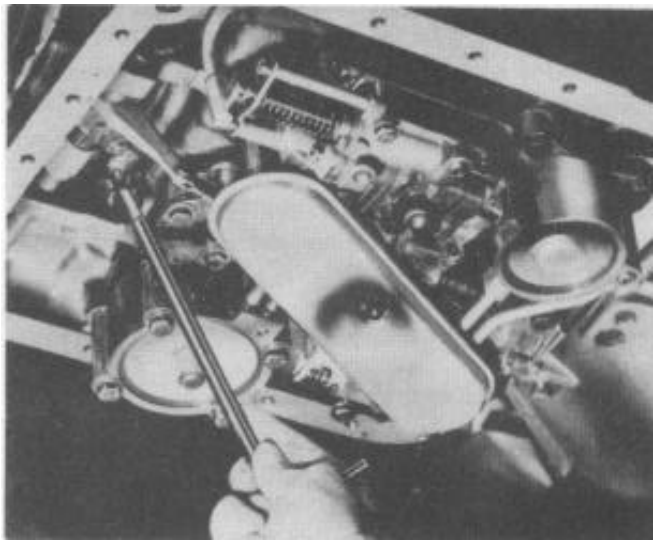


FIGURE 149—*Removing Governor with Special Tool J-5976*

Brake Band Adjustment

The reverse and the low range brake bands are adjusted as follows:

Loosen the band adjusting screw lock nut, torque tighten the adjusting screw to 20 foot pounds, back the screw out 13/4" turns, and re-tighten the lock nut.

ULTRAMATIC TRANSMISSION OIL CIRCUITS

Neutral and Park Range

With the selector lever in Neutral or Park range the flow of hydraulic oil pressure is as follows (Fig. 150) :

With the engine running the front pump rotates at all times. Pressure is obtained immediately and opens the front pump check valve.

Oil leaving the front pump fills the main oil gallery and is routed to the pump valve and to the head of the pump valve. It passes through the pump valve, through the converter valve and fills the converter.

From the main oil gallery oil passes through the throttle valve and to the throttle limit valve. From the throttle limit valve it is routed to the pump valve where it assists the spring to hold the pump valve in its "at rest" position. It also branches off to the head of the low regulator valve.

Oil is also delivered from the throttle valve to the low-high shift valve where it fills the cavity in the valve in its "at rest" position. It is also routed from the throttle valve to the direct shift throttle valve and to the head of the valve.

Oil from the main gallery passes to the land of the low-high shaft valve. From the main gallery it also is directed to the land of the manual valve and through the reverse shuttle valve to the top of the reverse piston holding the brake in its released position.

In Neutral and Park range the high range clutch pressure and low range brake top and bottom pressures are vented at the manual valve.

The oil pressure in Neutral and Park is not high enough to cause the valves to move.

High Range Converter "Dot" Drive

With the selector lever in the "Dot" position (Fig. 151), the manual valve blocks off the passage to the bottom of the reverse brake piston. This passage now vents the oil from the bottom of the piston out past the rear of the manual valve. At the same time, pressure passes through the reverse shuttle valve to the top of the reverse piston holding the brake in its released position.

When the manual valve was moved, a passage was opened to admit pressure to the head of the modulating valve causing the valve to move. The oil continues through the passage where it branches off and is directed above the piston to assist the spring in holding the brake in its released position.

From the manual valve, another passage routes oil to the bottom of the low range brake piston. However, the oil and spring pressures above the piston are greater than the oil pressure below the piston and the low range brake is held in its released position.

From the manual valve, another passage routes oil to the bottom of the low range brake piston. However, the oil and spring pressures above the piston are greater than the oil pressure below the piston and the low range brake is held in its released position.From the manual valve, another passage routes oil to the bottom of the low range brake piston. However, the oil and spring pressures above the piston are greater than the oil pressure below the piston and the low range brake is held in its released position.

At this time, the car is standing still, the engine is idling, the converter is filled with oil, and the high range clutch is engaged.

To drive the car forward, depress the accelerator pedal which increases engine speed, front pump speed, and pump pressure. This partial pressure passes through the high speed governor, where a certain amount of regulation takes place, to the low speed governor which does the major regulating during low speed operation.

From the low speed governor, the oil is directed to the direct shift valve and to the low-high shift valve, but at this time, the pressure is not great enough to cause the valves to move.

Governor pressure also is routed to the detent housing where it assists the springs in holding the plungers into the detents in the manual valve.

As car speed and governor pressure increases, the plungers are held tighter into the detents in the valve thereby making it quite difficult to accidentally knock the selector lever into another range while the car is under way.

As car speed increases, the governor pressure also increases and the governor pressure at the head of the low-high shift valve is great enough to move the valve.

When the valve moves, it closes off the throttle pressure passage leading into the cavity in the valve and pressure is vented. At the same time, the valve has connected passages which permits pump pressure to pass through the low-high shift valve into a passage where it is directed to the modulating valve and through the modulating valve to the pump valve. It also is directed to the manual valve where the passage is closed off.

The converter and high range clutch are now the driving members. At this point the transmission automatically shifts into High Range Direct "Dot" Drive.

High Range Direct "Dot" Drive

With the selector lever in "Dot" Drive (Fig. 152) governor pressure became high enough, as vehicle speed increased, to move the low-high shift valve and direct shift valve. When the direct shift valve moved, passages were connected to permit pump pressure to be routed

to the direct drive clutch. The passage branching off the direct drive clutch passage has admitted pressure to move the converter valve piston. The pressure at the head of the converter valve moves the valve to reduce the converter pressure.

When the converter pressure was reduced, the pressure in the main gallery increased momentarily. This higher pressure directed to the head of the pump valve, assisted by the higher pressure ahead of the valve land, causes the valve to move.

The rear pump pressure now is greater than the front pump pressure which is being by-passed. The rear pump pressure opens the rear pump check valve and closes the front pump check valve. The front pump is now rotating but is only re-circulating the oil and the rear pump is the pressure source. Rear pump pressure is regulated by the pump valve which vents enough oil to maintain a pre-determined rear pump pressure.

The direct drive clutch and the high range clutch are now driving the car at a constant speed.

As car speed decreases, the governor pressure also decreases. Governor pressure at the head of the direct shift valve has dropped to a point where the valve moves closing off and venting the passage leading to the direct drive clutch and the direct drive clutch disengages.

Governor pressure to the head of the low-high shift valve at this point also has fallen off and the valve moves and admits throttle pressure into the spring cavity in the valve. When the low-high shift valve moved, it closed off the passage leading through the modulating valve to the pump valve.

When the direct drive clutch disengaged and the pressure was vented, the pressure also was vented from the head of the converter valve piston. The converter valve piston spring moves the piston, which in turn moves the converter valve, to admit oil under a higher pressure to the converter causing the converter valve to regulate.

Now again a repetition of events occur which were previously described in High Range Converter "Dot" Drive when the system required a greater quantity of oil because the converter became a driving member.

The greater quantity of oil required results in a momentary pressure drop in the oil gallery.

The lower pressure at the head of the pump valve allows the valve to move and permits the front pump to build up pressure.

The front pump pressure now is greater than the rear pump pressure causing the front pump check valve to open and the rear pump check valve to close. The rear pump now is only putting out a partial pressure and the front pump is the pressure source.

When the car stops, the rear pump does not rotate. Consequently, there is no rear pump or governor pressure. Throttle pressure now has fallen off ahead of the direct shift throttle valve allowing the valve to move and close off the passage to the direct shift valve.

Throttle pressure passing through the throttle limit valve, which no longer is limiting pressure, also has dropped off ahead of the low regulator valve and the spring moves the valve. With the engine idling, front pump pressure from the main gallery to the head of the pump valve has fallen off and the valve moves and no regulation is taking place. This lowered pressure also is being delivered to the converter valve and the pressure has fallen off at the head of the converter valve. The valve moves and the converter now is only being kept full of oil.

Low Range Converter Drive

With the selector lever in Drive position (Fig. 153), the manual valve moves and a land on the valve closes off the passage leading to the head of the modulating valve and the spring moves the valve. The passage which passes through the shift regulator valve and to the high range clutch is closed off thus disengaging the clutch. A branch passage leading to the top of the low range brake piston is also closed off.

The pressure from the high range clutch, as well as pressure above the low range brake piston, is routed through a common passage which passes through the manual valve bore and is vented at the low-high shift valve.

At the same time, the manual valve admits pump pressure through another passage to the low range brake. It enters the low range brake housing below the piston moving the piston upward to apply the brake.

With the car standing and the engine idling, the low range brake is applied, and the converter is filled with oil.

Depressing the accelerator pedal increases the engine speed as well as the pump speed and, consequently, a greater pump pressure. This higher pressure at the head of the pump valve moves the valve causing it to regulate pressure. This higher pressure passes through the pump valve, through the converter valve,

and into the converter. The higher pressure at the head of the converter valve causes it to regulate and maintain a predetermined converter pressure.

When the throttle was depressed, the oil leaving the main gallery to the throttle valve increased in pressure. Throttle pressure also increases and this higher pressure at the head of the direct shift throttle valve moves the valve causing it to regulate and open a passage to admit pressure to the direct shift valve where it enters the cavity in the valve to assist the spring. The increased throttle pressure also passes through the throttle limit valve to the pump valve where it assists the spring. It also branches off and is delivered to the head of the low regulator valve to move the valve.

Because the car is in motion, the rear pump is rotating and putting out a partial pressure to the high speed governor valve from where it passes to the low speed governor valve. From this valve, it is delivered to the head of the low-high shift valve and to the head of the direct shift valve and to the detent housing. Governor pressure also is routed through the modulating valve to the pump valve.

