GROUP 5

SUPER TURBINE "400" AUTOMATIC TRANSMISSION

SECTION IN GROUP 5

SECTION 5-A

AUTOMATIC TRANSMISSION SPECIFICATION AND OPERATION

CONTENTS OF SECTION 5-A

5-1 AUTOMATIC TRANSMISSION GENERAL SPECIFICATIONS

a. Transmission Identification Number

A production identification number is stamped on a metal tag, located in the lower left side of the transmission case.

The production code number is located along the bottom of the tag. Since the production identification number furnishes the key to construction and interchangeability of parts in each transmission, the number should be used when selecting replacement parts as listed in the master parts list. The number should always be furnished on product reports, AFA forms, and all correspondence with the factory concerning a particular transmission.

b. General Specifications

Oil Capacity	19.2 Pints
Oil Capacity indicated between Marks on Gauge Rod	1 Pint
Oil Specification	Automatic Transmission Fluid Type A, Plus a Number and Suffix A
Drain and Refill Mileage and Change Filter Recommendations	24,000 Mi.
Change Filter at every MAJOR Overhaul	

Use a reliable torque wrench to tighten the attaching bolts or nuts of the parts listed below.

NOTE: These specifications are for clean and lubricated threads only. Dry or dirty threads produce increased friction which prevents accurate measurement of tightness.

Location	Thread Size	Torque Ft. Lbs.
Solenoid Assembly to Case	1/4-20	6-10
Valve Body to Case	1/4-20	6-10
Pump Body to Cover	5/16-18	15-20
Pump Body to Cover	5/16-18	15-20
Pump Assembly to Case	5/16-18	15-20
Rear Servo Cover to Case	5/16-18	15-20
Governor Cover to Case	5/16-18	15-20
Parking Brake Bracket to Case	5/16-18	15-20
Vacuum Modulator Retainer to Case	5/16-18	15-20
Valve Body to Case	5/16-18	6-10
Oil Pan to Case	5/16-18	10-13
Case Extension to Case	3/8-16	20-25

5-2 DESCRIPTION AND MECHANICAL OPERATION

The Super Turbine Automatic 400 Transmission, is a fully automatic unit consisting primarily of a 3-element hydraulic torque converter and a compound planetary gear set. Three multiple-disc clutches, two sprag units, and two bands provide the friction elements required to obtain the desired function of the compound planetary gear set.

The 3-element torque converter consists of a pump, turbine and a variable pitch stator assembly. The stator blades can be operated in two different positions, maximum or high angle and minimum or low angle. The stator is mounted on a one way roller clutch which will allow the stator to turn clockwise but not counterclockwise.

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

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

High stator blade angle means greater redirection of the oil and increased engine speed and torque multiplication for maximum performance. At engine idle it reduces the efficiency of the converter which reduces "creep".

Low angle results in a more efficient converter for coupling operation.

As turbine speed increases, the direction of the oil leaving the turbine changes and flows against the rear side of the stator vanes in a clockwise direction. Since the stator is now impeding the smooth flow of oil, its roller clutch releases and it revolves freely on its shaft. Once the stator becomes inactive, there is no further multiplication of engine torque within the converter. At this point, the converter is merely acting as a fluid coupling as both the converter pump and turbine are being driven at approximately the same speed - or at a one-to-one ratio.

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

External control connections to transmission are:

Manual Linkage - To select the desired operating range.

Engine Vacuum - To operate a vacuum modulator unit.

12 Volt Electrical Signal - To operate an electrical detent solenoid and stator solenoid.

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

The detent solenoid is activated by an electric switch on the carburetor. When the throttle is fully open, the switch on the carburetor is closed, activating the detent solenoid and causing the transmission to downshift at speeds below approximately 70 MPH.

The stator control solenoid is activated by a signal from a switch on the carburetor linkage at engine idle which changes the stator blade angle from low to high. It is also energized at 48° and over of carburetor opening by a switch on the carburetor linkage to change the stator blades from low angle to high angle.

The selector quadrant has six selector positions: P, R, N, DR, L^2, L^1.

P. - Park position positively locks the output shaft to the transmission case by means of a locking pawl to prevent the vehicle from rolling either direction. This position should be selected whenever the driver leaves the vehicle. The engine may be started in park position.

R. - Reverse enables the vehicle to be operated in a reverse direction.

N. - Neutral position enables the engine to be started and run without driving the vehicle.

DR. - Drive range is used for all normal driving conditions and maximum economy.

Drive range has three gear ratios, from the starting ratio to direct drive. Detent downshifts are available for safe passing by depressing the accelerator to the floor.

L^2 - L^2 range adds new performance for congested traffic or hilly terrain. L^2 range has the same starting ratio as drive range, but prevents the transmission from shifting above second speed to retain second speed acceleration when extra performance is desired. L^2 range can also be used for engine braking.

L^2 range can be selected at any vehicle speed, and the transmission will shift to second gear and remain in second until the vehicle speed or the throttle are changed to obtain first gear operation in the same manner as in DR. range.

L^1. - L^1 range can be selected at any vehicle speed and the transmission will shift to second gear and remain in second until vehicle speed is reduced to approximately 40 MPH, depending on axle ratio.

L^1 range position prevents the transmission from shifting out of first gear. This is particularly beneficial for maintaining maximum engine braking when continuous first gear operation is desirable.

a. Neutral—Engine Running

In neutral, all clutches and bands are released; therefore no power is transmitted from the torque converter turbine to the planetary gear train and output shaft.

b. Drive Range—First Speed

With the selector lever in Drive Range, the forward clutch is applied. This delivers turbine torque to the mainshaft and turns the rear internal gear in a clockwise direction. (Converter torque ratio = approximately 2.:1. at stall.)

Clockwise motion of the rear internal gear causes the rear pinions to turn clockwise to drive the sun gear counterclockwise. In turn, the sun gear drives the front pinions clockwise, thus turning the front internal gear, output carrier, and output shaft clockwise in a reduction ratio of approximately 2.5:1. The reaction of the front pinions against the front internal gear is taken by the reaction carrier and sprag assembly to the transmission case. See Figure 5-200. (Approximate stall ratio = 5. :1.)

c. Drive Range—Second Speed

In second speed, the intermediate clutch is applied to allow the intermediate sprag to hold the sun gear against counterclockwise rotation. Turbine torque through the forward clutch is now applied through the mainshaft to the rear internal gear in a clockwise direction.

Clockwise rotation of the rear internal gear turns the rear pinions clockwise against the stationary sun gear. This causes the output carrier and output shaft to turn clockwise in a reduction ratio of approximately 1.5:1. See Figure 5-201.

d. Drive Range—Third Speed

In direct drive, engine torque is transmitted to the converter through the forward clutch to the mainshaft and rear internal gear. Because the direct clutch is applied, equal power is also transmitted to the sun gear shaft and the sun gear. Since both the sun gear and internal gears are now turning at the same speed, the planetary gear set is essentially locked and turns as one unit in direct drive or a ratio of 1 :1. See Figure 5-203.

e. Low—L^2 Range—Second Speed

In second speed, the intermediate clutch is applied to allow the intermediate sprag to hold the sun gear against counterclockwise rotation. Turbine torque through the forward clutch is now applied through the mainshaft to the rear internal gear in a clockwise direction.

Clockwise rotation of the rear internal gear turns the rear pinions clockwise against the stationary sun gear. This causes the output carrier and output shaft to turn clockwise in a reduction ratio of approximately 1.5:1.

In second speed, overrun braking is provided by the front band as it holds the sun gear fixed. Without the band applied, the sun gear would overrun the intermediate sprag. See Figure 5-204.

f. Low—L^1 Range—First Speed

With the selector lever in L^1 Range, the forward clutch is applied. This delivers turbine torque to the mainshaft and turns

