PHASE 9
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UNIVERSAL TECHNICAL INSTITUTE

PHASE 9: AUTOMATIC TRANSMISSIONS LIST OF LAB PROJECTS

INSTRUCTOR_____ STUDENT'S NAME_____

TRANSMISSION MODEL	POWERGLIDE	TORQUEFLITE			
D & A					
FRONT BAND ADJUSTMENT					
REAR BAND ADJUSTMENT					
FRONT CLUTCH CLEARANCE					
REAR CLUTCH CLEARANCE					
ONE WAY CLUTCH					
END PLAY					
AIR TEST					

GLOSSARY

ATF – automatic transmission fluid

Accumulator – a piston and cylinder arrangement used to control pressure during the apply of a clutch or band

Accumulator valve – a valve used to control the flow and/or pressure of fluid to an accumulator, clutch or servo

Atmospheric pressure – pressure exerted by the surrounding air; at sea level, normal atmospheric pressure is said to be 14.7 psi, 29.92 in Hg, or, in SI units, 101 kPa.

Backlash – 1) the clearance between meshing teeth of two gears; or 2) the amount of free motion in a mechanical system such as a gear train. (*See end play*).

Balanced valve – a valve in which hydraulic pressure exactly balances an opposing force; usually a spring force varied by mechanical linkage, hydraulic pressure, vacuum (atmospheric pressure) or a combination of these forces

Band – a friction device used to hold a member of a planetary gear set by tightening around the members outer circumference

Bellows, aneroid – a pleated chamber sensitive to small changes in atmospheric pressure; used in some modulators to sense changes in altitude

Bore – the diameter of a hole; a machined or bored hole in a valve body or clutch cylinder

Burr – a rough edge on a piece of metal

Bypass valve – a valve that regulates hydraulic pressure by shunting or bypassing part of the incoming pressure to the sump or pump inlet

Check valve (ball check) – a valve that permits the flow of fluid in one direction only

Clutch – a friction device that can be used to either hold or drive a member of a planetary gear set

Coefficient of friction – the force required to overcome friction divided by the weight of the moving body

Detent – 1) a shallow depression, notch or hole in a shaft or plate into which a spring-loaded ball or plunger fits serving to lock the shaft or plate in one or more positions; or 2) in GM automatic transmissions, used to denote wide-open throttle shifts.

Diaphragm – a thin sheet of rubber or neoprene used to separate a pressure chamber, such as a modulator into a high (atmospheric) and low (vacuum) side.

Diaphragm spring – a disc-shaped spring used as a piston return spring or spacer in some clutch assemblies

End play – the amount of free motion in a mechanical system; in automatic transmissions, the working clearance between the components of a gear train

Friction – the resistance to motion caused by two surfaces in contact with one another.

Governor – in automatic transmissions, a device used to control shift points in relation to vehicle speed

Hydraulics – a branch of physics dealing with the use of liquids to transfer motion or force

Modulator – in an automatic transmission, a vacuum device used to control pressure and shift points

Multiple-disc clutch – a clutch using several friction discs; allows the frictional area to be increased while keeping a relatively small diameter

One-way clutch – a clutch using bearing races that allows rotation in one direction only; rollers or sprags allow free motion in one direction, but jam the races to prevent motion in the opposite direction

Planetary gear set (compound) – a planetary gear set made up of two, or parts of two or more simple planetary sets; more flexible and easier to control (for automatic transmission use) than a simple set

Planetary gear set (simple) – a gear set that consists of a sun gear, planet gears and carrier, and a ring gear; changes in ratio are made without taking the gears out of mesh

Regulator valve – a valve used to regulate hydraulic pressure

Restriction valve – a valve that regulates hydraulic pressure by restricting or blocking part of the incoming pressure

Servo – in an automatic transmission, a hydraulically operated cylinder/piston arrangement used to apply a band

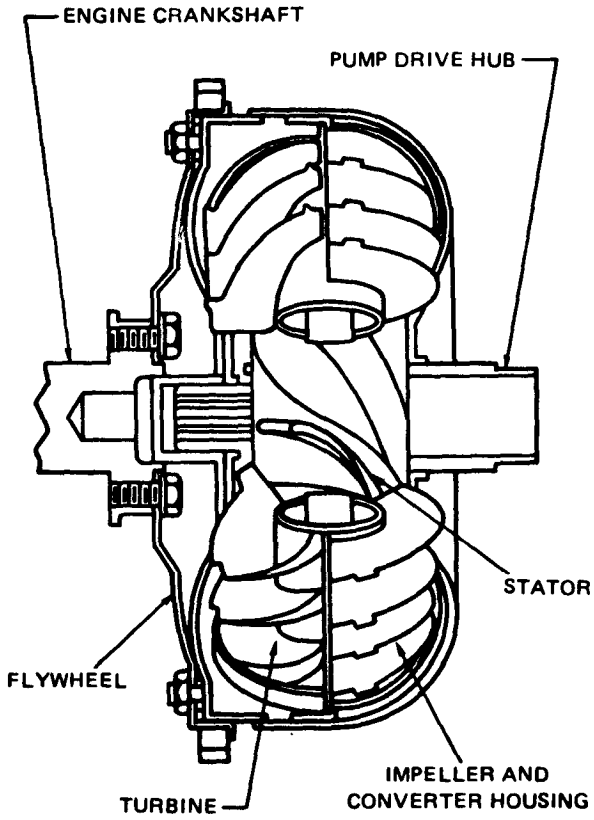
Shift valve – a valve used to direct hydraulic fluid to a clutch or servo for automatic shifting