The car speed now is such that the governor pressure is great enough to move the low-high shift valve which closes off the throttle pressure passage to the cavity in the valve. When the low-high shift valve moved, it connected passages to admit pump pressure to the modulating valve. It also is directed through the manual valve passing out through a passage leading to the head of the modulating valve causing the valve to move and admit pressure to the pump valve.

With the converter in and the low range brake applied, the converter through the planet gear assembly is the driving member. At this point the transmission automatically shifts into High Range Converter Drive.

High Range Converter Drive

As vehicle speed increases (Fig. 154), oil is routed to the low range brake housing where it is directed above the piston. The low range brake piston spring and the oil pressure move the piston downward to release the brake. At the same time, the oil branches off and passes through the shift regulator valve and to the high range clutch where it engages the clutch.

With the converter in and the high range clutch applied and the low range brake released, the converter and high range clutch are the driving members. At this point the transmission automatically shifts into High Range Direct Drive.

High Range Direct Drive

As car speed further increases (Fig. 155) the governor pressure to the direct shift valve becomes great enough to move the valve. The direct shift valve now connects passages to admit pressure to the direct drive clutch and engage the clutch.

The passage branching off from the direct drive clutch passage has admitted pressure to move the converter valve piston. The pressure at the head of the converter valve moves the valve to reduce the converter pressure. The pressure in the main oil gallery increases and the higher pressures at the head of the pump valve and at the valve land move the pump valve to where it by-passes the oil. The rear pump pressure now is greater than the front pump pressure.

The rear pump pressure opens the rear pump check valve and closes the front pump check valve. The front pump now is rotating but is only re-circulating the oil and the rear pump is the pressure source. Rear pump pressure is regulated by the pump valve.

The direct drive clutch and the high range clutch are now the driving members.

Kickdown—High Range Direct to Low Range Converter Drive

When a quick speed is desired for vehicle passing "kickdown" (Fig. 156) may be accomplished by depressing the accelerator pedal beyond the full throttle position. In doing so, full pump pressure is admitted through the throttle valve. This pressure is directed behind the head of the low-high shift valve causing the valve to move. When the low-high shift valve moves, it closes off the pressure to the direct drive clutch which releases the clutch. The pressure from the direct drive clutch is vented from a passage at the low-high shift valve.

Full pump pressure is also directed behind the head of the low-high shift valve to move the valve which uncovers the throttle pressure passage admitting throttle pressure into the spring cavity. When the low-high shift valve moves, it closes off the passage which supplies oil through the modulating valve to the pump valve. Pressure is also blocked off through the manual valve to the point where it branches off to the head of From this branch point, the pressure also is blocked off.

From this branch point, the pressure also is blocked off through the shift regulator valve and to the high range clutch to disengage the clutch. The pressure leading to the top of the low range brake piston also is blocked off. Both the high range clutch and the low brake top pressures are vented through the common passage which passes through the manual valve to the low-high shift valve where the venting takes place.

When the pressure above the low brake piston was blocked off and vented, the pressure below the piston moved the piston upward to apply the brake. The direct drive clutch disengaged, the high range clutch disengaged, and the low range brake was applied; these events or operations are taking place almost simultaneously.

The converter now comes into operation and the front pump takes over the function of the rear pump. When the direct drive clutch pressure was closed off and vented, the pressure at the head of the converter valve piston also was vented and the spring moves the piston which in turn moves the converter valve to admit oil at a higher pressure into the converter. The pressure at the head of the converter valve causes the valve to move and regulate this pressure. The greater quantity of oil required by the converter has momentarily resulted in a pressure drop in the main oil gallery.

The pressure at the head of the pump valve has dropped and allows the valve to move partially closing off the front pump re-circulating passage, thereby permitting the front pump to build up pressure.

When the direct drive clutch disengaged, the engine and front pump speeds increased and, consequently, front pump pressure increased and now is higher than the rear pump pressure. Pressure from the front pump opens the front pump check valve, closes the rear pump check valve, and the front pump now is the pressure source.

The converter through the low range brake is the driving member. When throttle pressure is released pump pressure to the low-high shift valve is blocked.

As shown in Figure 155, governor pressure moves the low-high shift valve which blocks off the throttle pressure to the spring cavity. The low-high shift valve also connects passages to direct oil to the modulating valve. It continues on through the manual valve to a point where it branches off to the head of the modulating valve moving the valve which now directs oil to the pump valve. From this branch point, the oil is routed to the top of the low range brake piston. The oil and spring pressures above the piston are greater than the oil pressure below the piston and the piston moves downward to release the brake.

At lower car speeds, the pump pressure passing through the orifice and to the release side of the low range brake piston slows down temporarily to provide a smooth upshift. At higher car speeds, it is desirable to have the low range brake release rapidly. This is accomplished by admitting a so-called "boost" pressure above the brake piston. This "boost" pressure is taken from a passage leading to the high range clutch and passes through the low regulator valve and into the passage leading to the top of the low range brake piston.

While the low range brake is releasing, oil is also branching off through a passage ahead of the orifice and through the shift regulator valve to the high range clutch to engage the clutch.

Pump pressure from the throttle valve also was blocked off to the direct shift valve and governor pressure moves the valve which connects passages to permit pressure to the direct drive clutch and the direct clutch passage has admitted pressure to move the converter valve piston. The pressure at the head of the converter valve moves the valve to reduce the converter pressure. When the converter pressure was reduced, the pressure in the main oil gallery increased momentarily. This higher pressure at the head of the pump valve, assisted by the pressure ahead of the valve land, causes the valve to move.
The rear pump pressure now is greater than the front pump pressure which is being by-passed.

The rear pump pressure opens the rear pump check valve and closes the front pump check valve. The front pump now is rotating but is only re-circulating the oil and the rear pump is the pressure source. Rear pump pressure is regulated by the pump valve which vents enough oil to maintain a pre-determined rear pump pressure.

The direct drive clutch and the high range clutch are the driving members.

Low Range Converter "Low" Drive

"L" range (Fig. 157) is used for ascending and descending steep grades or pulling through sand, gravel etc. The manual valve closes off one passage and distributes the oil through

another passage to the low range brake. The oil enters the low range brake housing below the piston holding the piston upward which applies the brake.

Upon opening the throttle the increase in engine speed and pump speed results in a greater front pump pressure. The pressure at the head of the pump valve moves the valve causing it to regulate. The higher pressure passes through the pump valve, the converter valve, and into the converter. The higher pressure at the head of the converter valve moves the valve and causes it to regulate. The higher pressure from the main maln oil gallery passes through the throttle valve increasing throttle pressure. This pressure passes through the throttle limit valve to the head of the pump valve. It also passes to the head of the low regulator valve and causes the valve to move. Throttle pressure at the head of the direct shift throttle valve moves the valve causing it to regulate and also to uncover a passage leading to the direct shift valve.

The rear pump is now rotating and putting out a partial pressure through the high speed governor and the low speed governor. As a result governor pressure is directed to the low-high shift valve and to the direct shift valve and also to the detent housing. Governor pressure also is passing through the modulating valve to the pump valve. Therefore, when ascending steep grades the converter through the low range brake is the driving member. As car speed increases the transmission automatically shifts into Low Range Direct "Low" Drive.

Low Range Direct "Low" Drive

When descending a steep grade car speed is increased. Consequently, governor pressure will increase (Fig. 158). The governor pressure now at the head of the low-high shift valve moves the valve to close off the throttle pressure passage leading into the spring cavity. At the same time, it has uncovered a passage to admit pump pressure to the direct shift valve, to the modulating valve, and to the manual valve. Governor pressure now at the head of the direct shift valve moves the valve to connect passages and transfer pressure to the direct drive clutch to engage the clutch.

The passage branching off from the direct drive clutch passage admitted pressure to move the converter valve piston. The pressure at the head of the converter valve moves the valve to reduce the converter pressure. When the converter pressure was reduced, the pressure in the main oil gallery increased. Higher pressure at the head of the pump valve, assisted by the pressure ahead of the valve land, causes the valve to move.

The rear pump pressure now is greater than the front pump pressure which is being by-passed. Rear pump pressure opens the rear pump check valve and closes the front pump check valve. The front pump now is rotating but is only re-circulating the oil and the rear pump is the pressure source. Rear pump pressure is regulated by the pump valve.

Because the direct drive clutch now is engaged, it acts as a solid coupling between the engine and the rear wheels. This permits the engine to be used as a brake when descending steep grades.
The direct drive clutch through the low range brake is the driving member.

Reverse Drive Range

When the selector lever is placed in the reverse position I Fig. 159 pump pressure passes through the manual valve to the head of the reverse shuttle valve causing the valve to move thereby venting the pressure from the top of the reverse brake piston. At the same time, pump pressure passes through the manual valve to the bottom of the reverse brake piston to apply the reverse brake.

Depressing the accelerator pedal increases the engine speed and also the pump speed causing the pump to put out a greater pressure. Pressure being directed to the head of the pump valve is now high enough to move the valve and cause it to regulate. Oil from the main gallery passes through the pump valve at a higher pressure, through the converter valve also at a higher pressure, and into the converter. The pressure at the head of the converter valve now is high enough to cause the converter valve to regulate.

The converter is the driving member through the rear sun gear and planet pinions.

As engine speed is reduced, pump speed is also reduced. Consequently, the front pump pressure is reduced. Lower pressure at the head of the pump valve allows the valve to move and no regulation is taking place. This lower pressure through the converter valve also is lowered at the head of the valve and it no longer is regulating. The converter is only being kept filled with oil.