Figure 5-200—Drive Range First Speed

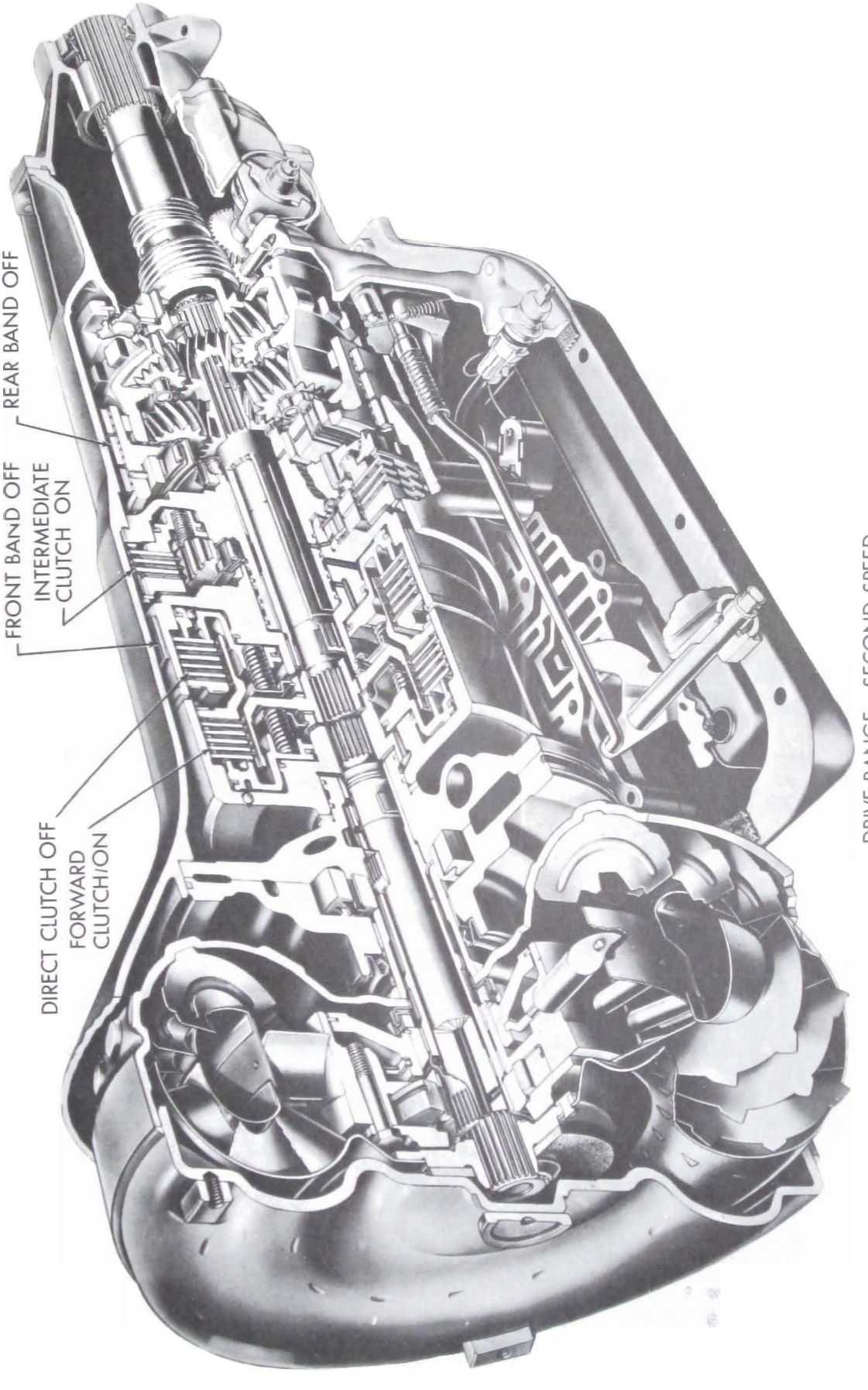

Figure 5-201—Drive Range - Second Speed

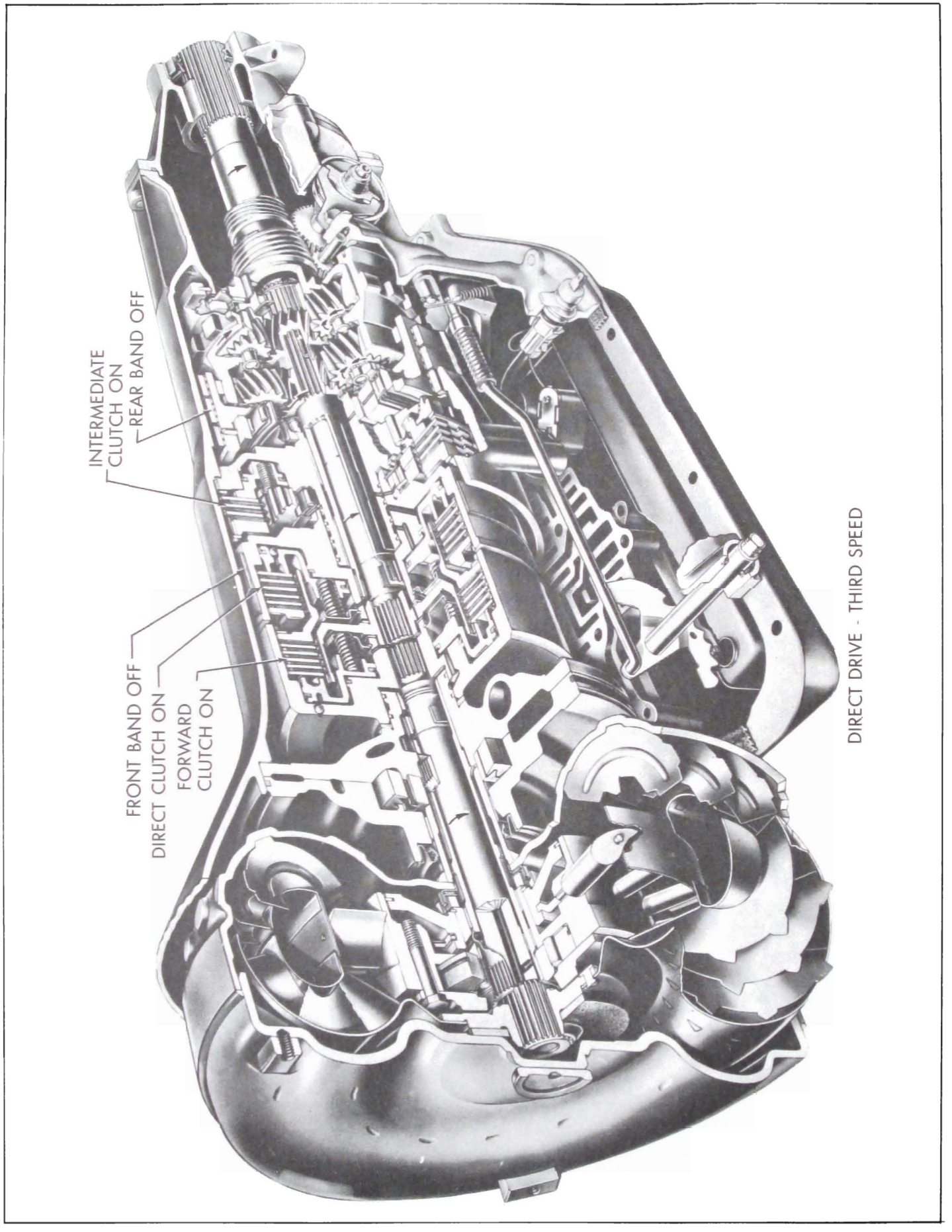

Figure 5-203—Drive Range - Third Speed

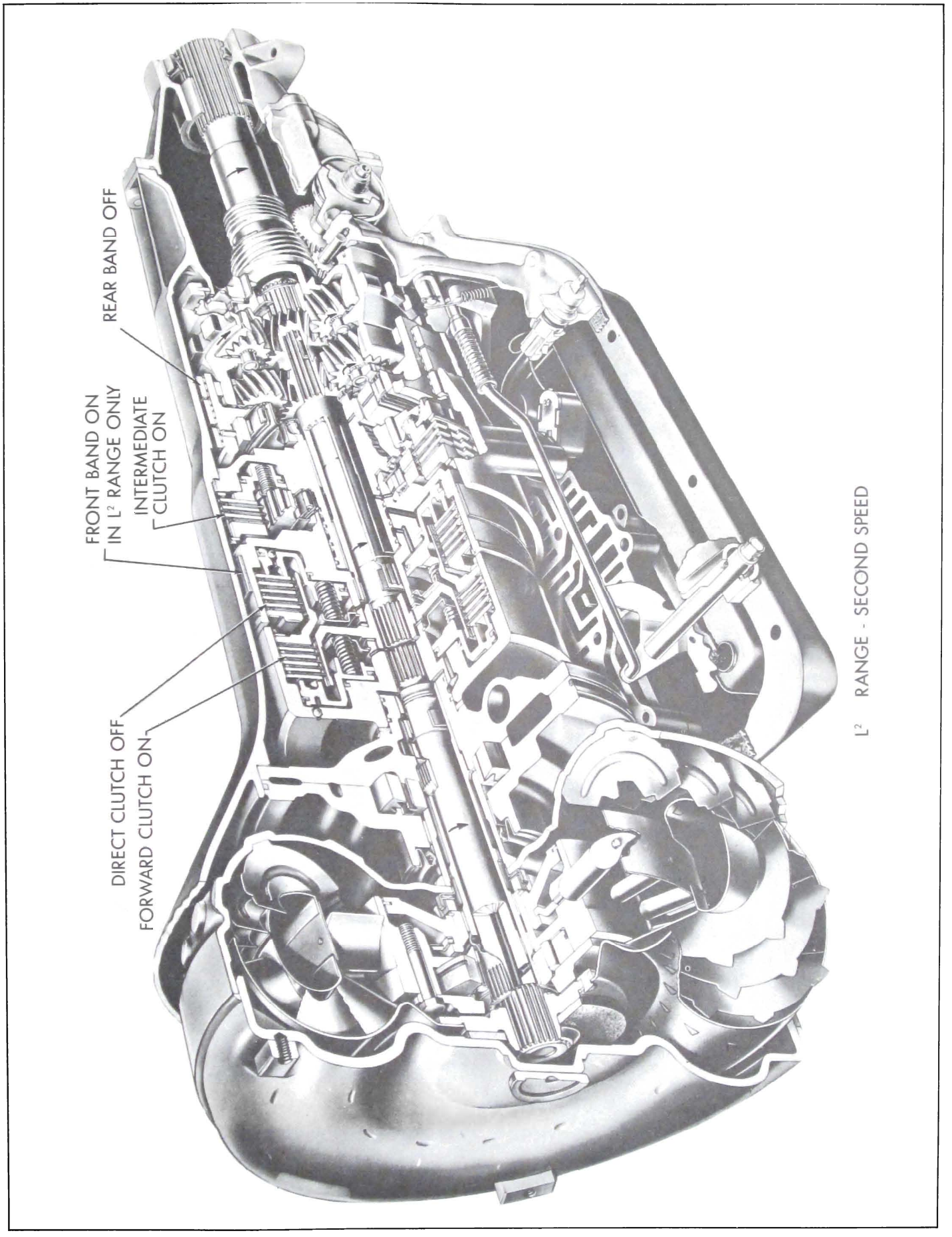

Figure 5-204—Low L² Range Second Speed

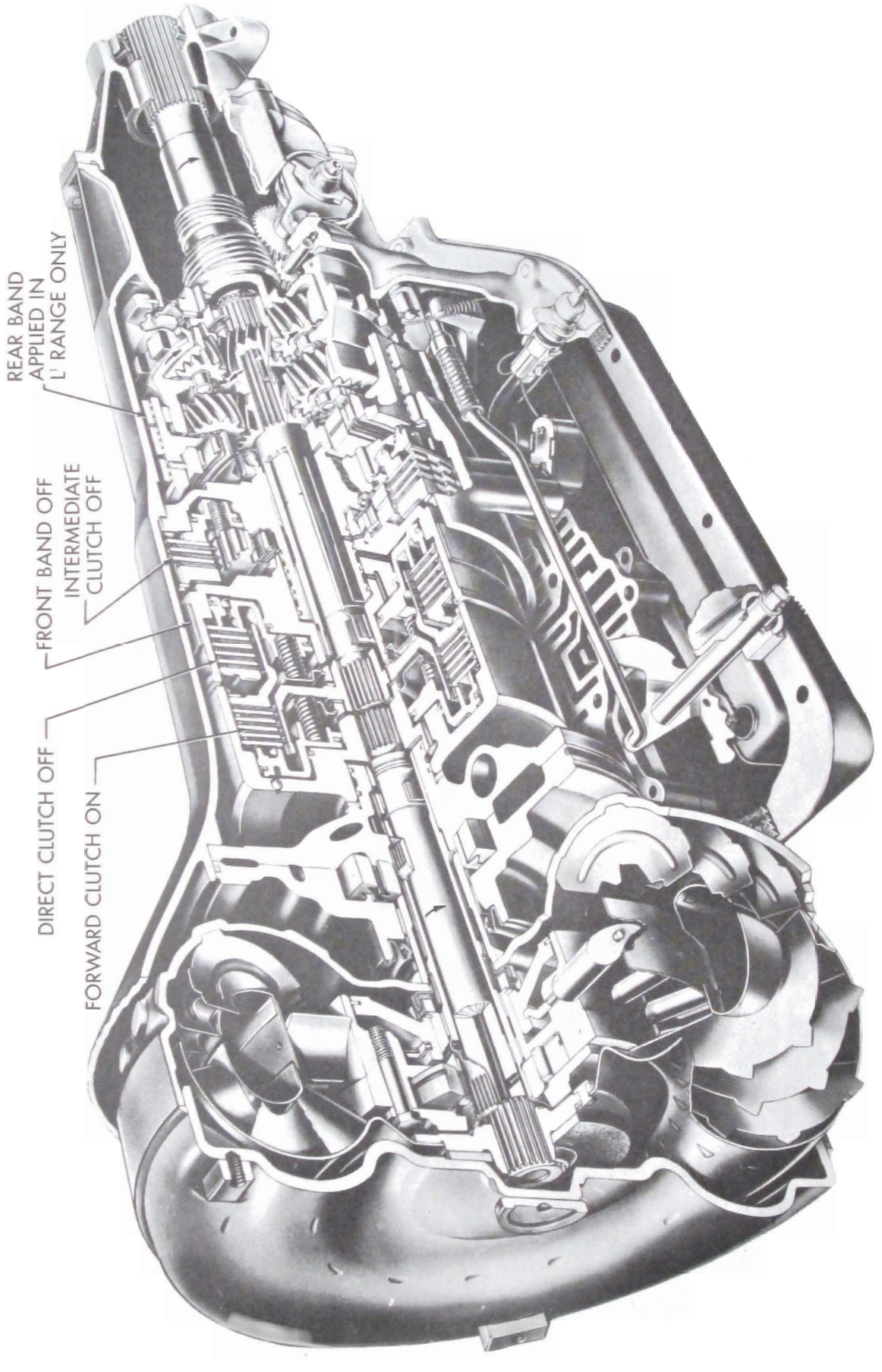

Figure 5-205—Low L1 Range - First Speed

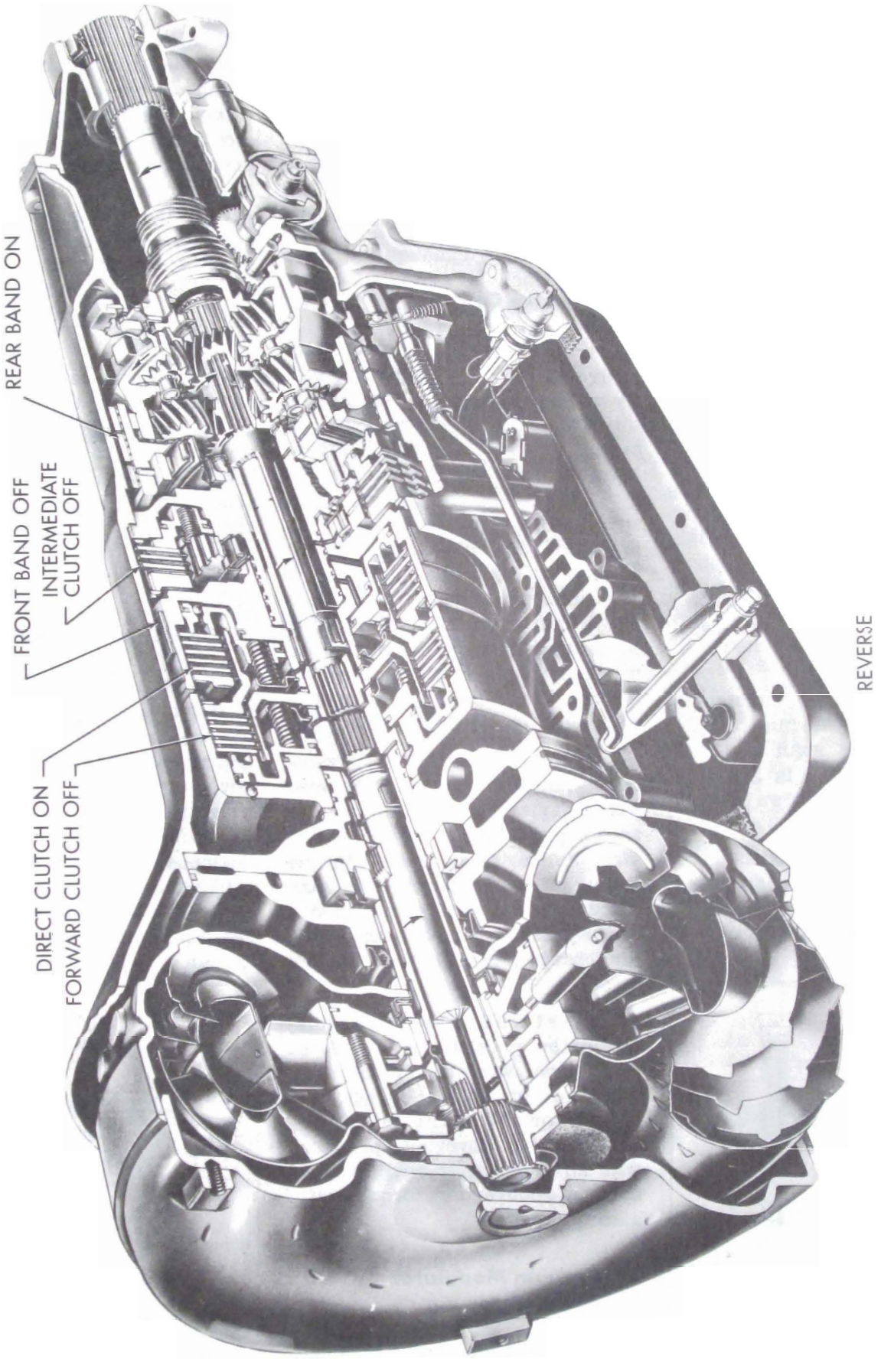

Figure 5-206—Reverse

the rear internal gear in a clockwise direction. (Converter torque ratio = approximately 2. :1. at stall.)

Clockwise motion of the rear internal gear causes the rear pinions to turn clockwise to drive the sun gear counterclockwise. In turn, the sun gear drives the front pinions clockwise, thus turning the front internal gear, output carrier, and output shaft clockwise in a reduction ratio of approximately 2.5:1. The reaction of the front pinions against the front internal gear is taken by the reaction carrier and sprag assembly to the transmission case. (Total stall ratio = approximately 5. :1.)