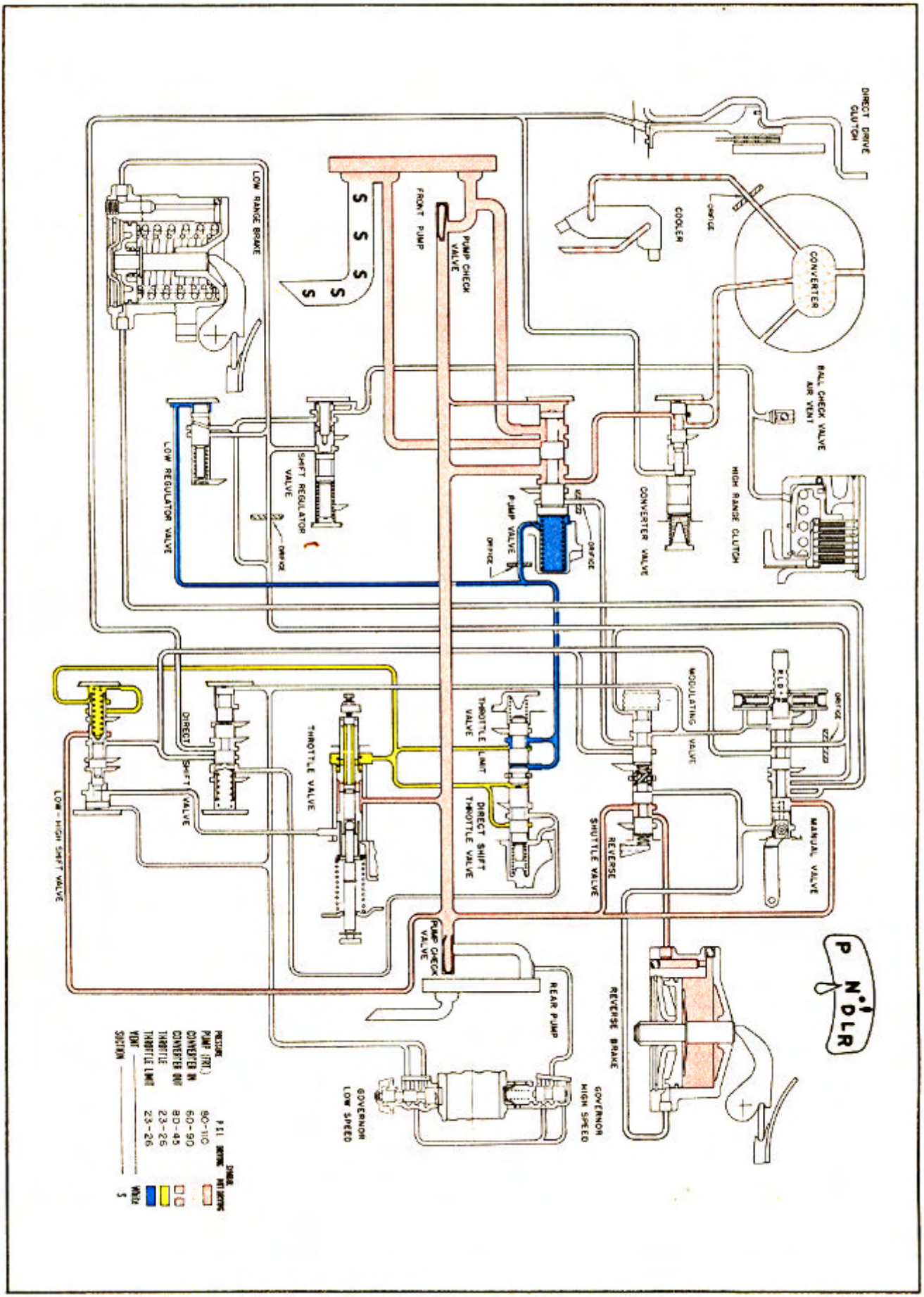


FIGURE 150—*Neutral and Park Range*

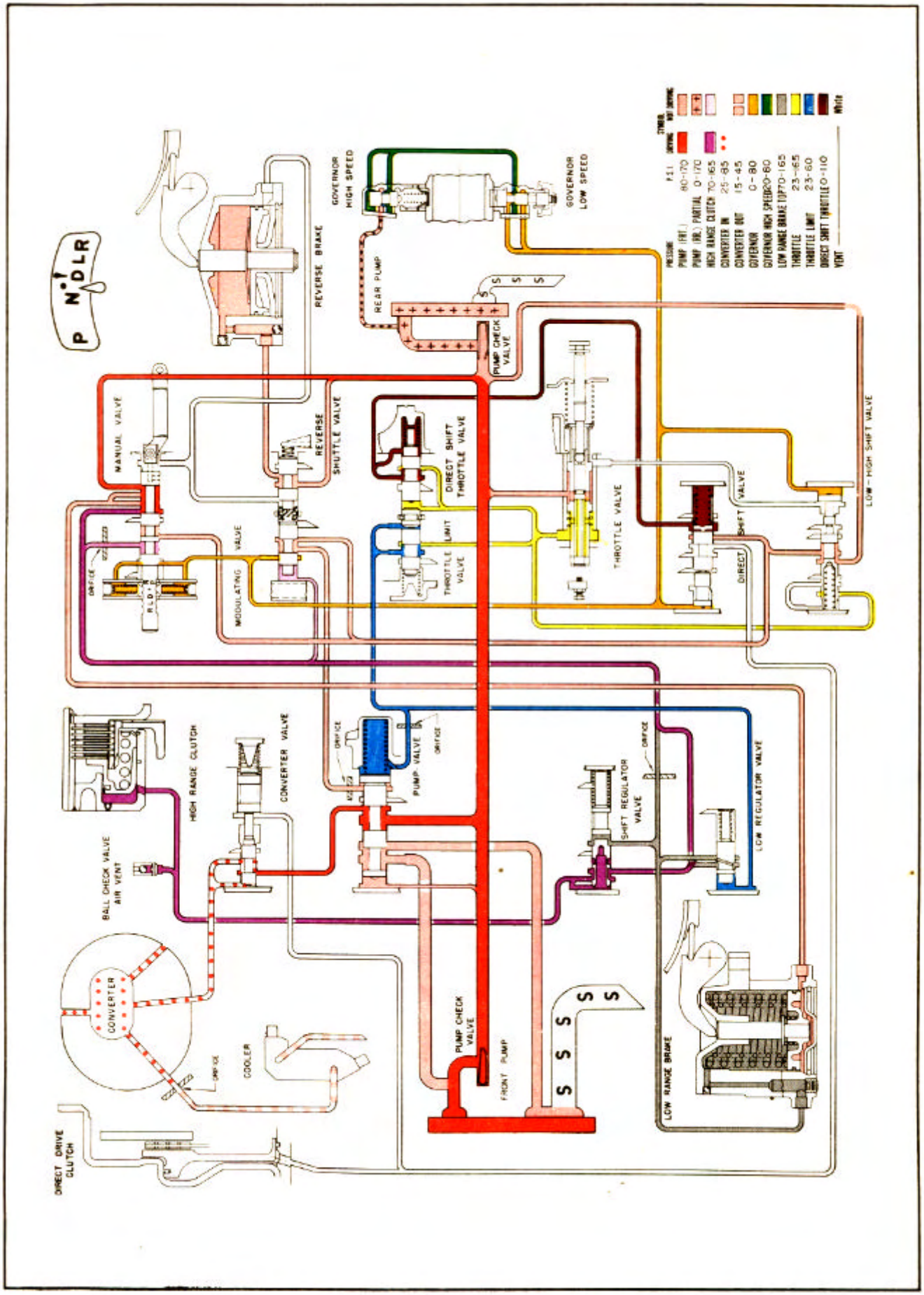


FIGURE 151—*High Range Converter "Dot" Drive*

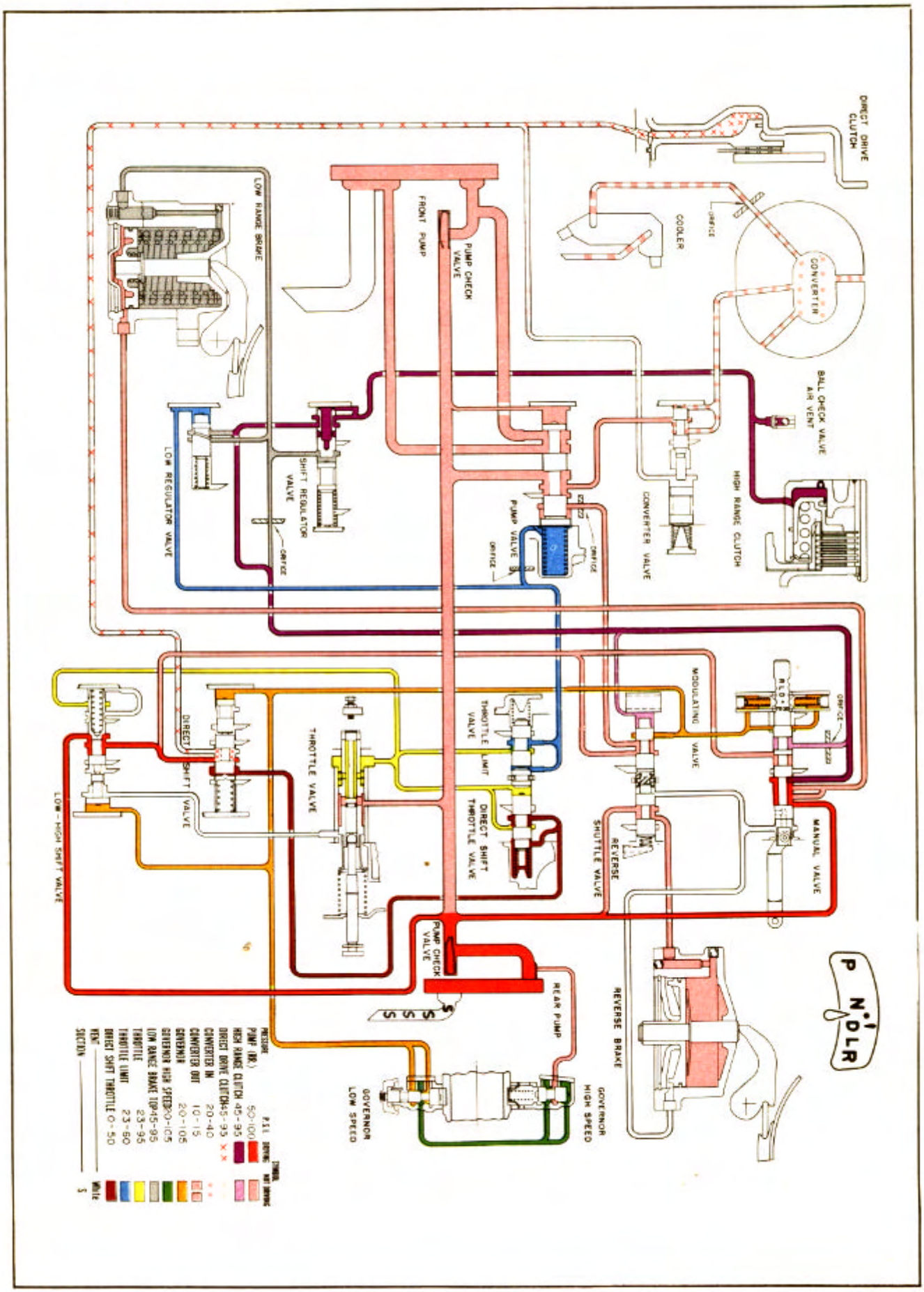


FIGURE 152—*High Range Direct "Dot" Drive*

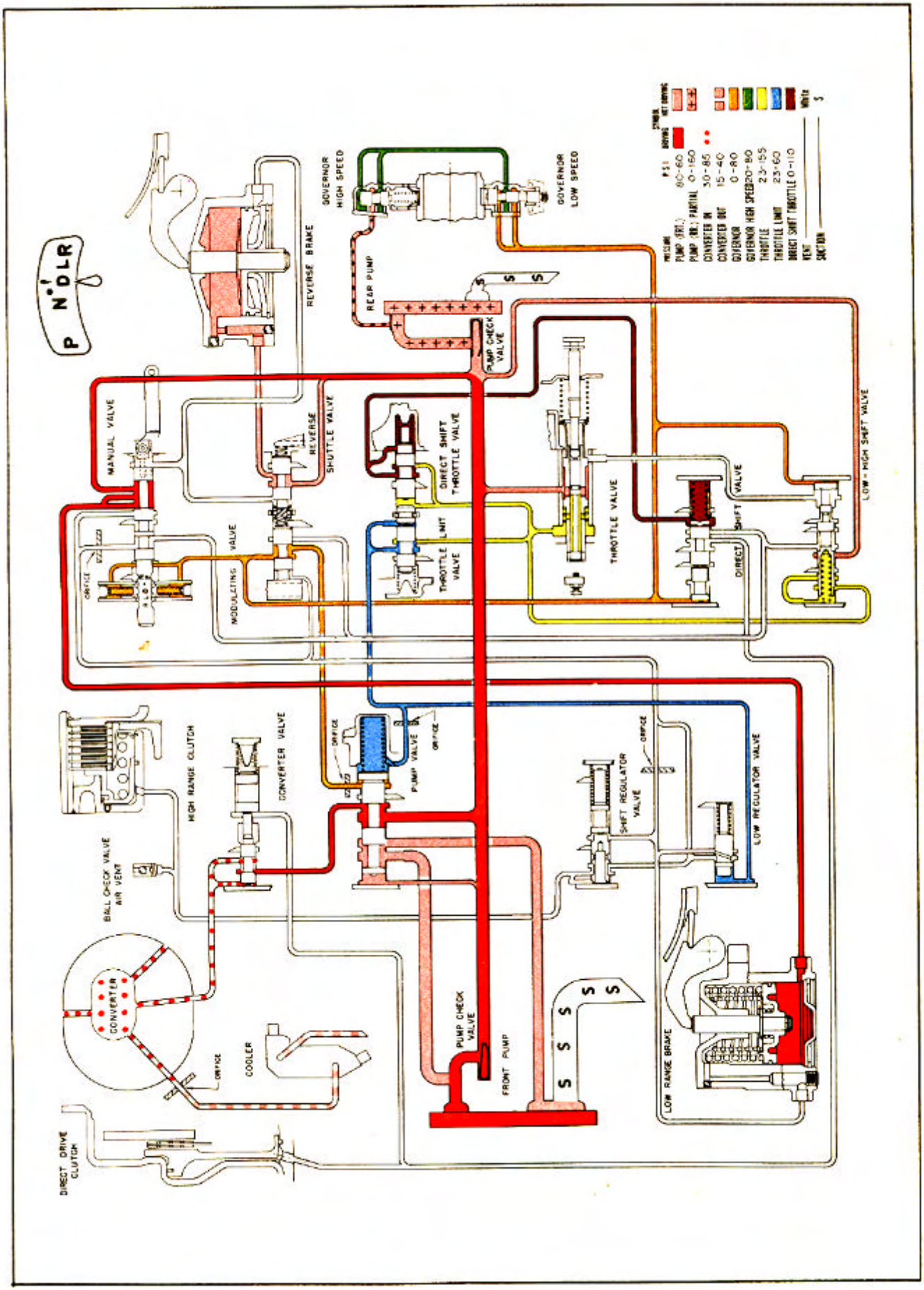


FIGURE 153—*Low Range Converter Drive*

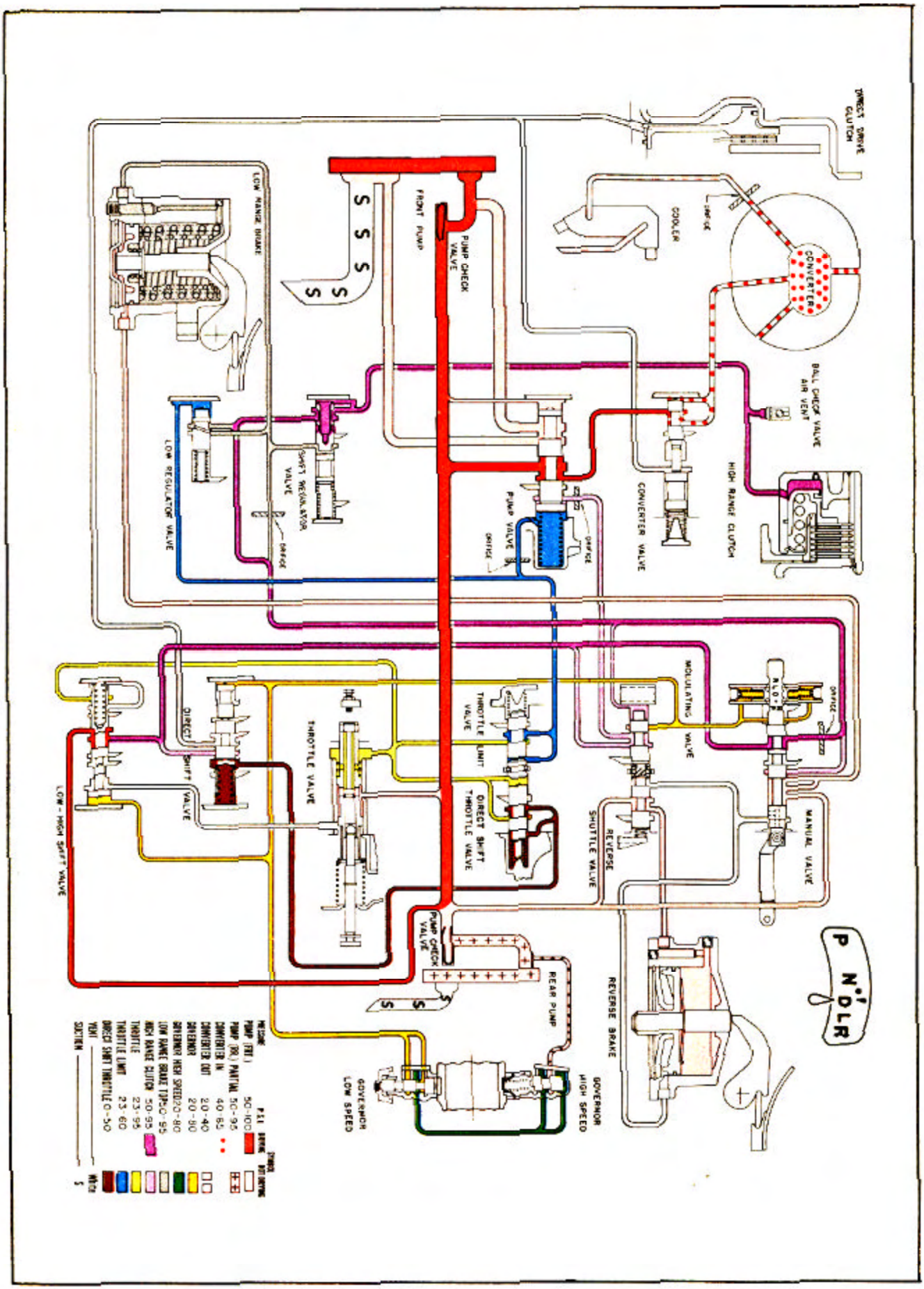


FIGURE 154—*High Range Converter Drive*

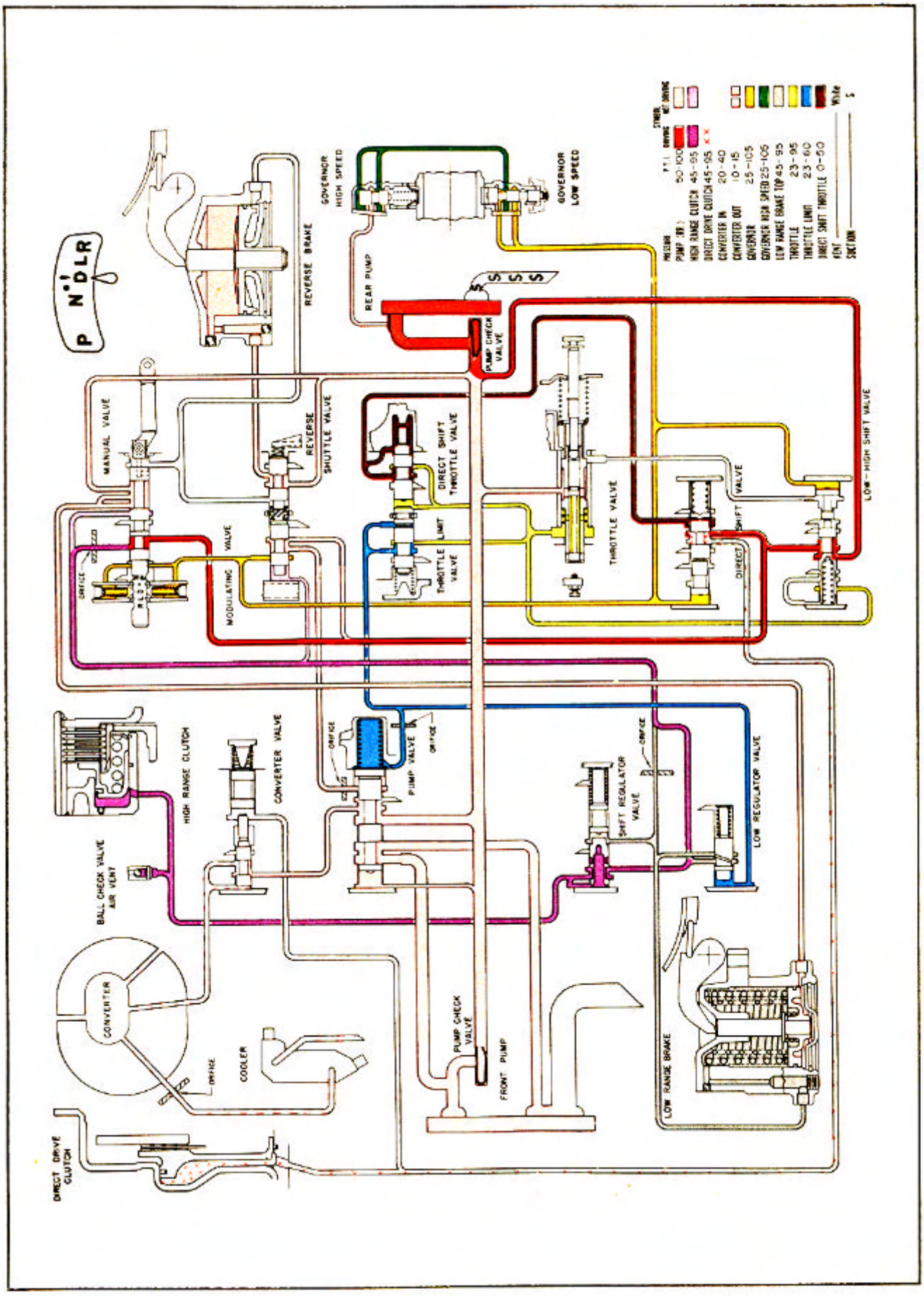