Downhill or overrun braking is provided in Lo Range by applying the rear band as this prevents the reaction carrier from overrunning the Low sprag. See Figure 5-205.

g. Reverse

In Reverse, the direct clutch is applied to direct turbine torque to the sun gear shaft and sun gear. The rear band is also applied, holding the reaction carrier.

Clockwise torque to the sun gear causes the front pinions and front internal gear to turn counterclockwise in reduction. The front internal gear is connected directly to the output shaft, thus providing the reverse output gear ratio of approximately 2. :1. The approximate reverse torque multiplication at stall (converter and gear ratios) is approximately 4. :1. See Figure 5-206.

5-3 HYDRAULIC OPERATION

a. Pressure Control

The transmission is automatically controlled by a hydraulic system. Hydraulic pressure is supplied by the transmission gear type oil pump, which is engine driven. Main line pressure is controlled by a pressure regulator valve train located in the pump. This regulator controls line pressure automatically, in response to a pressure signal from a modulator valve, in such a way that the torque requirements of the transmission are met and smooth shifts are obtained at all throttle openings. See Figure 5-207.

To control line pressure properly, a modulator pressure is used which varies in the same manner as torque input to the transmission. Since the converter torque output is the product of engine torque and converter ratio, modulator pressure must compensate for changes in either or both of these.

To meet these requirements, modulator pressure is regulated by engine vacuum which is an indicator of engine torque and carburetor opening. It is decreased by governor pressure with an increase in vehicle speed because converter torque ratio also decreases.

b. Vacuum Modulator Assembly

The engine vacuum signal is provided by the vacuum modulator, which consists of an evacuated metal bellows, a diaphragm and springs. These are so arranged that when installed, the bellows and one spring apply a force which acts on the modulator valve. This force acts on the modulator valve so that it increases modulator pressure. Engine vacuum and the other spring act in the opposite direction to decrease modulator, or low engine vacuum, high modulator pressure; high engine vacuum, and low modulator pressure. See Figure 5-208.

To reduce the effect of altitude on shift points, the effective area of the diaphragm is made somewhat larger than that of the bellows. Atmospheric pressure then acts on the resulting differential area to reduce modulator pressure.

c. Governor Assembly

The vehicle speed signal to the modulator valve is supplied by the transmission governor, which is driven by the output shaft. The governor consists of two flyweights and a regulator valve. Centrifugal force of the flyweights is imposed on the regulator valve, causing it to regulate a pressure signal that increases with speed. See Figure 5-210.

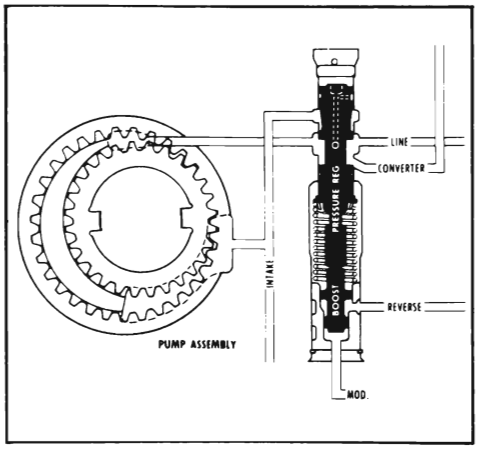

Figure 5-207—Pump and Pressure Regulator Valve

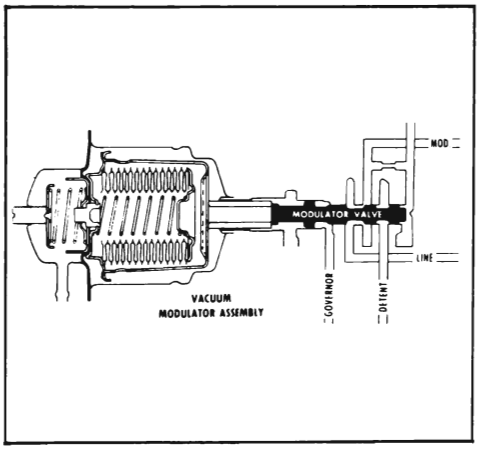

Figure 5-208—Vacuum Modulator Assembly

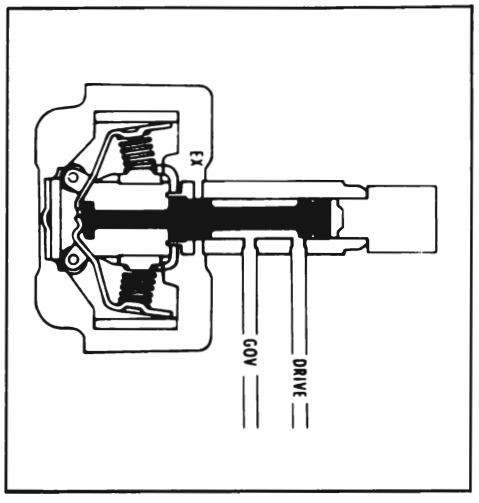

Figure 5-210—Governor Assembly

Centrifugal force is proportional to the square of vehicle speed. This means that a given change in vehicle speed results in a smaller change in governor pressure at low speeds than at high speeds. Because of this characteristic a governor with a single weight only is less accurate at low speed than at high speed. To increase the accuracy of the governor signal at low speeds, the flyweights are so designed that their effective mass is greater at speeds below approximately 720 output RPM than it is above this speed.

This is done by dividing each flyweight into two parts and arranging them so that the primary weights act through preloaded springs on the secondary weights, which in turn acts on the valve. At approximately 720 RPM the centrifugal force on each primary weight exceeds the spring force and the primary weights move to a grounded stop. With the primary weights grounded, the force on the governor regulator valve is equal to the spring forces plus the centrifugal force on the secondary weights.

Governor pressure acts on the modulator valve to cause modulator pressure to decrease as vehicle speed increases.

5-4 FUNCTIONS OF VALVE AND HYDRAULIC CONTROL UNITS

1. Pressure Regulator

a. Regulates line pressure according to a fixed spring force and forces controlled by modulator and reverse pressure. See Figure 5-211.

b. Controls the flow of oil that charges the torque converter, feeds the oil cooler and provides lubrication for the transmission.

2. Manual Valve

Establishes the range of transmission operation, i.e. P, R, N, D, L^2, L^1 as selected by the vehicle operator through the manual selector lever. See Figure 5-212.

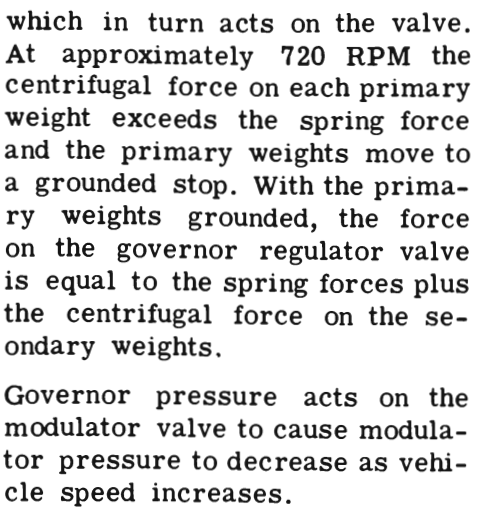

Figure 5-213—Governor Assembly

3. Governor Assembly

Generates a speed sensitive oil pressure that increases with output shaft or vehicle speed. Governor pressure is used to vary the shift points and modulator pressure regulation. See Figure 5-213.

4. Modulator Valve

Regulates line pressure to modulator pressure that varies with torque to the transmission. See Figure 5-214. It senses forces created by:

a. The vacuum modulator bellow that increases modulator pressure.

b. Engine vacuum acting on a diaphragm to decrease modulator pressure.

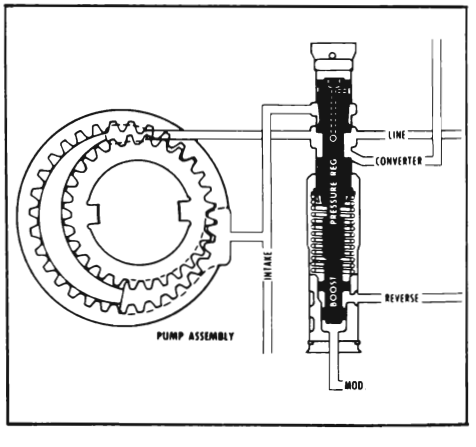

Figure 5-211—Pressure Regulator

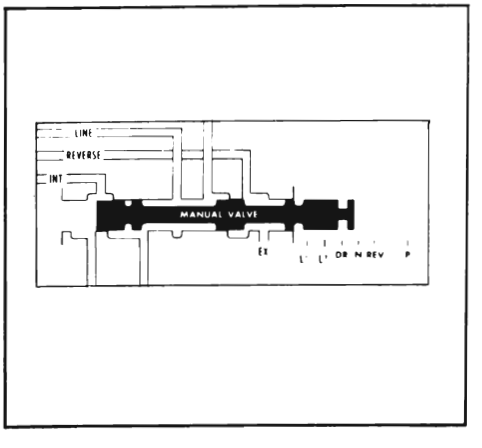

Figure 5-212—Manual Valve

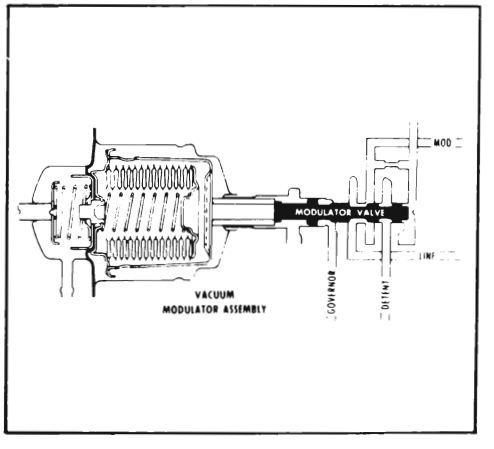

Figure 5-214—Vacuum Modulator Valve

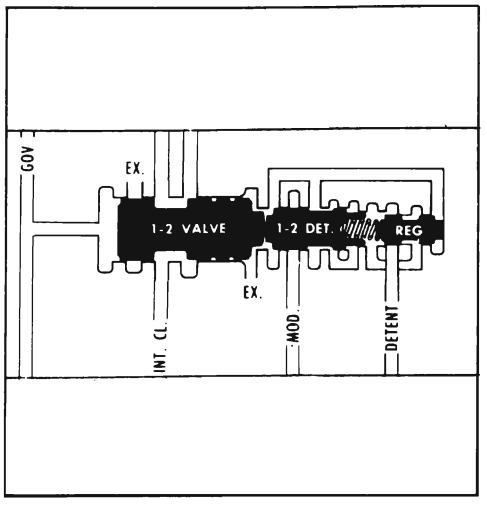

Figure 5-215—1-2 Shift Valve and 1-2 Modulator Valve

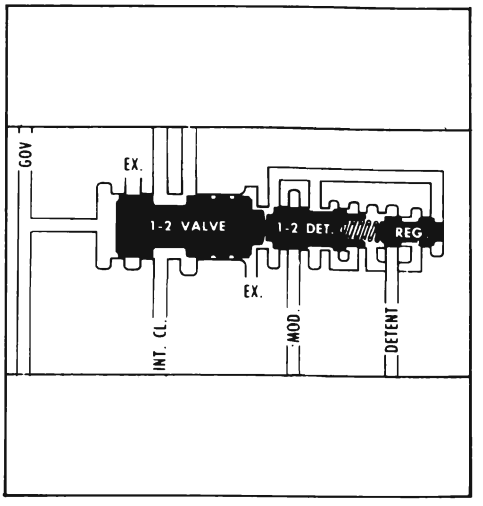

Figure 5-217

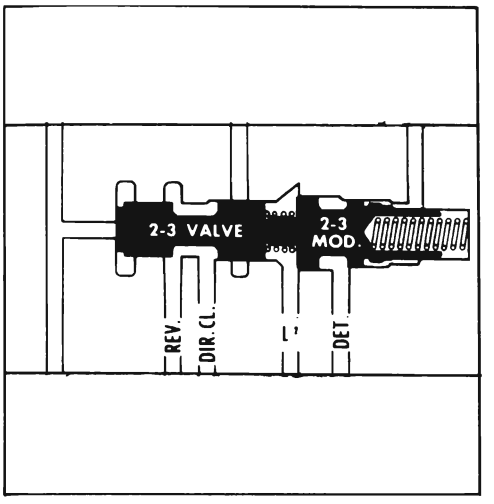

Figure 5-220

c. Governor pressure which is generated by the governor assembly. Governor pressure tends to decrease modulator pressure.

5. 1-2 Shift Valve

Controls the oil pressure that causes the transmission to shift from 1-2 or 2-1. Its operation is controlled by governor pressure, detent pressure, modulator pressure, and a spring force. See Figure 5-215.

6. 1-2 Regulator Valve

Regulates modulator pressure to a pressure proportional to modulator pressure, tending to keep the 1-2 shift valve in the downshift position. See Figure 5-216.

7. 1-2 Detent Valve

Senses regulated modulator pressure tending to hold the 1-2 shift valve in the downshift position and provides an area for detent pressure for detent 2-1 shifts. See Figure 5-217.

8. 2-3 Shift Valve

Controls the oil pressure that causes the transmission to shift from 2-3 or 3-2. Its operation is controlled by modulator, intermediate governor and detent pressure as well as a spring force. See Figure 5-218.

9. 2-3 Modulator Valve

Senses modulator pressure to apply a variable force proportional to modulator pressure which tends to hold the 2-3 shift valve down-shifted. See Figure 5-220.

10. 3-2 Valve

Shuts off modulator pressure from acting on the shift valve trains after the direct clutch has been applied. This allows heavy throttle operation in third speed without downshifting. In third speed detent pressure can be directed to the shift valves to provide the downshift forces. See Figure 5-221.