FIGURE 155—*High Range Direct Drive*

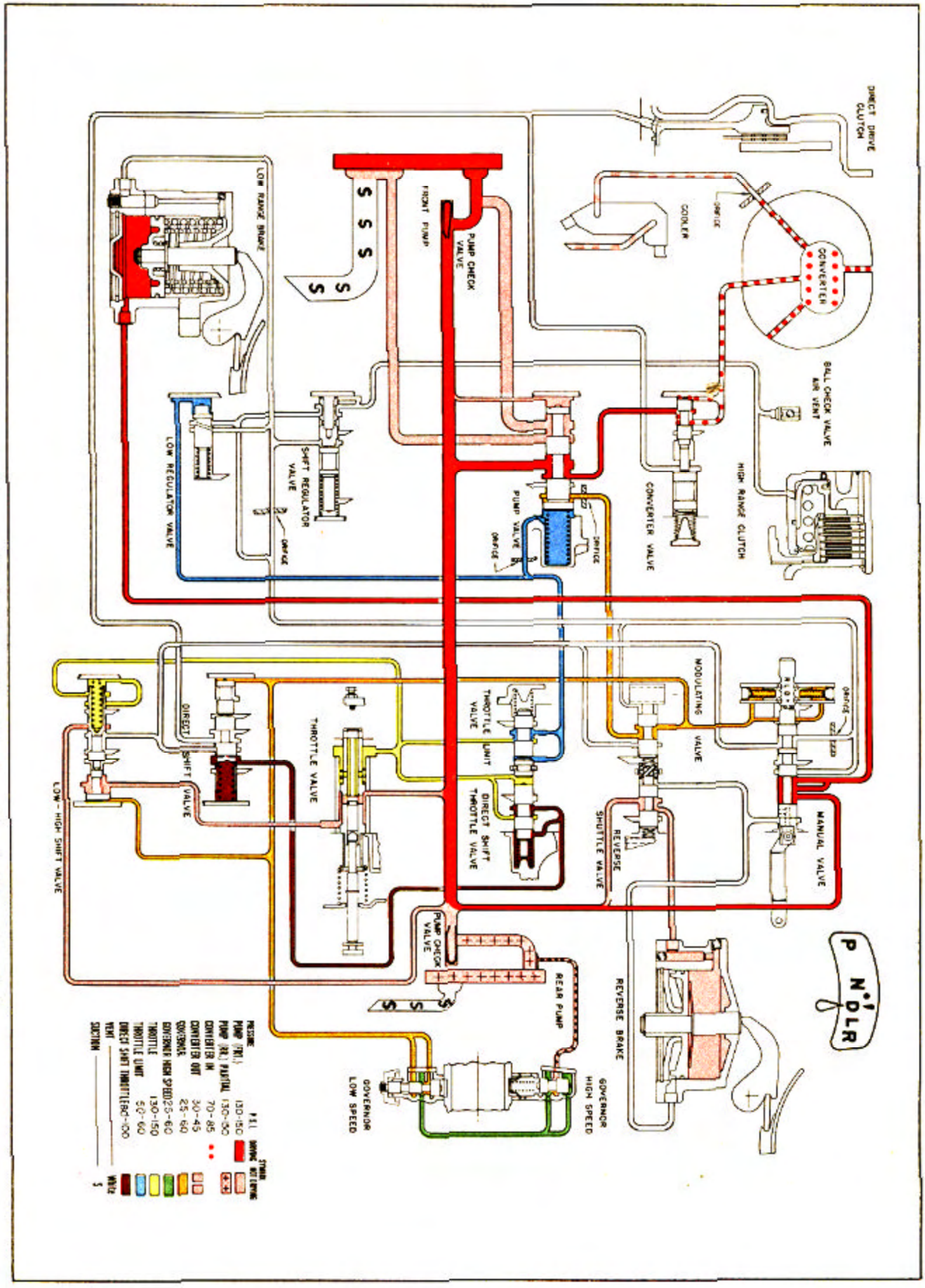


FIGURE 156—*Kickdown—High Range Direct to Low Range Converter Drive*

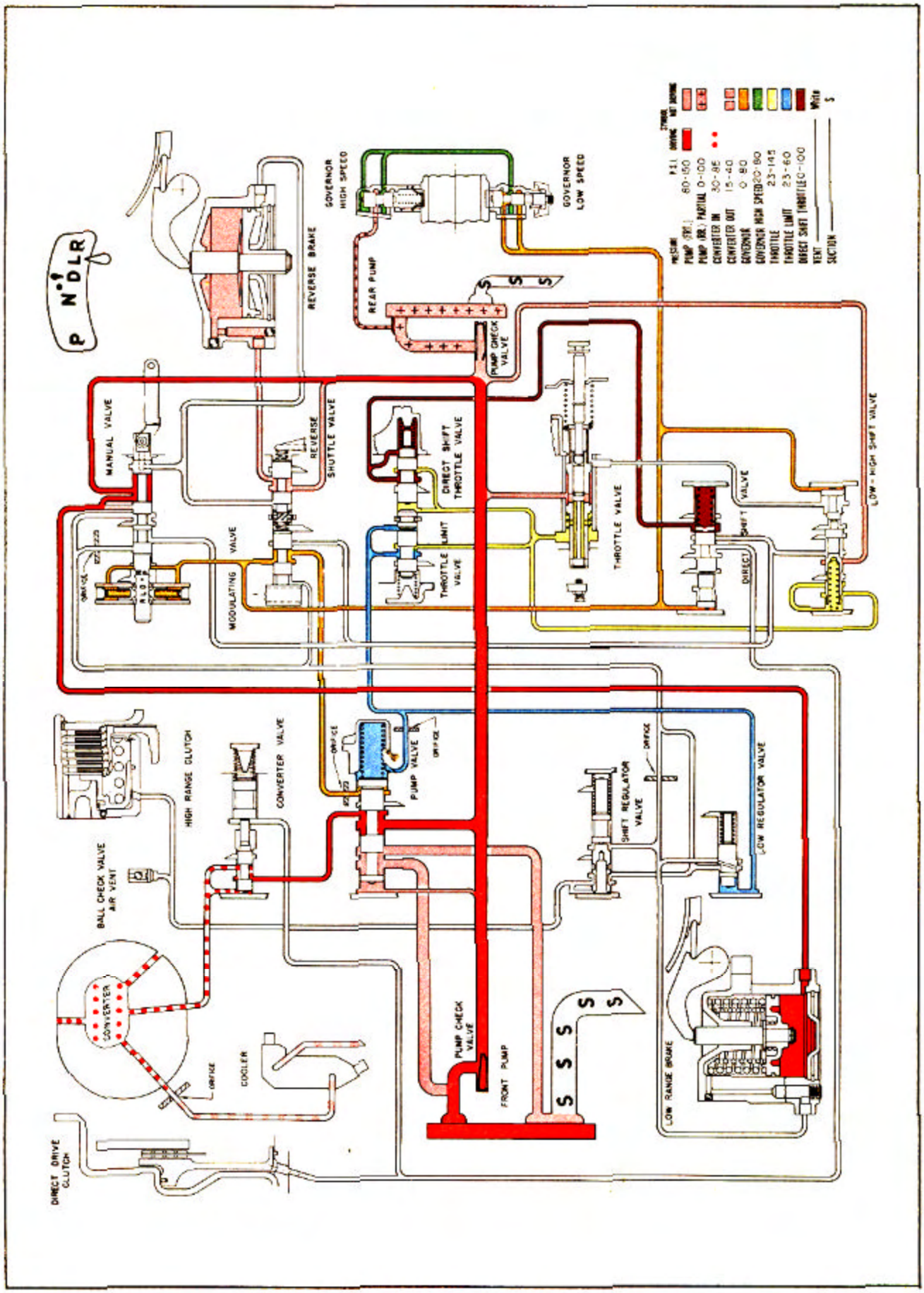


FIGURE 157—*Low Range Converter "Low" Drive*