11. Detent Valve

Shifts when line oil is exhausted at the end of the valve when the detent solenoid is energized. This directs detent pressure to the 1-2 and 2-3 modulator valves, and

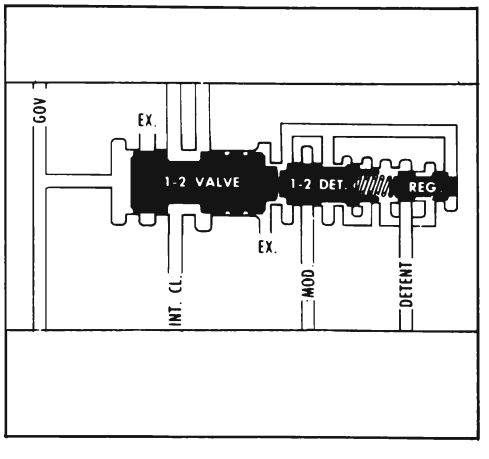

Figure 5-216

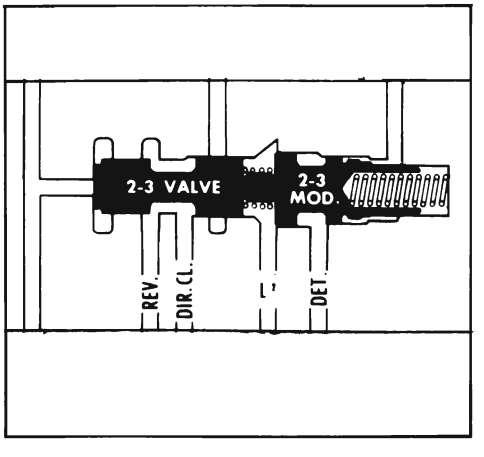

Figure 5-218

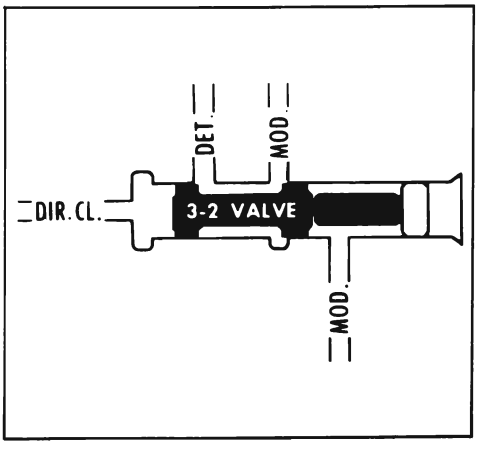

Figure 5-221

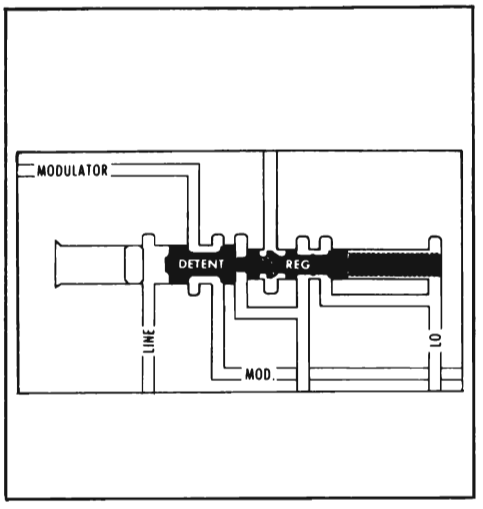

Figure 5-222

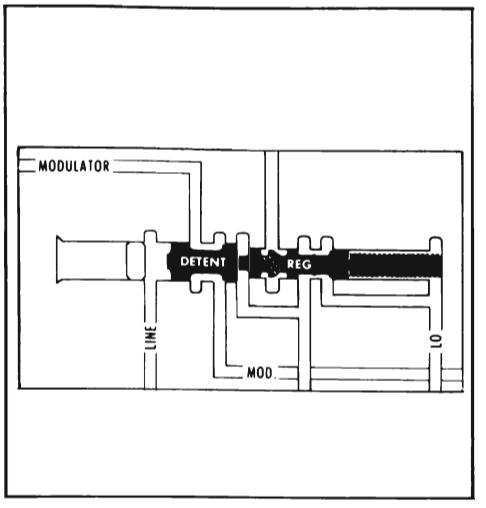

Figure 5-223

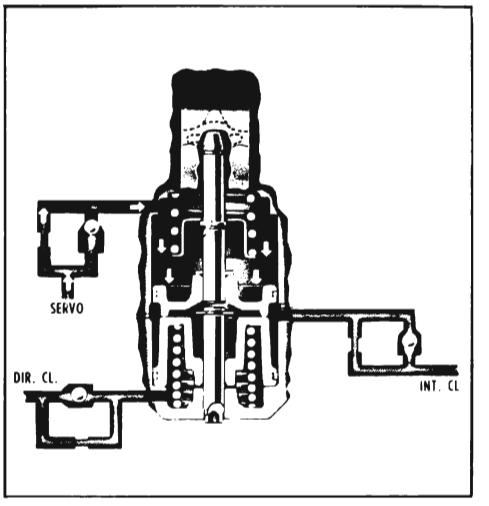

Figure 5-225

also allows the detent regulator valve to regulate. See Figure 5-222.

12. Detent Regulator Valve

When the detent valve shifts, the detent regulator is freed to allow drive oil to enter the detent passage and thus becomes regulated to a value of 70 psi. Detent pressure will also flow into the modulator passage which flows to the shift valves. Lo oil moves the detent regulator open to drive oil allowing drive oil to enter the modulator and detent passages. See Figure 5-223.

13. Stator Valve

Shifts when line oil is exhausted at end of the valve when the stator control solenoid is energized. This exhausts oil from the variable stator piston and the stator blades change from low angle to high angle. When the solenoid is not energized, converter oil is directed to the stator piston and low angle is obtained. See Figure 5-224.

14. Front Servo

The front servo applies the 2nd overrun band to provide engine braking in 2nd gear in L^2 and L^1 Ranges. It is also used as an accumulator for the apply of the direct or 3rd clutch and in conjunction with a series of check balls controlling orifices is a part of the timing for the release of the direct or 3rd clutch.

To prevent the apply of the 2nd overrun band in Neutral, Drive and Reverse ranges, oil is directed from the manual valve to the release side of the servo piston.

In Drive Range the servo release oil from the manual valve is used to charge the servo in preparation for the apply of the direct clutch.

Direct clutch oil is directed to the front servo accumulator piston where spring force plus 3rd clutch pressure stroke the piston up against the force of servo release oil. This lowers the clutch

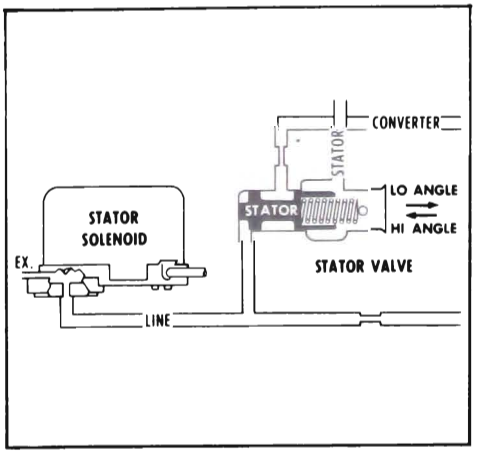

Figure 5-224

apply pressure for a smooth engagement.

The release of the direct clutch and the exhausting of the front servo accumulator is slowed down by three check balls and three orifices which permits a soft return of the drive load to the intermediate sprag and also allows engine RPM to increase during a detent 3-2 downshift in preparation for the lower gear ratio, which results in a smooth shift and better acceleration.

a. Front Servo Operation in Reverse—Neutral—Drive - 1st Speed

Servo oil from the manual drive valve in Drive Range charges the accumulator by stroking the servo and accumulator pistons against the accumulator spring. This prepares the accumulator for the controlled apply of the direct clutch on a 2-3 shift. The charging of the accumulator in Drive Range, 1st gear, also makes it possible to have a controlled 1-3 "let up" shift as the accumulator is prepared for direct clutch apply in 1st gear. See Figure 5-225.

Servo oil and the servo release spring prevents the apply of the band in 2nd gear Drive Range when intermediate clutch apply oil is directed between the servo and accumulator pistons.

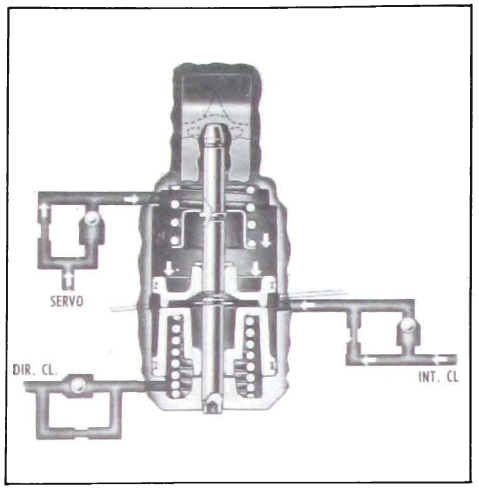

Figure 5-226

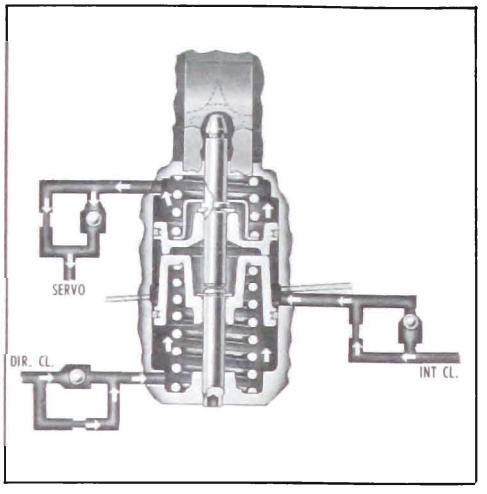

Figure 5-227

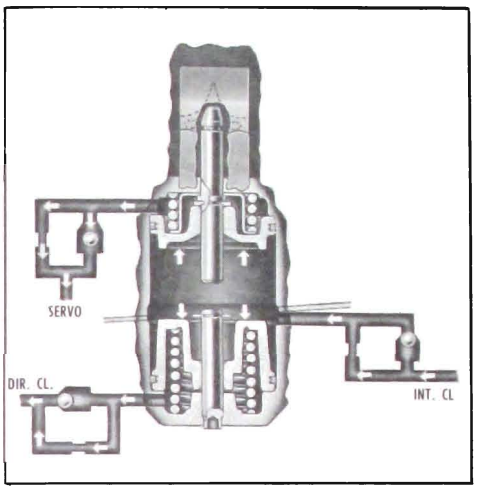

Figure 5-230

Servo oil in Reverse and Neutral Ranges is incidental.

b. Front Servo Operation in—Drive Range Second Speed

Servo Oil charging the accumulator is present in 1st and 2nd gears and has the servo and accumulator pistons stroked against the accumulator spring. In 2nd gear intermediate clutch oil is directed between the servo and accumulator pistons but does not separate the pistons as the force of servo oil holding the piston down is equal to the force in intermediate clutch oil attempting to stroke the servo piston. See Figure 5-226.

c. Front Servo Operation in Drive Range Third Speed

Direct clutch pressure rises to a value such that the force from it plug the accumulator spring force overcomes the force from the servo pressure and moves the accumulator piston to the stop on the accumulator piston pin; this in turn strokes the servo piston the same amount of travel which allows it to just contact the band apply washer on the servo pin, but it will not move the pin and apply the band.

The stroking of the accumulator piston absorbs some direct clutch oil and permits the direct clutch to apply at reduced pressure for a smooth 2-3 shift. See Figure 5-227.

d. Front Servo Operation During a 3-2 Downshift

The release of the direct clutch is softened by the front servo, three orifices and three check balls to allow a smooth transfer of the drive load to the intermediate sprag. The controlled release pressure lets the engine increase its RPM during detent downshifts to prepare for the lower gear ratio of 2nd gear, which results in a smooth shift and better acceleration.

Servo oil seats a check ball, intermediate clutch oil seats another check ball and oil must pass through the two orifices which slows the stroking of the servo and accumulator pistons. The exhausting direct clutch oil from the accumulator and the direct clutch seats a third check ball and the exhausting direct clutch oil passes through an orifice which controls the clutch pressure during the direct clutch release. See Figure 5-228.

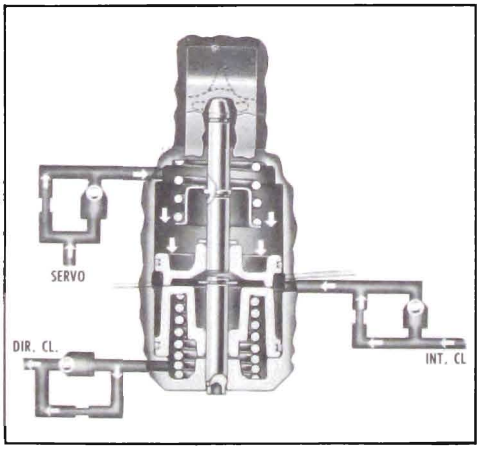

Figure 5-228

e. Front Servo Operation L^2 Range—Second Speed

Intermediate clutch oil from the 1-2 shift valve seats the check ball, passes through an orifice and applies the front band. The pressure applying the band is reduced by the action of the accumulator piston which is moved by orificed flow of intermediate clutch oil and resisted by the accumulator spring and exhausting orificed direct clutch oil in a manual downshift 3-2 for a smooth apply of the band for L^2 Range engine braking. See Figure 5-230.

15 Rear Servo

The rear servo applies the rear band for overrun engine braking in Lo Range 1st gear. It applies the band in Reverse to hold the reaction carrier to provide the reverse gear ratio.

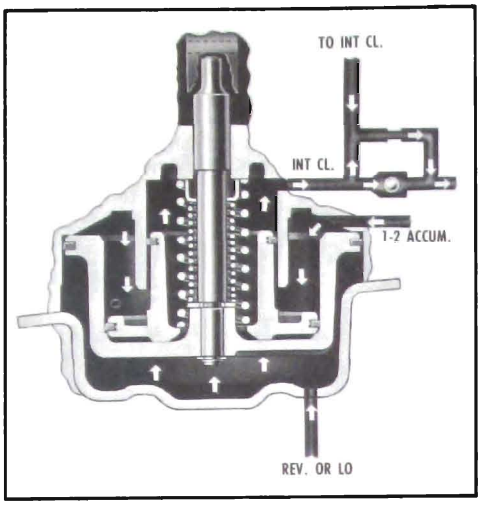

Figure 5-231

a. Rear Servo Function—Low Range 1st Speed

On the 1-2 shift in Drive and L^2 Ranges it serves as an accumulator for the intermediate clutch to provide a smooth shift. See Figure 5-231.

b. Rear Servo Operation in Drive—L^2 First Speed

In 1st gear Drive and L^2 Ranges, 1-2 accumulator oil is directed to the rear servo accumulator piston in preparation for the 1-2 shift. See Figure 5-232.

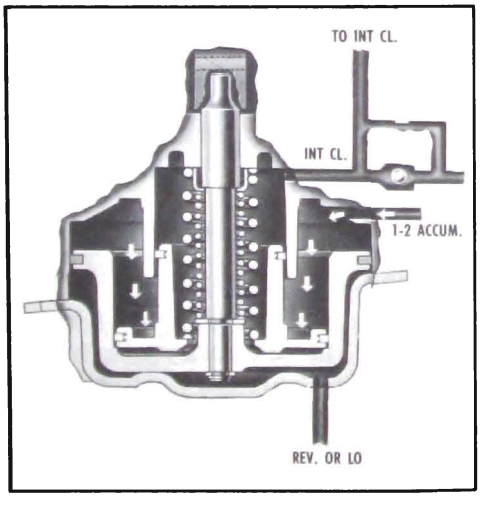

Figure 5-232

c. Rear Servo Operation—Drive L^2 2nd Speed

Intermediate clutch apply oil is directed to the rear servo accumulator piston, stroking the piston against 1-2 accumulator oil and the accumulator spring. This action absorbs some intermediate clutch apply oil and permits the intermediate clutch to apply at reduced pressure for a smooth 1-2 shift. See Figure 5-233.

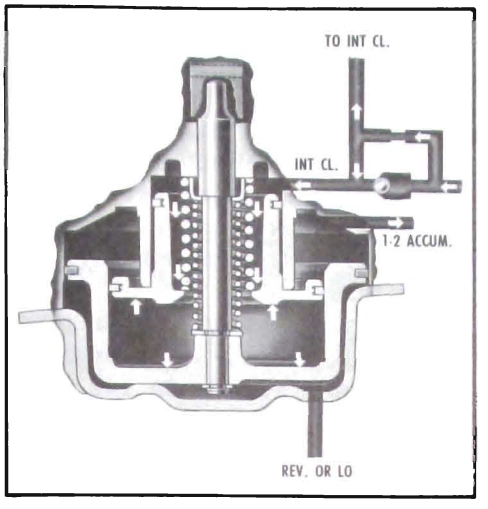

Figure 5-233

d. Rear Servo Operation L^1 Range 1st Speed

Overrun engine braking in Lo Range 1st gear is provided for by the rear servo applying the band to hold the reaction carrier from clockwise rotation.

1-2 Accumulator oil is directed to the accumulator piston which attempts to prevent the servo from applying. Lo Range oil directed to the servo piston which has the larger area, applies the band. Because 1-2 accumulator oil is present, the force applying the band is lowered. This provides a smooth apply. See Figure 5-234.

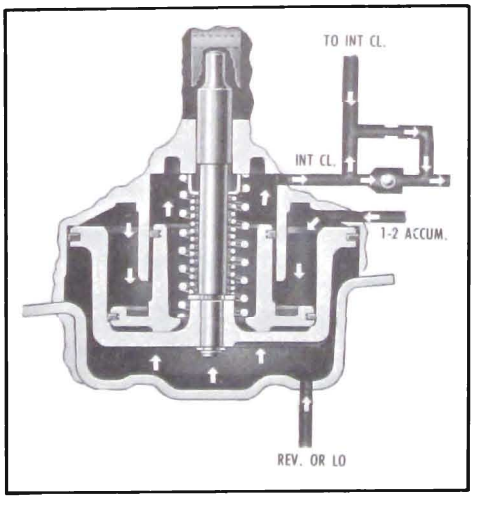

Figure 5-234

e. Rear Servo Operation—L^1 Range Second Speed

In second gear the rear band is released. Intermediate clutch oil is directed to the release side of the servo piston which, with 1-2 accumulator oil, balances out the L^1 Range oil on the apply side of the servo piston and the servo release spring strokes the servo piston to the released position. See Figure 5-235.

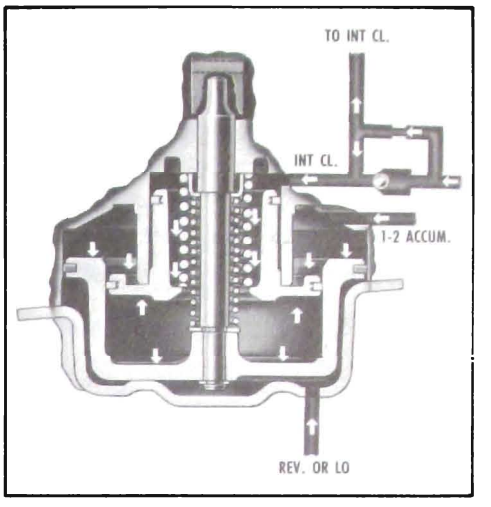

Figure 5-235

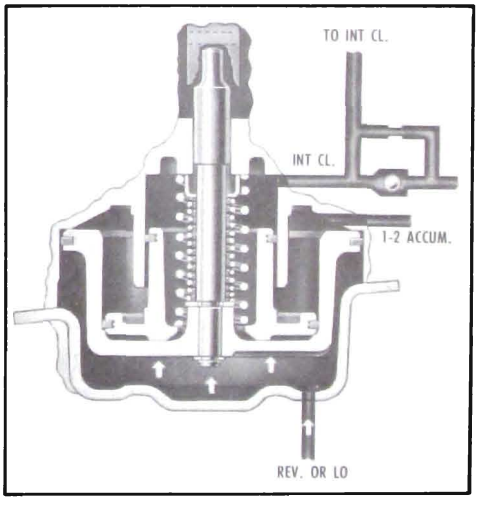

Figure 5-236

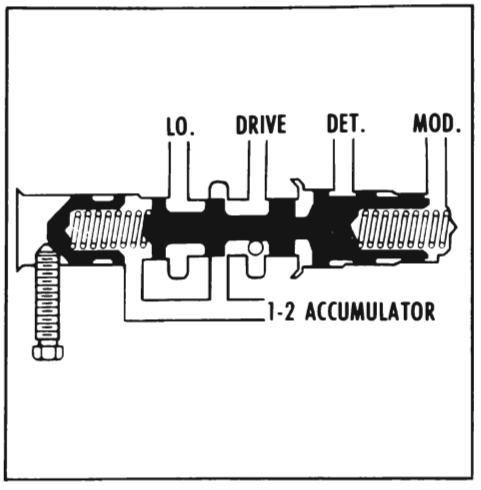

Figure 5-237

f. Rear Servo Operation—
Reverse Range

In Reverse the rear band is applied to hold the reaction carrier. Reverse oil is directed to the servo piston to apply the band. To insure the band holding the reaction carrier for the reverse gear ratio, line pressure is increased in Reverse and no other oil pressures are present in the servo to resist the apply of the servo piston. See Figure 5-236.

16. 1-2 Accumulator

1-2 Accumulator oil charges the rear servo accumulator in 1st gear in preparation for the apply of the intermediate clutch on the 1-2 shift.

The valve train consists of a 1-2 primary valve and spring, a 1-2 accumulator valve and spring and a 1-2 accumulator adjusting plug and screw.

1-2 Accumulator oil pressure is a two-stage pressure to obtain greater flexibility in obtaining the desired curve for various engine requirements.

Drive oil is directed to the 1-2 accumulator valve and is regulated by the valve train to 1-2 accumulator oil. Modulator pressure is directed to the primary valve and its effect is on the primary and 1-2 accumulator valve for the first stage of 1-2 accumulator pressure. When modulator pressure on the larger area of the primary valve can overcome the effect of modulator pressure and spring pressure on the smaller area of the primary valve, it moves the primary valve to its stop and increases the effective area for modulator pressure on the 1-2 accumulator valve which results in 1-2 pressure rising faster to start the second stage of 1-2 accumulator pressure. The result of these two stages of 1-2 accumulator pressure is that at light throttle shifts, 1-2 accumulator pressure is on a lower pressure slope for smooth shifts and on heavy throttle shifts, 1-2 accumulator pressure is on the second slope of higher pressures for smooth durable shifts.

Detent oil is directed to the 1-2 primary valve to raise 1-2 accumulator pressure during detent 1-2 shifts for clutch durability. Lo Range oil is directed to the 1-2 accumulator valve during Lo Range operation to raise 1-2 accumulator pressure to line pressure; this increased pressure directed to the rear servo accumulator piston resists servo apply pressure and slows down the apply of the rear band for a smooth manual shift to Lo Range 1st gear or for a 2-1 shift in Lo Range.

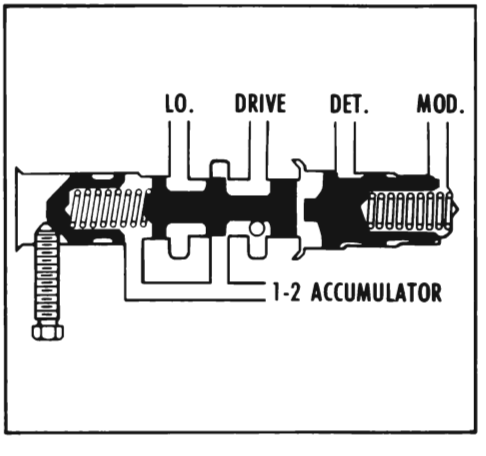

Figure 5-238

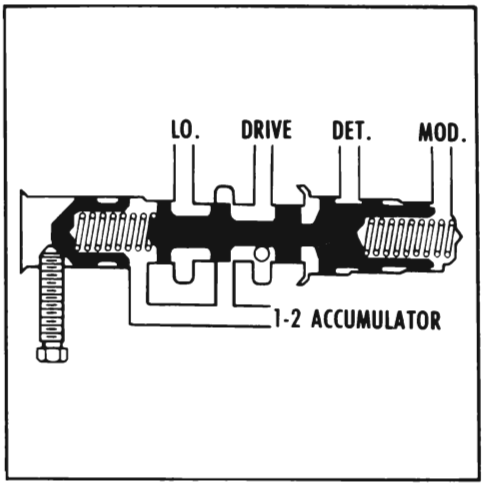

Figure 5-240

The 1-2 accumulator pressure is adjusted by the adjusting screw at the factory and should not be changed in field service.

a. 1-2 Accumulator-1st Stage

Drive oil is regulated to 1-2 accumulator pressure by the effect of modulator oil and spring pressure on the primary and 1-2 accumulator valves and 1-2 accumulator oil and spring pressure on the 1-2 accumulator valve. The lo passage is used for exhaust.

In the first stage of regulation the primary valve is grounded to the 1-2 accumulator valve and the effective area on which modulator pressure is working is small, which results in a low slope of 1-2 accumulator pressure. See Figure 5-237.

b. 1-2 Accumulator 2nd Stage

When modulator pressure on the larger area of the primary valve can overcome modulator oil and spring pressure on the smaller end of the primary valve, it grounds the primary valve in the valve bore. This results in a larger effective area for modulator pressure to work on, and 1-2 accumulator pressure is on the higher slope. See Figure 5-238.

c. 1-2 Accumulator—Low

During Lo Range operation, Lo oil is directed to the 1-2 accumulator valve. The Lo port is used for exhaust when 1-2 accumulator pressure is regulated, but in Lo Range 1-2 accumulator becomes line pressure because the Lo oil is in this passage. See Figure 5-240.

d. 1-2 Accumulator—Detent

During detent operation, 1-2 accumulator pressure is increased by directing detent pressure to an area on the primary valve which increases the effective area of the valve. See Figure 5-241.

5-5 HYDRAULIC OPERATION

a. Park or Neutral—Engine Running

Whenever the engine is running at idle with the selector lever in "P" or "N", oil from the pump is directed to the: (See Figure 5-242.)

1. Pressure Regulator Valve
2. Converter
a. Oil Cooler
b. Cooler By-Pass Valve
c. Lubrication System
d. Stator Valve
3. Manual Valve
4. Detent Valve
5. Detent Solenoid
6. Vacuum Modulator Valve
7. Front Servo (Neutral only)
8. Stator Solenoid and Valve

Cooling and Lubrication

Oil flows from the pump to the pressure regulator valve which regulates the pump pressure. When the pump output exceeds the demand of line pressure, oil from the pressure regulator is directed to the converter feed passage to fill the converter and is directed to the stator valve. Oil from the converter, termed converter return oil, is directed to the transmission cooler and cooler by-pass valve. Oil from the cooler is directed to the transmission lubrication system.