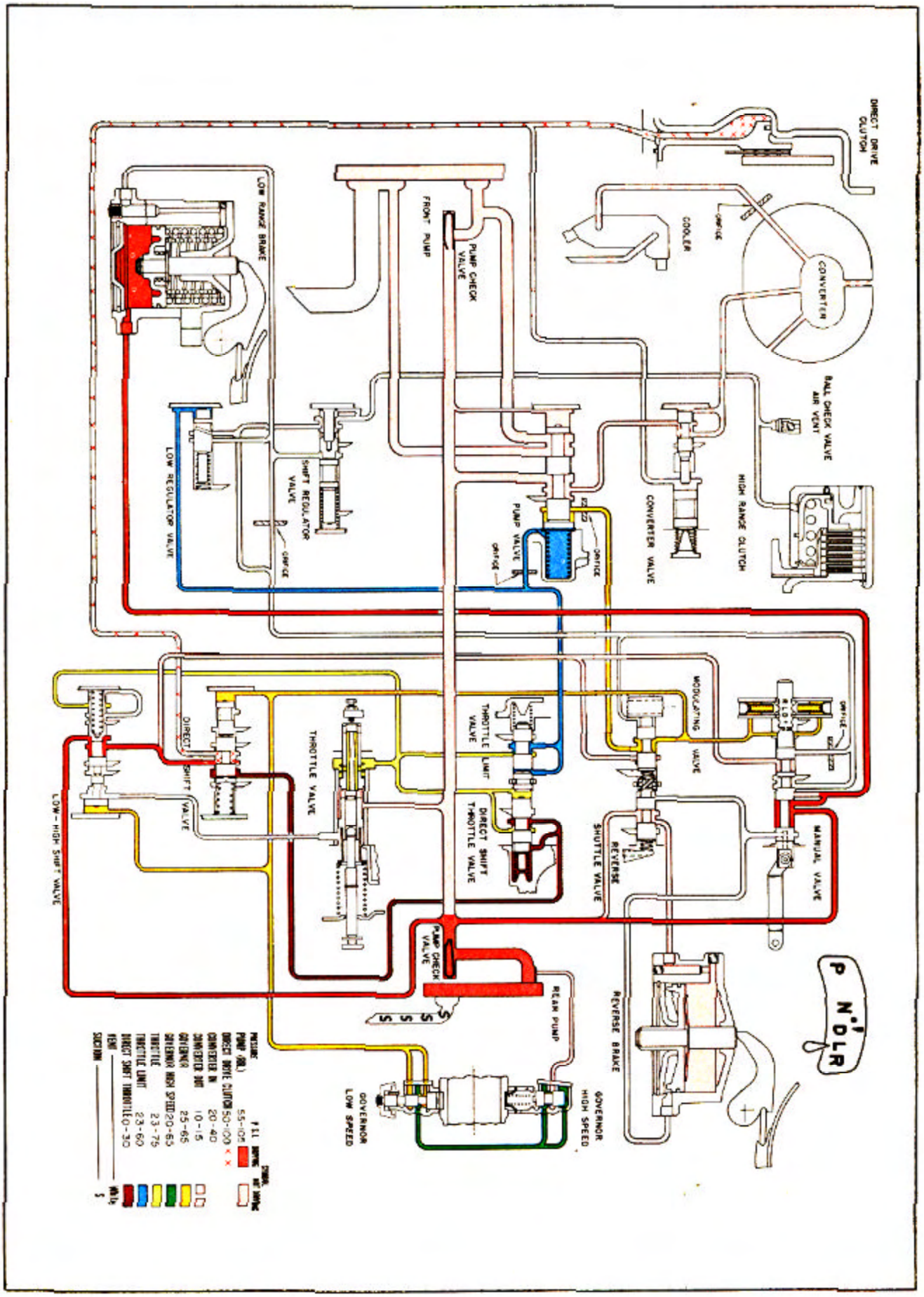


FIGURE 158—*Low Range Direct "Low" Drive*

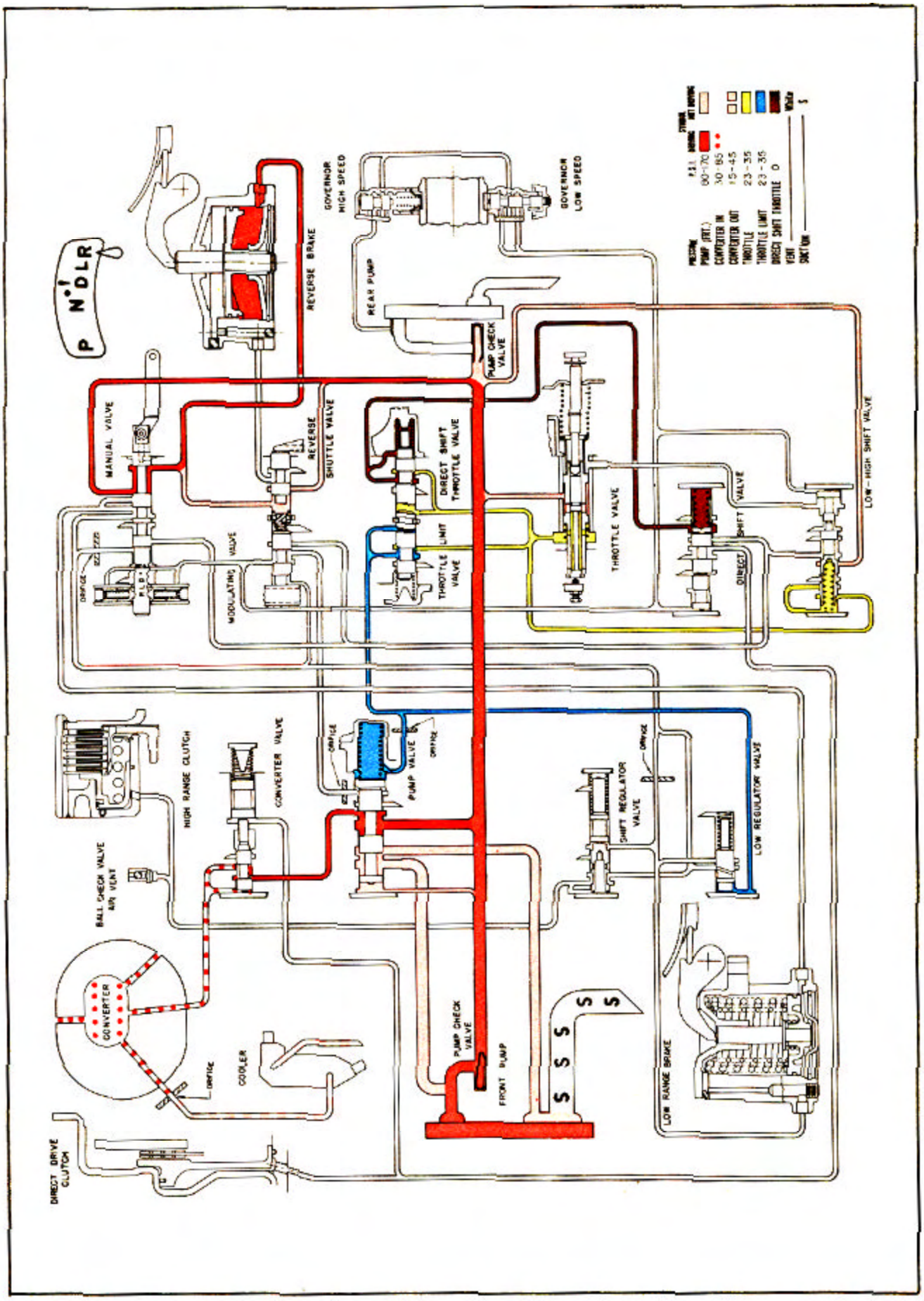


FIGURE 159—*Reverse Drive Range*

ULTRAMATIC TRANSMISSION SHIFT PATTERN IN M.P.H.