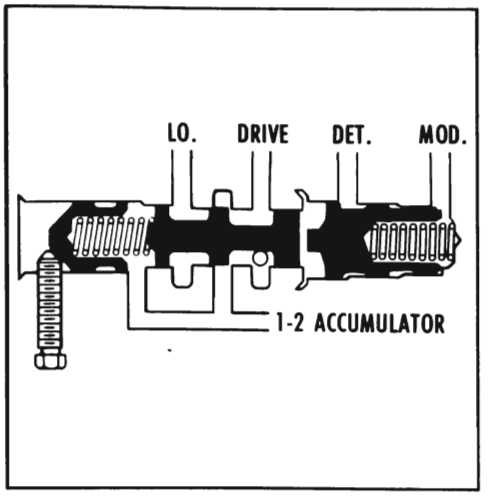

Figure 5-241

The cooler by-pass valve permits oil to be fed directly from the converter to the lubrication circuit if the cooler becomes restricted.

Line Pressure acts on the:

1. Manual Valve
2. Detent Valve
3. Detent Solenoid
4. Modulator Valve
5. Stator Valve
6. Stator Solenoid

Line pressure at the modulator valve is regulated to a pressure called modulator oil, which acts on the pressure boost valve, 1-2 accumulator and primary valves, and passes through the detent valve and 3-2 valve to the 1-2 and 2-3 valve trains.

Stator Blade Angle

Line oil at the stator valve and stator solenoid is exhausted through an orifice at the solenoid, when the solenoid switch is activated. (The switch is activated at idle.) This allows the stator valve spring to move the stator valve, cutting off converter oil and allowing stator oil to exhaust. This places the stator blades at high angle.

SUMMARY

The converter is filled, stator blades are at high angle, and all clutches and bands are released. The transmission is in Neutral.

b. Drive Range—First Speed

When the selector lever is moved to the Drive position, the manual valve is repositioned to allow line pressure to enter the drive circuit. Drive oil then flows to the: (See Figure 5-243).

1. Forward Clutch
2. 1-2 Shift Valve
3. Governor Assembly
4. 1-2 Accumulator Valve
5. Detent Regulator Valve

Basic Control

Drive oil is directed to the forward clutch where it acts on two areas of the clutch piston to apply the forward clutch. The first, or inner area, is fed through an unrestricted passage. The outer area is fed through an orifice to insure a smooth shift from Park, Neutral and Reverse to Drive.

Drive oil at the governor assembly is regulated to a variable pressure. This pressure, called governor oil, increases with vehicle speed and acts against the ends of the 1-2 and 2-3 shift valves and an area on the modulator valve.

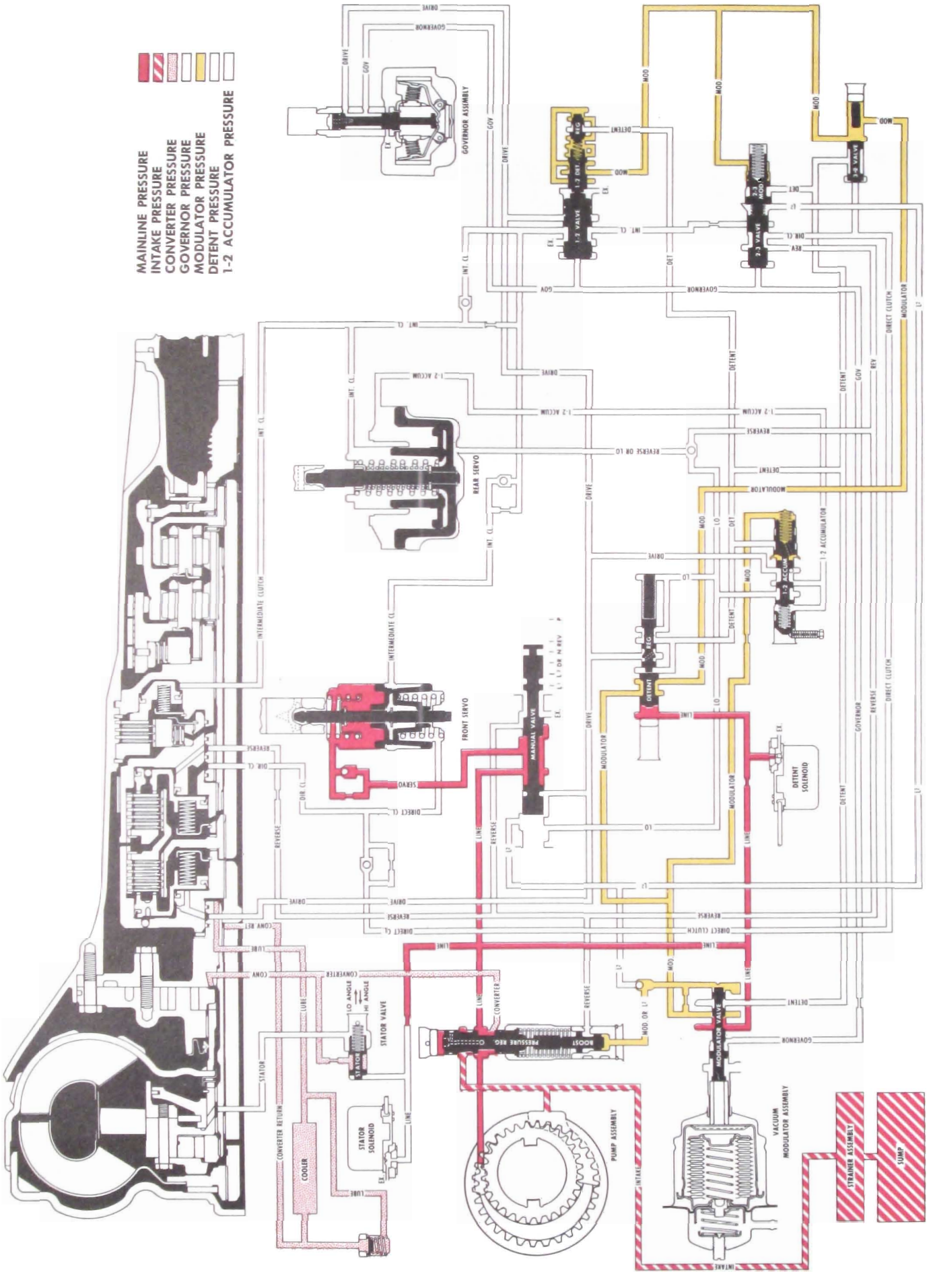

Figure 5-242—Park or Neutral Engine Running

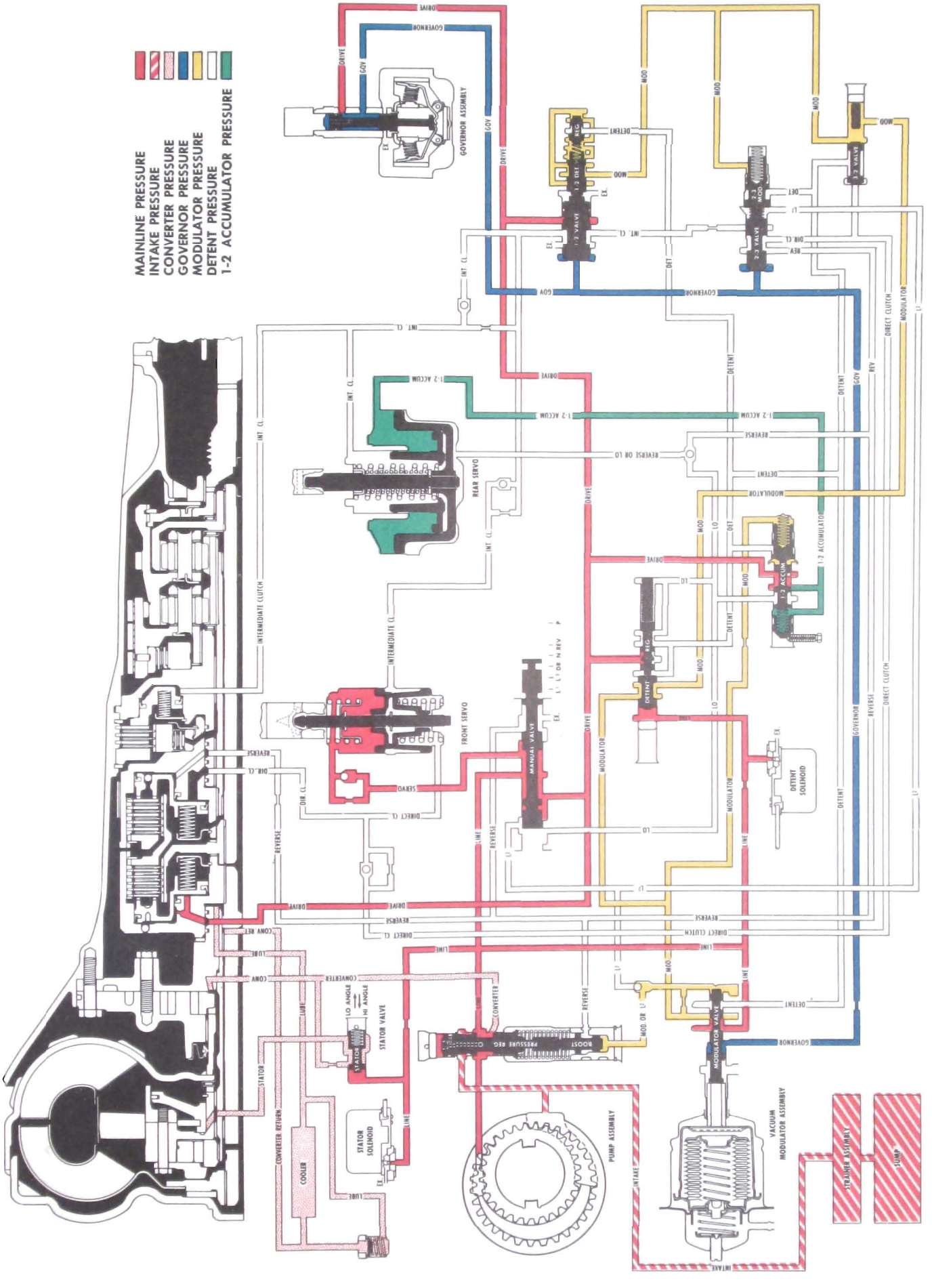

Figure 5-243—Drive Range - First Speed

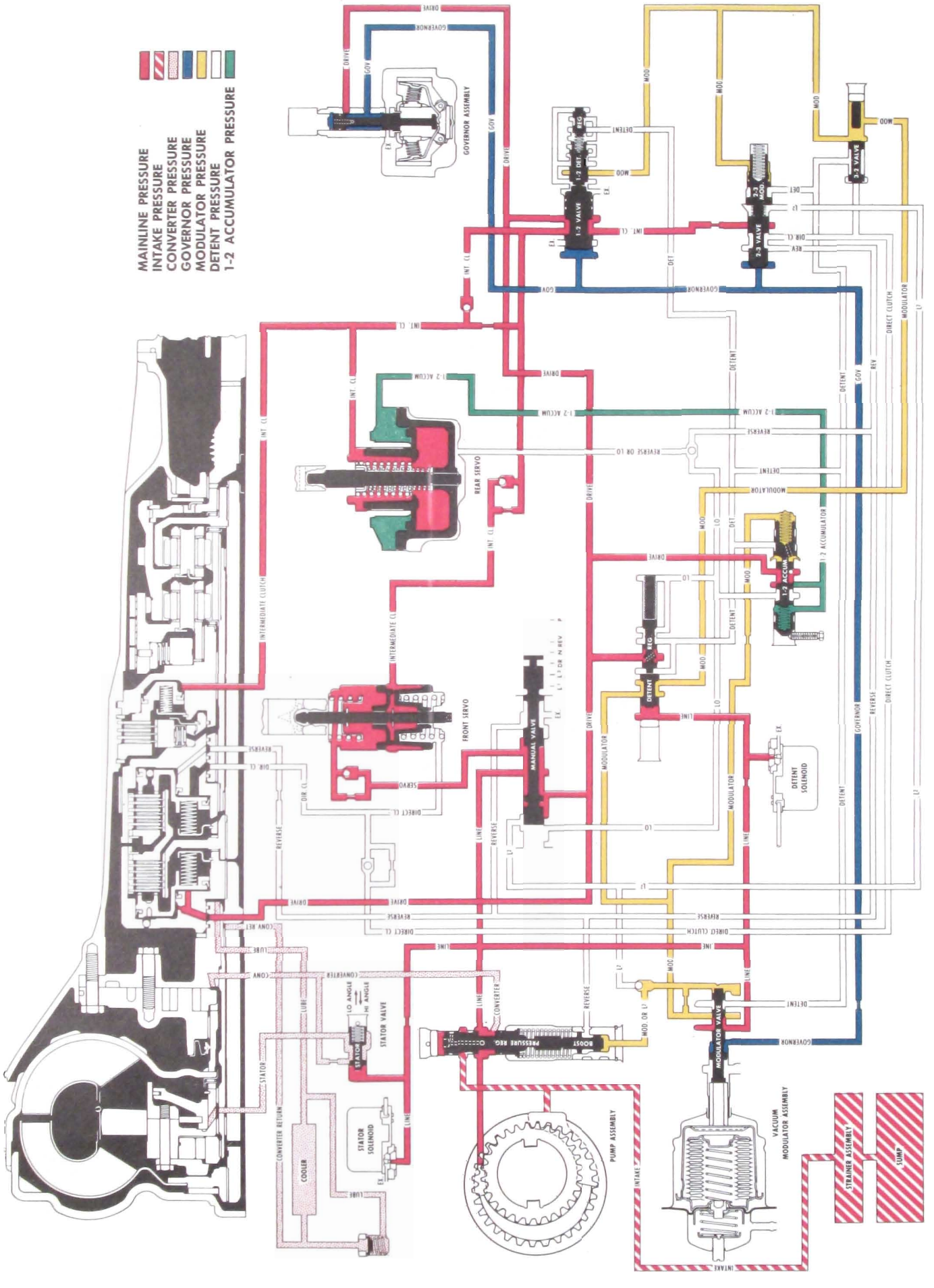

Figure 5-244—Drive Range - Second Speed

Drive oil is also regulated to another variable pressure at the 1-2 accumulator valve. This pressure, called 1-2 accumulator oil, is controlled by modulator oil and is directed to the rear servo. 1-2 Accumulator oil at the rear servo acts on the accumulator piston.

Stator Blade Angle

When at idle, the stator blades are at high angle. This is also true under heavy throttle operation due to the stator solenoid being activated.

At light or medium throttle (as shown), the solenoid is not activated. Line pressure then moves the stator valve against the spring, allowing converter oil to act on the stator piston, which puts the blades at low angle.

SUMMARY

The converter is filled and the stator blades are at high or low angle, depending upon throttle position. The forward clutch is applied. The transmission is in first gear.

c. Drive Range—Second Speed

As both vehicle speed and governor pressure increase, the force of governor oil acting on the 1-2 shift valve will overcome the force of re-regulated modulator oil pressure. This allows the 1-2 shift valve to open, permitting drive oil to enter the intermediate clutch passage. Oil in this passage is called intermediate clutch oil. See Figure 5-244.

Intermediate clutch oil from the 1-2 shift valve is directed to the:

1. Intermediate Clutch
2. Rear Servo
3. Front Servo and Accumulator Pistons
4. 2-3 Shift Valve

Basic Control

Intermediate clutch oil from the 1-2 shift valve seats a one-way check ball and flows through an orifice to the intermediate clutch piston to apply the intermediate clutch. At the same time, intermediate clutch oil moves the accumulator piston against the 1-2 accumulator oil and accumulator spring to maintain lower pressure in the clutch during a 1-2 shift for a smooth clutch apply. Intermediate clutch oil seats a second one-way check ball and flows to the front servo and accumulator pistons. Intermediate clutch oil is also directed to a land of the 2-3 shift valve.

SUMMARY

The forward and intermediate clutches are applied. The transmission is in second gear.

d. Drive Range—Third Speed

As vehicle speed and governor pressure increase, the force of governor oil acting on the 2-3 shift valve overcomes the force of the 2-3 shift valve spring and modulator oil. This allows the 2-3 shift valve to move, feeding intermediate clutch oil to the direct clutch passage. This oil is termed direct clutch oil. See Figure 5-245.

Direct clutch oil from the 2-3 shift valve is directed to the:

1. Direct Clutch
2. Front Accumulator Piston
3. 3-2 Valve

Basic Control

Direct clutch oil from the 2-3 shift valve flows past a one-way check valve to the inner area of the direct clutch piston to apply the direct clutch. Simultaneously, direct clutch oil is fed to the front accumulator piston. The pressure of the direct clutch oil, combined with the accumulator spring, moves the accumulator and servo pistons against servo oil. This acts as an accumulator for a smooth direct clutch apply.

Direct clutch oil is also supplied to the 3-2 valve to move the valve against modulator pressure. This cuts off modulator oil to the 1-2 regulator and 2-3 modulator valves and allows the transmission to utilize the torque multiplying characteristics of the variable pitch converter.

Stator Blade Angle

The degree of converter torque multiplication is dependent upon the angle of the stator blades (high or low angle) which is controlled by the stator solenoid. When activated, the line oil acting on the solenoid and stator valve is exhausted at the solenoid. The stator valve spring will move the stator valve cutting off converter oil to the stator piston. The converter charge pressure will move the stator piston, putting the stator blades at high angle.

SUMMARY

The forward, intermediate and direct clutches are applied. The transmission is in third gear (direct drive).