"Dot" Drive Position

	Low High	High Drive	Direct Low	Direct High
Light Throttle		16-29		
Full Throttle		47-35		
Part Throttle				39-36
Max. Kickdown				64-57
Closed Throttle				18-12

"Drive" Position

	Low High	High Drive	Direct Low	Direct High
Light Throttle	13-19	16-29		
Full Throttle	32-40	47-35		
Part Throttle				39-56
Max. Kickdown			54-47	64-57
Full Throttle				18-12

"Low" Drive Positiojn

	Low Direct			
Light Throttle	17-28			
Full Throttle	47-54			

HYDRAULIC TESTS

Do not disassemble any unit or assembly until the oil level is checked and filled to level, the car road tested, a hydraulic unit pressure test made, an accurate and precise diagnosis made and the cause of the complaint definitely located or established.

Many times a unit or assembly is disassembled and when the inspection is made, the cause of the complaint cannot be found because the evidence of the cause of the complaint has been lost or destroyed.

Low fluid level can be the cause of many complaints ranging from excessive noise to a noticeable slip in any or all of the operating ranges.

After the oil level is brought up to the full mark, road test the car to determine if correcting the oil level has corrected the complaint. The road test will also warm up the engine and transmission to operating temperature necessary to make an accurate pressure test.

Hydraulic Pressure Test

To diagnose and isolate the cause of the faulty operation, a pressure test should be made of the following hydraulic units:

Front Pump Regulated Pressure
High Range Clutch Pressure
Low Range Brake Top Pressure
Converter "IN" Pressure
Converter "OUT" Pressure
Direct Drive Pressure
Governor Pressure
Throttle Valve Pressure

Fold the floor mat away from the left side of the front seat to uncover the oblong floor hole cover. Remove the cover and insert the flexible pressure gauge lines supplied with Tool J-5975 to the transmission. Remove the brass plug and connect the line fitting to the correct passage for the desired test. These passages are outlined in Figure 160.

Drive the car with frequent stops and starts, at low speed, accelerating, and at medium speeds, similar to the conditions that would exist in driving in heavy traffic and highway driving.

After the engine and transmission are thoroughly warmed up and the nonstandard operation noted, make the hydraulic pressure test as outlined in Figure 160. The pressure readings should conform to those listed under the various selector lever positions and driving speeds.

To test the low range brake and throttle pressures, the following procedure applies:

Drain the transmission fluid in a clean container.

Remove the oil pan and screen and install Pressure Test Set Tool J-5975.

Install the rubber extension tube to the rear pump suction tube. Install the special fitting with the "0" rings to the front pump suction inlet on the valve body. Remove the two Allen screws from the low range brake and rear lower valve body. Then connect the flexible lines to these units and insert the test lines through the elbow tube and install the oil pan.

Insert the rubber plug in the right side of the special test tool and run the flexible lines through the floor hole cover and connect these lines with the test gauges.

Refill the transmission with the oil that was drained and proceed to road test the car. Follow the procedure as outlined in Figure 160.

TWIN ULTRAMATIC TRANSMISSION PRESSURE TESTS

Front Pump (1)—400 RPM—All Selector Positions

80-110 80-110 80-110 80-110 80-110

• (Dot) Position—15 to 20 MPH— Full throttle before Direct Drive engages—Maximum Pressure

150-170

D Position—Full throttle before Direct Drive engages—Maximum Pressure

140-160

High Range Clutch (2)—Pressure should be the same or not more than 10 lbs. under pump pressure.

	P.P.	H.R.C.P.
• (Dot) Position—400 RPM	80-110	70-110
• (Dot) Position—15 to 20 MPH Converter Drive	150-170	145-165
D Position—400 RPM	80-110	0
D Position—20 MPH—Direct Drive		55-65

Low Brake Top (3)—Pressure should be the same or not more than 10 lbs. under pump pressure.

	P.P.	L.B.T.P.
• (Dot) Position—400 RPM	80-110	70-100
D Position—400 RPM	80-110	0
D Position Immediately After Upshift	50-70	40-65

Converter In (4)—400 RPM D Position

30-50

15 MPH "Before Direct Drive"

55-80

Direct Drive Engaged

15-25

Kickdown

70-85

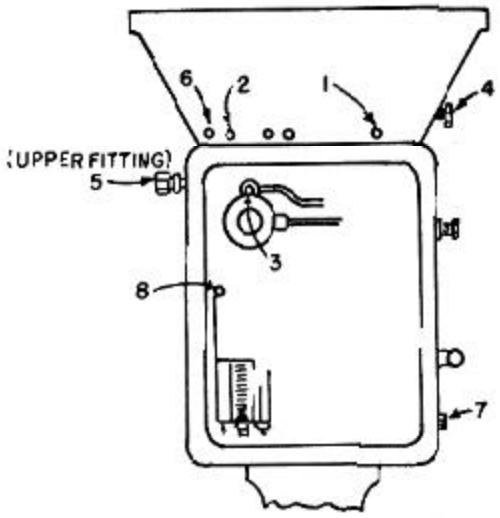
Converter Out (5)—D Position 15 to 28 MPH

Converter Drive

25-40

Direct Drive

10-20



Direct Drive (6)—Pressure should be the same or not more than 10 lbs. under pump pressure

	P.P.	D.D.P.
D Position 15 to 13 MPH Before Engagement	70-100	0
After Engagement	55-65	
Kickdown	140-160	0
Governor (7)—13 MPH	15-20	
28 MPH	30-35	
56 MPH	55-65	
Throttle (3)—400 RPM	23-26	
Full Throttle	65-72	
Kickdown	86-95	

NOTE: • (Dot) Position—Not Gear-Start

D Position—Gear-Start

All pressures taken at normal operating temperature

P.P. — Pump Pressure

H.R.C.P.— High Range Clutch Pressure

L.B.T.P.— Low Brake Top Pressure

D.D.P. — Direct Drive Pressure

FIGURE 160—*Pressure Test Chart*

POSSIBLE DIFFICULTIES AND CORRECTIONS

CONDITIONS	POSSIBLE CAUSE	CORECTIONS
Car fails to move regardless of selector lever position	Insufficient oil	Add oil to proper level
	Clogged inlet screen	Perform front pump pressure test. If little or no pressure is indicated, clean inlet screen
	Converter valve stuck	Perform converter (In) pressure test. If little or no pressure is indicated, free up valve
	Pump valve stuck	Perform front pump pressure test. If little or no pressure is indicated, free up pump valve
	Selector control linkage disconnected	Inspect the selector control linkage. Connect and adjust the linkage
	Transmission output shaft broken loose from planetary cage	Jack up the car and operate the engine with the selector lever in drive position. Apply partial pressure to the brake pedal and accelerate the engine. If the propeller shaft does not rotate, it is an indication of an output shaft broken loose from the planetary cage. If this condition exists, the test will be accompanied by a grating noise in the transmission
	Parking gear lever spring broken. This might allow the pawl to remain engaged in the parking gear	Jack up the car and try to rotate the propeller shaft by hand. If the propeller shaft cannot be rotated, it is possible that the parking gear pawl is still engaged
	Low and reverse bands adjusted too tight	Adjust the low and reverse bands properly
	Bushings or bearings seized in the transmission. Noise may or may not be present	Disassemble the transmission. Inspect all bearings or bushings and replace all faulty parts
Car fails to move in drive range with the selector lever pointed under the letter "D"	Insufficient oil	Add oil to the proper level
	Selector control linkage disconnected or out of adjustment	Connect the selector control linkage and adjust properly
	Loss of pressure to the apply side of the low range brake	Check for obstruction in the low range brake to inlet opening in brake housing

POSSIBLE DIFFICULTIES AND CORRECTIONS (Continued)

CONDITIONS	POSSIBLE CAUSE	CORECTIONS
	Low range brake band strut out of position	Remove oil pan and place strut in proper position
	Low range brake band badly worn	Replace brake band
Car fails to move in "Dot" drive range with the indicator pointed at the dot position	Rubber lip seal on high range clutch piston out of position causing piston to stick	Perform high range clutch pressure test. If pressure is normal, disassemble high range clutch and check position of rubber seal
	Shift regulator valve stuck	Perform high range clutch pressure test. If little or no pressure exists, free up shift regulator valve
	Burned or worn clutch plates	If high range clutch pressure is normal, but car fails to move, the high range clutch plates may be worn or burned. Disassemble the high range clutch
	Selector control linkage disconnected	Connect the selector control linkage properly and adjust
Car fails to move with the selector lever in manual low "L" position	Selector control linkage out of adjustment or not hooked up	Connect the control linkage and adjust properly
	Badly worn low range band or band strut out of position	Remove oil pan, check band, and correct as necessary
	Low range brake piston jammed	Remove oil pan and reverse brake and disassembly brake. Correct as required
	Insufficient oil pressure to the apply side of the low range brake	Check for obstruction in inlet opening in brake housing and also for inlet tube being in proper position
Car fails to move with the selector lever in the reverse "R" position	Selector control linkage not hooked up or out of adjustment	Hook up linkage or adjust properly
	Excessively worn reverse brake band or strut out of position	Remove oil pan and check band and correct as necessary