e. Detent Downshift—Valves in Second Speed Position

While operating at speeds below approximately 70 MPH a forced

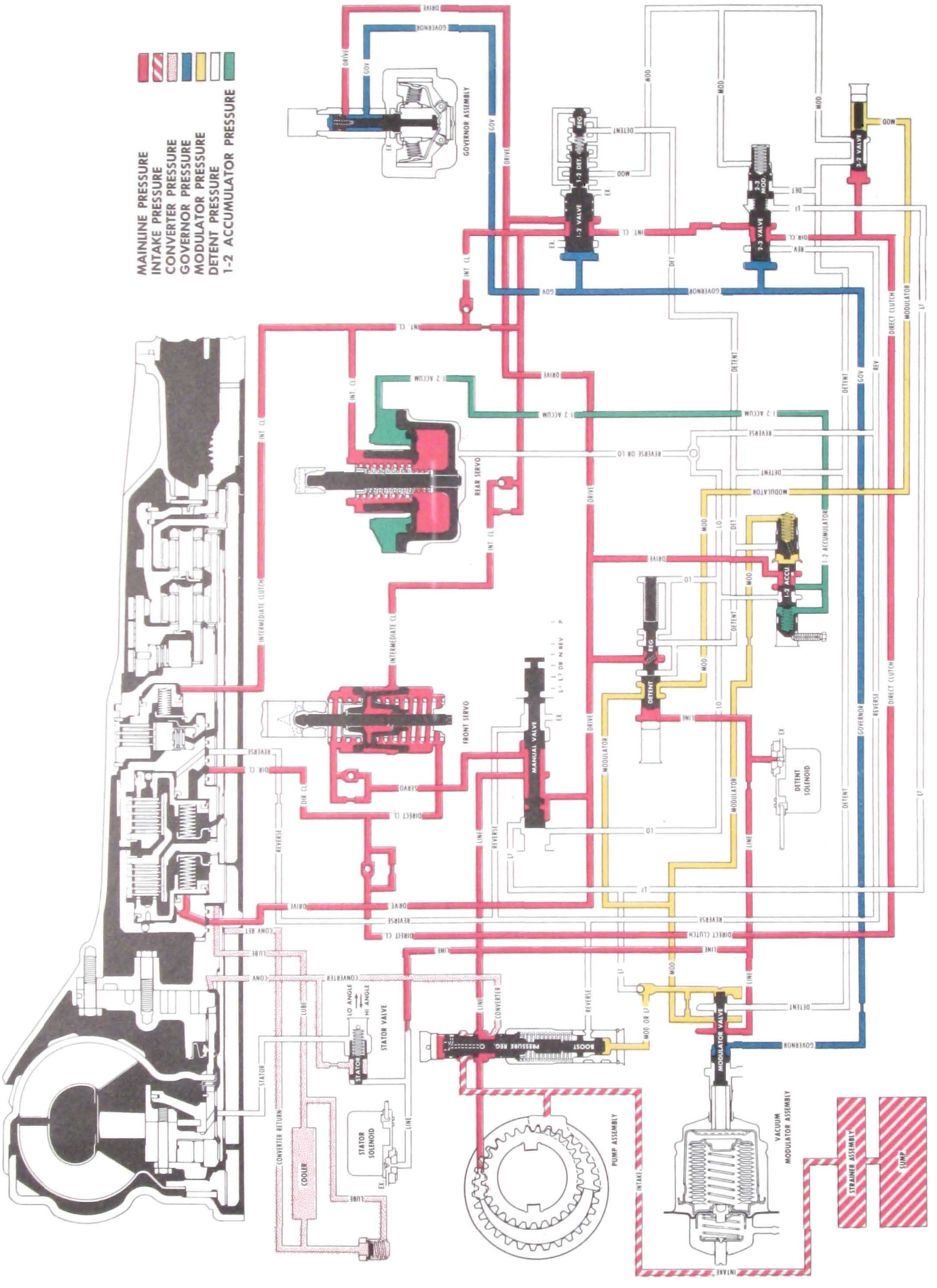

Figure 5-245—Third Speed - Drive

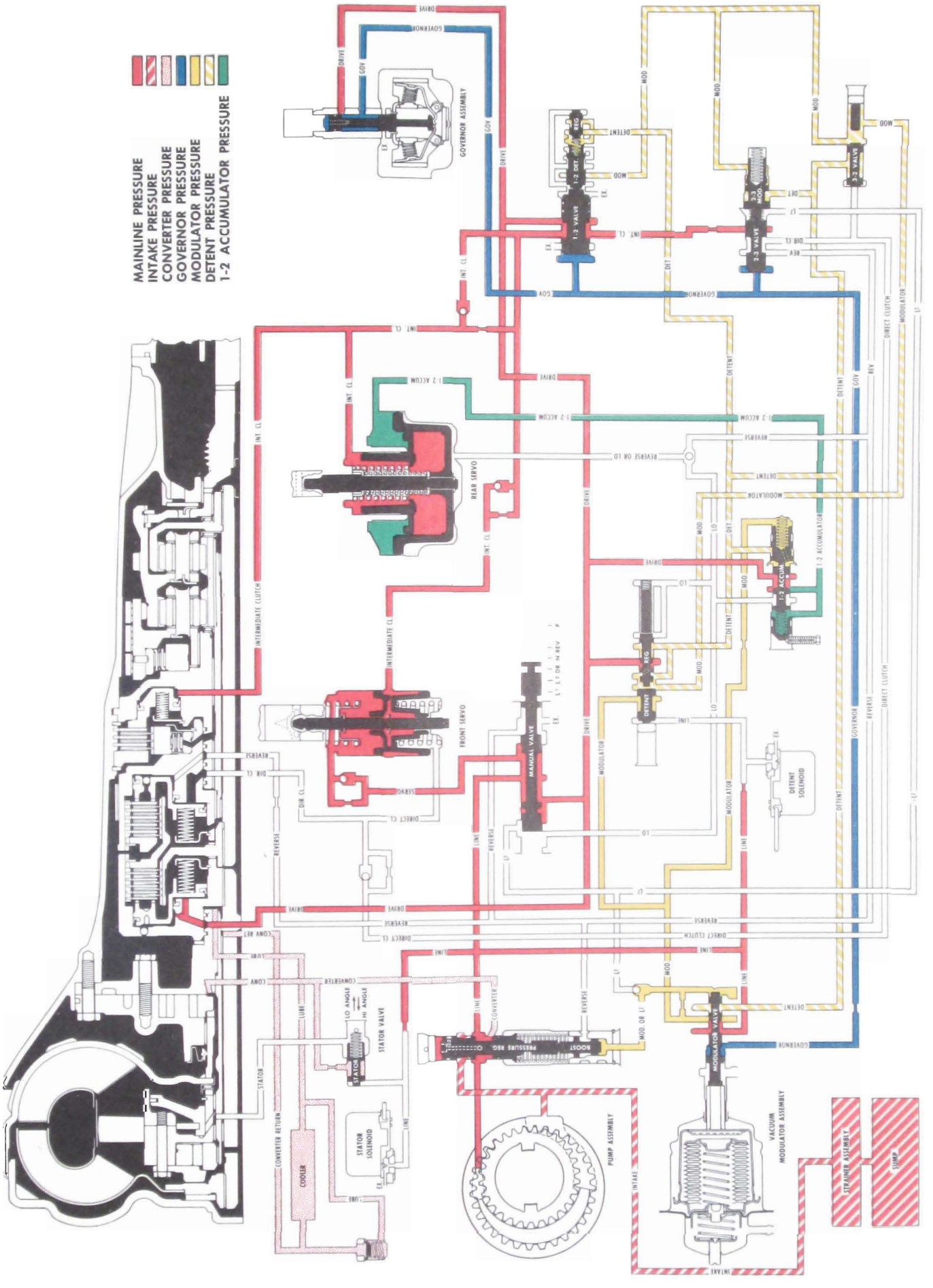

Figure 5-246—Detent Downshift Valves in Second Speed Position

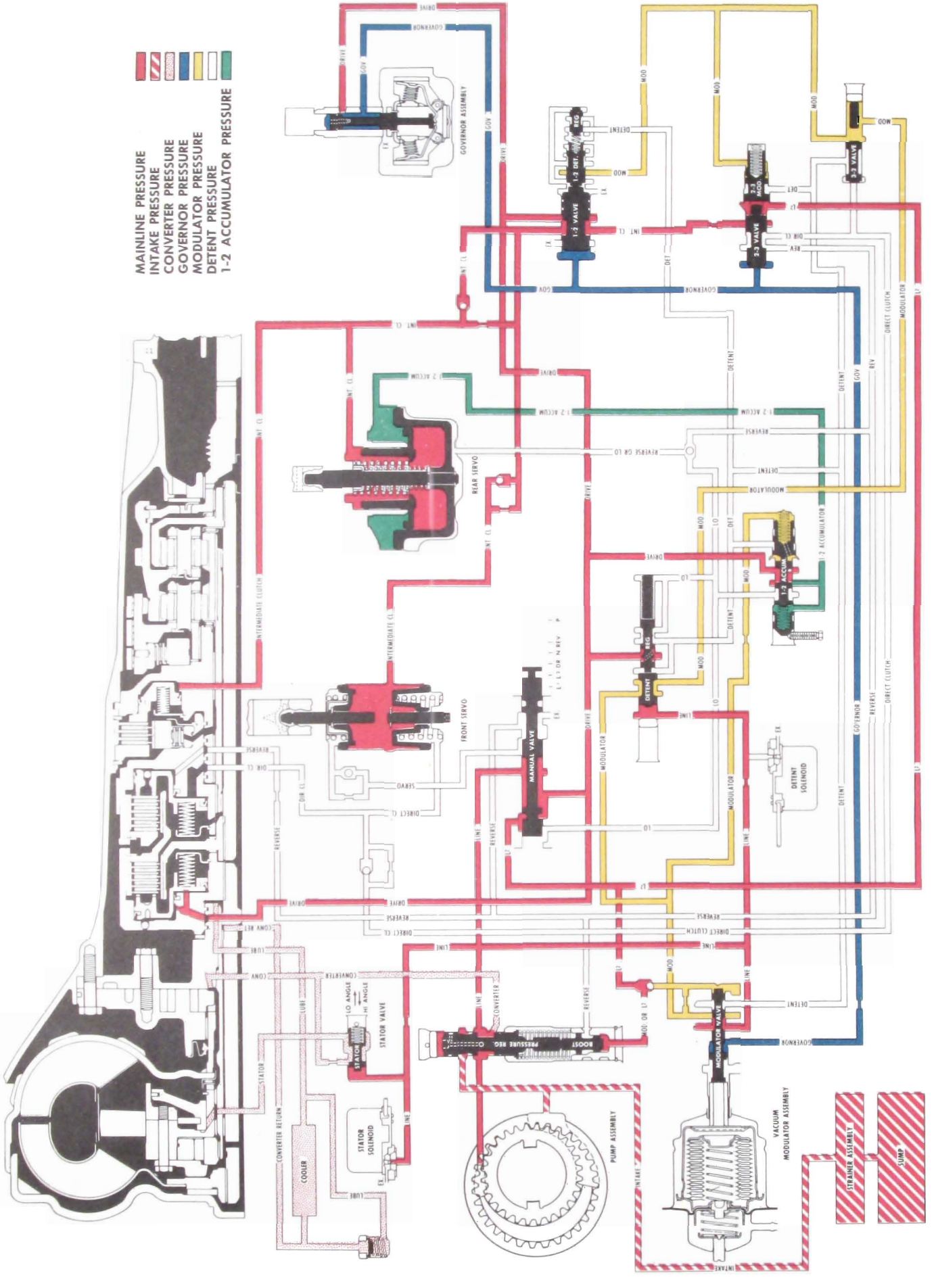

Figure 5-247—L^2 Range - Valves in Second Speed Position

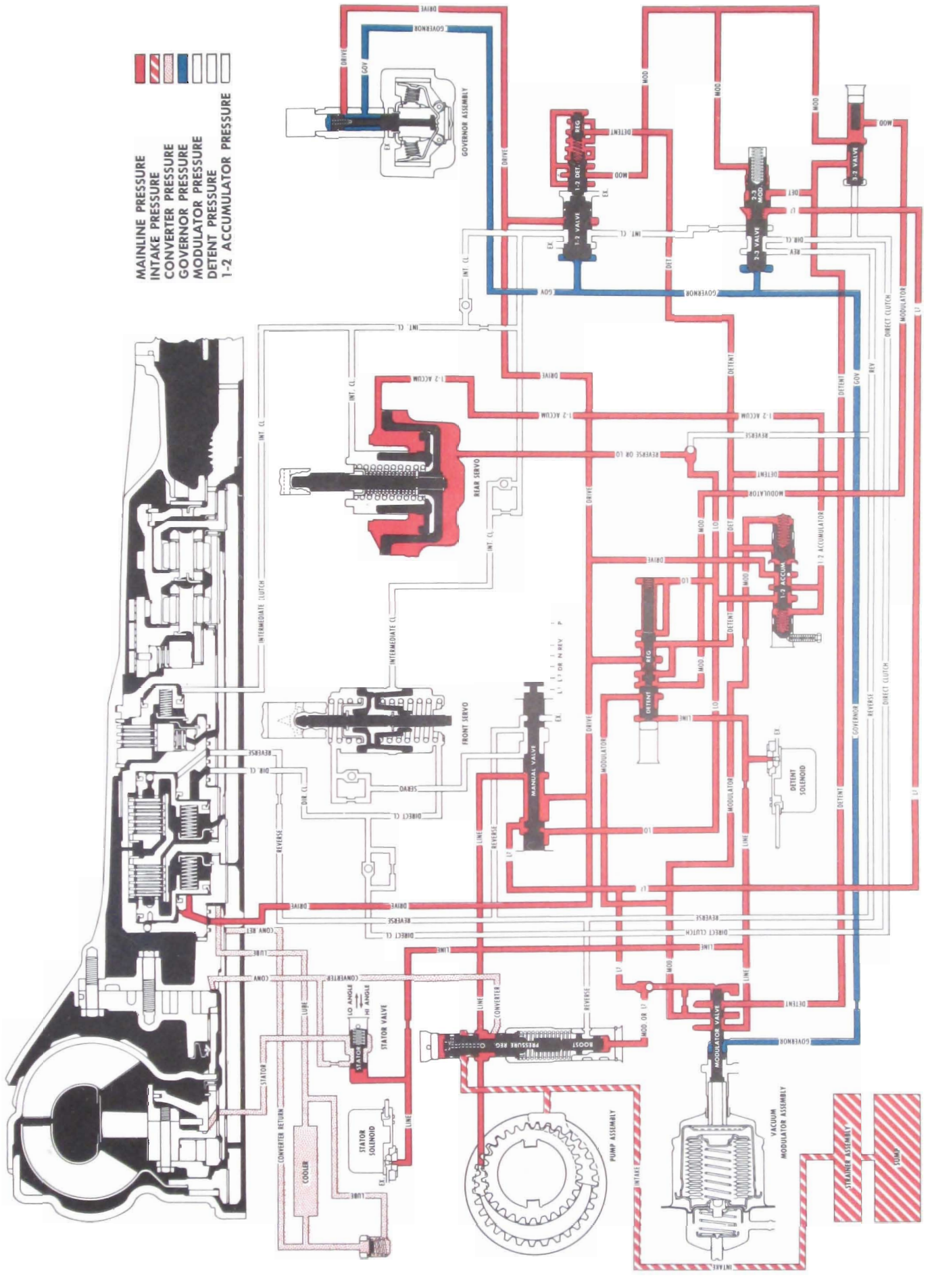

Figure 5-248—L^1 Range - First Speed

or detent 3-2 downshift is possible by depressing the accelerator fully. This engages an electrically operated switch at the carburetor and actuates the detent solenoid. The detent solenoid opens an orifice that allows line oil at the detent valve to be exhausted, thus permitting the detent regulator valve to operate. Line oil acting on the detent valve and solenoid is supplied by a smaller orifice. See Figure 5-246.

Drive oil on the detent regulator valve is then regulated to a pressure of approximately 70 psi and called detent oil. Detent oil is then routed to the:

1. Modulator Passage
2. 1-2 Regulator Valve
3. 2-3 Modulator Valve
4. 3-2 Valve
5. 1-2 Primary Accumulator Valve
6. Vacuum Modulator Valve

Detent oil in the modulator passage and at the 2-3 modulator valve will close the 2-3 shift valve below approximately 70 MPH, shifting the transmission to second gear.

A detent 2-1 downshift can also be accomplished below approximately 20 MPH because detent oil is directed to the 1-2 regulator valve, regulating or exhaust port. This allows detent oil to act on the 1-2 regulator and 1-2 detent valve to close the 1-2 shift valve, shifting the transmission to first gear.

To insure clutch durability during 1-2 upshifts under detent conditions, detent oil is directed to the 1-2 accumulator primary valve to increase 1-2 accumulator oil pressure acting on the rear servo accumulator piston.

Detent oil is also directed to the modulator valve to prevent modulator pressure from regulating 70 psi at high speeds or at high altitudes.

f. L^2 Range—Valves in Second Speed Position

A 3-2 downshift can be accomplished by moving the selector lever from Drive to L^2 Range. When the selector lever is in the L^2 position, L^2 oil from the manual valve is directed to the: (See Figure 5-247).

1. Pressure Boost Valve
2. 2-3 Shift Valve

L^2 oil at the boost valve will increase line pressure to 150 psi. This increased intermediate oil pressure at the 2-3 shift valve will close the 2-3 shift valve, regardless of car speed.

For engine braking the front band is applied by exhausting servo oil at the manual valve in L^2 Range. This allows intermediate clutch oil, acting on the servo piston, to move the piston and apply the front band. Once the transmission is in second speed - L^2 Range, it cannot upshift to third gear regardless of vehicle speed.

SUMMARY

The forwaid and intermediate clutches and front band are applied. The transmission is in second gear - L^2 Range.

g. L^1 Range—First Speed—Valves in First Speed Position

Maximum downhill braking can be attained at speeds below 40 MPH with the selector lever in Lo position as this directs Lo oil from the manual valve to the: (See Figure 5-248).

1. Rear Servo
2. 1-2 Accumulator Valve
3. Detent Regulator Valve

Basic Control

Lo oil flows past a ball check to the apply side of the rear servo piston and to the 1-2 accumulator valve to raise the 1-2 accumulator oil to line pressure for a smooth band apply.

Lo oil acts on the detent regulator valve. Combined with the detent spring, Lo oil holds the detent valve against line oil acting on the detent valve, causing drive oil to flow through the detent regulator valve into the detent and modulator passages. Modulator and detent oil at line pressure acting on the 1-2 regulator and 1-2 detent valve overcomes governor oil on the 1-2 shift valve at any vehicle speed below approximately 40 MPH and the transmission will shift to first gear.

With the transmission in first speed - L^1 Range, the transmission cannot upshift to second speed regardless of vehicle or engine speed. The forward clutch and rear band are applied. The transmission is in first speed - L^1 Range.

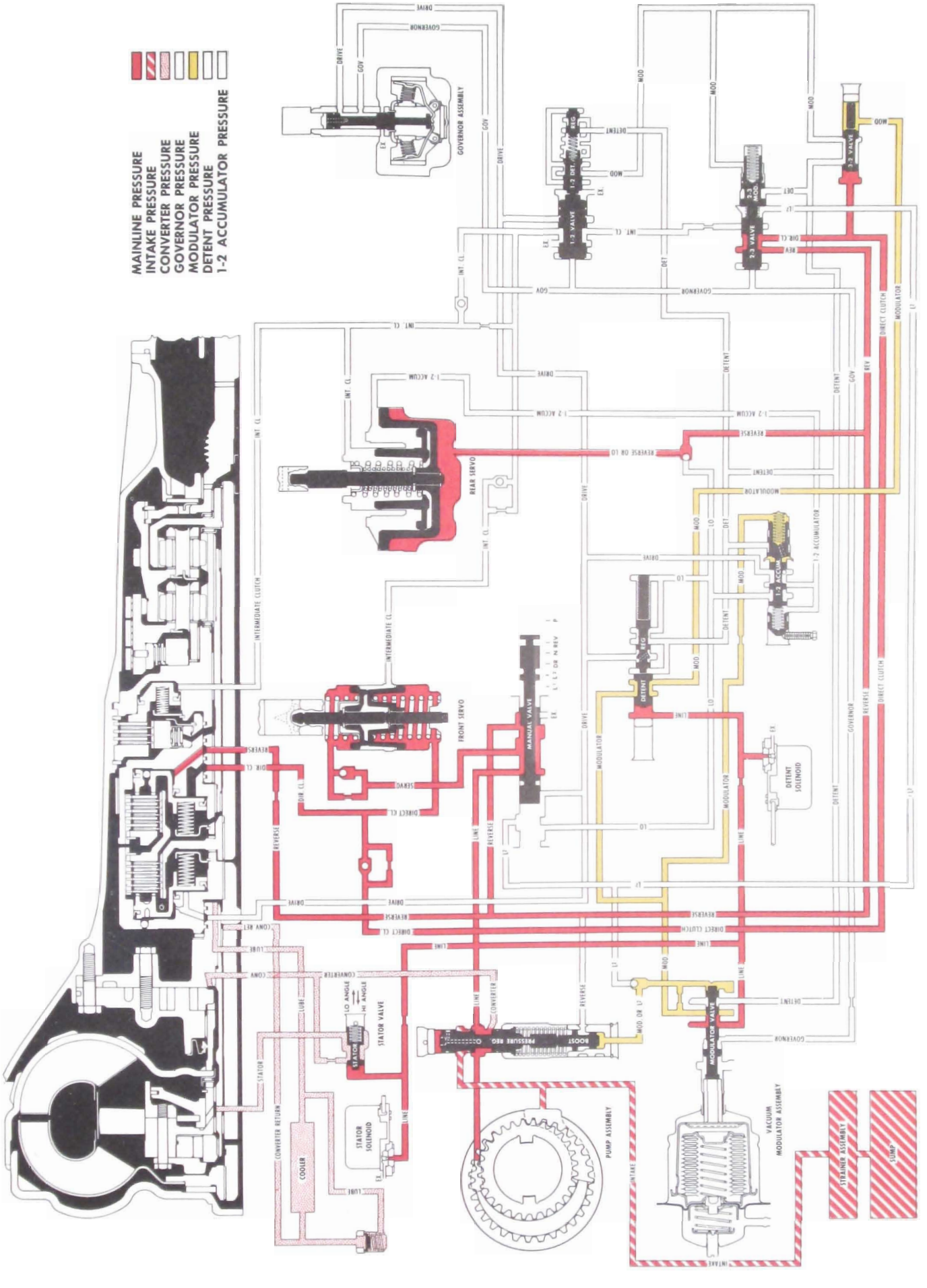

Figure 5-250—Reverse

h. Reverse

When the selector lever is moved to the Reverse position, the manual valve is repositioned to allow line pressure to enter the reverse circuit. Reverse oil then flows to the: (See Figure 5-250).

1. Direct Clutch
2. 2-3 Shift Valve
3. Rear Servo Piston
4. Pressure Boost Valve

Basic Control

Reverse oil from the manual valve flows to the large area of the direct clutch piston and to the 2-3 shift valve. From the 2-3 shift valve, it enters the direct clutch passage and is directed to the small area of the direct clutch piston to apply direct clutch.

Reverse oil flows to the rear servo and acts on the servo piston to apply the rear band. Reverse oil also acts on the pressure boost valve to boost line pressure.

SUMMARY

The direct clutch and the rear band are applied. The transmission is in Reverse.