POSSIBLE DIFFICULTIES AND CORRECTIONS (Continued)

CONDITIONS	POSSIBLE CAUSE	CORECTIONS
	Manual valve stop inside transmission not adjusted properly allowing the manual valve to over-travel	Remove oil pan and adjust manual valve stop properly
	Lack of oil to the apply side of the reverse brake piston caused by a stuck reverse shuttle valve	Remove valve body and free up reverse shuttle valve
	Reverse brake piston stuck in housing	Remove reverse brake, free up piston
Excessive slippage in all ranges	Insufficient oil	Check oil level and bring up to full mark
	Low front oil pump pressure due to sticking pump valve	Perform front pump pressure test if little or no pressure is indicated. Check pump valve
	Low front oil pump pressure due to ball plugs being out of low range brake housings	Perform front pump pressure test. If the pump pressure is too low, check both brake housings for having the ball plugs in place
	Low oil pressure to the converter caused by stuck converter valve	Perform converter "In" pressure test. If pressure is too low, remove valve body and check converter valve for being free
	Low front pump pressure due to worn or badly scored rotors	Remove the front pump and check the condition of the rotors
Excessive drag in "Dot" drive range using high range clutch start. Also drags in reverse but is OK in low range	Low range brake band too tight	Adjust the low range brake band properly
	Low range brake piston stuck holding the brake partly applied	Free up low range brake piston. Also check piston ring for being properly gapped
	Transfer tube to release side of low range brake out of position	Remove oil pan and check position of transfer tube
Excessive drag in both "Dot" drive and "D" range. OK in reverse	Reverse brake band too tight	Adjust reverse band properly
	Reverse brake piston stuck holding the brake partly applied	Free up reverse brake piston. Also check piston ring for being properly gapped

POSSIBLE DIFFICULTIES AND CORRECTIONS (Continued)

CONDITIONS	POSSIBLE CAUSE	CORECTIONS
Car creeps forward in neutral	Low range brake band too tight	Adjust the low range brake band properly
	High range clutch plates sticking on splines	Disassemble high range clutch and free up clutch plates
	High range clutch piston rubber lip seal out of position causing the piston to stick and partly engage the clutch	Disassemble the high range clutch and install a new lip seal properly
Car creeps excessively engine idling	Engine idling too fast	Set engine idle to specifications
Car creeps forward when the selector lever is in reverse	Manual valve linkage out of adjustment	Adjust the manual valve linkage properly
Car does not move with the selector lever in the reverse position	Reverse shuttle valve stuck preventing the oil above the reverse brake piston from venting	Remove the control body and free up the reverse shuttle valve
	Reverse brake band strut out of position	Remove the oil pan and position. the strut properly
Chatter when starting drive "D" range using high range clutch start	Low range brake band dragging	Adjust the low range brake band properly
	Reverse Brake band dragging	Adjust the reverse brake band properly
	Worn, burned, or distorted high range clutch plates. Could also be caused by sticking plates or piston	Disassemble the high range clutch. Install new clutch plates or correct as necessary
Chatter when starting in low range	Low range brake band out of adjustment	Adjust low range brake band properly
	Reverse brake band dragging	Adjust reverse brake band properly
	Sticking high range clutch plates or piston	Disassemble the high range clutch. Free up clutch plates or piston or install new parts as necessary
Chatter when starting in reverse	Reverse brake band out of adjustment	Adjust reverse brake band properly

POSSIBLE DIFFICULTIES AND CORRECTIONS (Continued)

CONDITIONS	POSSIBLE CAUSE	CORECTIONS
	Low range brake band dragging	Adjust low range brake band properly
	Sticking high range clutch plates or piston	Disassemble the high range clutch. Free up clutch plates or piston or install new parts as necessary
	Reverse drum (ring gear) bushing badly worn	Remove planetary assembly. Replace ring gear bushing
Direct drive clutch fails to engage	Sticking high speed governor valve, low speed governor valve or direct shift valve. Could also be caused by direct shift throttle valve sticking	Check the governor pressure and the direct drive clutch pressure. If no direct drive clutch pressure is indicated and governor pressure is normal, the direct shift valve or direct shift throttle valve is probably sticking. If no governor pressure exists or is very low, either of the governor valves may be sticking. Free up valves as necessary
	Direct drive clutch piston sticking	If governor pressure and direct drive clutch pressures are normal, disassemble converter and check for sticking direct drive clutch piston
Direct drive clutch "hangs on" or fails to release on deceleration	Sticking direct shift valve or low speed governor valve	Perform direct drive clutch and governor pressure tests. If on deceleration the governor pressure lowers but the direct drive clutch pressure remains constant, check for sticking direct shift valve. If both pressures do not lower, check for sticking low speed governor valve
Direct drive clutch engages late and disengages early	Direct shift valve spring "cocked" in valve bore	Remove valve body and relocate spring
	Direct shift throttle valve sticking open	Remove valve body and free up direct shift throttle valve
Direct drive clutch slips	Excessive leakage in the direct drive clutch circuit	Perform direct drive clutch pressure test. If pressure is low, check for loose or worn bushings or broken piston inner ring
	Sticking converter valve resulting in high converter pressure while in direct drive	Perform converter (In) pressure test. If pressure is too high, free up converter valve

POSSIBLE DIFFICULTIES AND CORRECTIONS (Continued)

CONDITIONS	POSSIBLE CAUSE	CORECTIONS
Transmission remains in low range using gear-start drive "D" position. Will not upshift from low range converter to high range converter	Sticking low-high shift valve or sticking governor valves	Perform high range clutch and governor pressure test. If governor pressure is normal but high range clutch pressure cannot be obtained, check for sticking low-high shift valve. If no high range clutch pressure exists and governor pressure is low, check for sticking governor valve
	Sticking throttle valve	Perform front pump and throttle pressure tests. If both pressures always remain the same, check for sticking throttle valve
Incorrect front oil pump pressure	Low oil level	Bring oil up to proper level
	Sticking pump valve	Free up pump valve
	Ball plugs missing in reverse brake housing	Install and stake ball plugs or replace housing
	Sticking pump check valves	Free up check valves
	Incorrect pump valve spring	Install correct spring
	Sticking modulating valve	Free up modulating valve
Incorrect high range clutch pressure	Sticking shift regulator valve	Free up shift regulator valve
	Sticking low-high shift valve	Free up low-high shift valve
	Incorrect pump pressure	Remedy cause for incorrect pump pressure
Incorrect low range top pressure	Ball plug missing in low range brake housing	Install and stake ball plug or replace brake housing
	Sticking low-high shift valve	Free up low-high shift valve
	Incorrect pump pressure	Remedy cause for incorrect pump pressure
	Threaded plug missing in low range brake housing	Install plug in housing
Incorrect converter (In) pressure	Incorrect front pump pressure Sticking converter valve	Remedy cause for incorrect front pump pressure
	Loss of pressure in the converter circuit caused by loose or worn bushings	Free up converter valve Replace bushings as necessary

POSSIBLE DIFFICULTIES AND CORRECTIONS (Continued)

CONDITIONS	POSSIBLE CAUSE	CORECTIONS
Incorrect direct drive clutch pressure	Sticking governor valves or sticking direct shift valve	Perform governor and direct drive clutch pressure tests. If both pressures are incorrect, check for sticking governor valves. If governor pressure is normal but direct drive clutch pressure is incorrect, check for sticking direct shift valve
	Worn or leaking direct drive clutch piston rings	Check condition of all rings and replace as necessary
	Loss of pressure through direct drive clutch circuit caused by loose or worn bushings	Replace bushings as necessary
Incorrect governor pressure	Sticking low or high speed governor valves	Free up governor valves
	Governor housing plate not properly installed	Install housing plate properly
Incorrect throttle pressure	Throttle pressure adjustment improperly set	Adjust throttle pressure as specified
	Throttled linkage not properly adjusted or binding	Free up linkage and adjust properly
	Throttle valve sticking	Free up throttle valve

TWIN ULTRAMATIC TORQUE SPECIFICATIONS

Direct Driven Plate Retaining Screws	18 to 20 Foot Pounds
Second Turbine Attaching Screws	12 to 15 Foot Pounds
Converter Pump to Clutch Housing Nuts	20 to 25 Foot Pounds
Rear Pump Cap Screws	15 to 18 Foot Pounds
Front Oil Pump to Bell Housing Screws	15 to 18 Foot Pounds
Rear Adapter Housing Retaining Screws	15 to 18 Foot Pounds
Output Shaft Long Flange Bolt	35 to 40 Foot Pounds
Control Valve Assembly Attaching Screws	1/2" Diameter-9 Foot Pounds 7/16"-Diameter-5 Foot Pounds
Tighten Both the Reverse and Low Range Brake Band Adjusting Screws to 20 Foot Pounds. Back the Screws Out 1-3/4 Turns and Tighten Lock Nuts	
Bell Housing to Flywheel Housing Bolts	25 to 30 Foot Pounds
Flywheel Housing Lower Cover to Flywheel Housing Bolts	15 to 18 Foot Pounds
Bell Housing to Case	55 to 60 Foot Pounds
Oil Pan Retaining Screws (21)	10 to 12 Foot Pounds