Shuttle valve – a valve used to direct hydraulic fluid to different parts of the valve body or hydraulic system

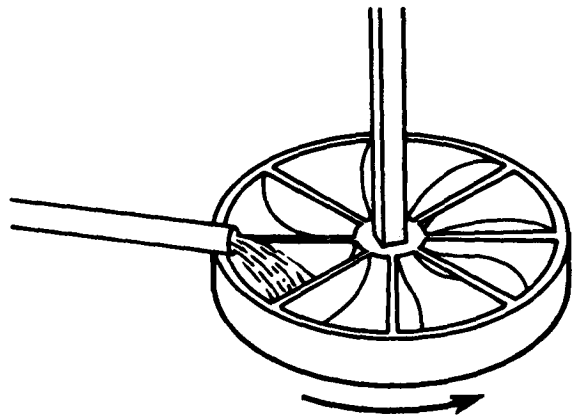
Spalling – bearing damage due to chipping or flaking of the case-hardened surfaces

Sprag – an hourglass-shaped bearing used in some one-way clutches

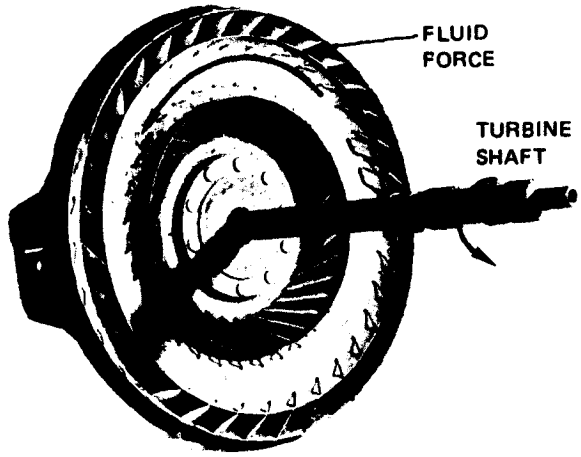
Vacuum – an absence or air; pressures below atmospheric



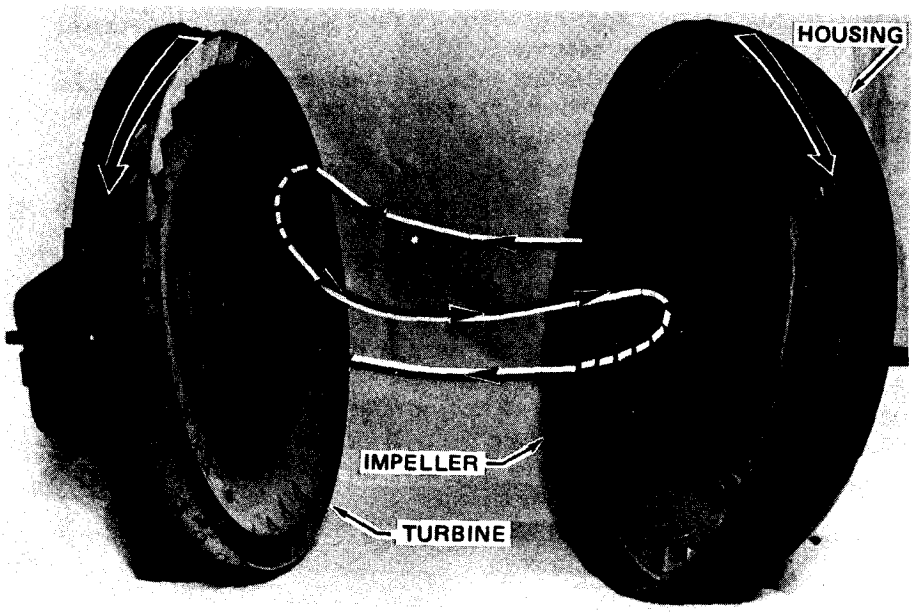
A torque converter for use with an automatic transmission.



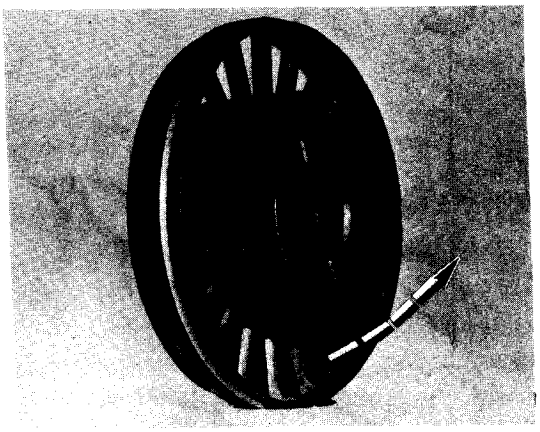
This type of water wheel works in the same way as a turbine.



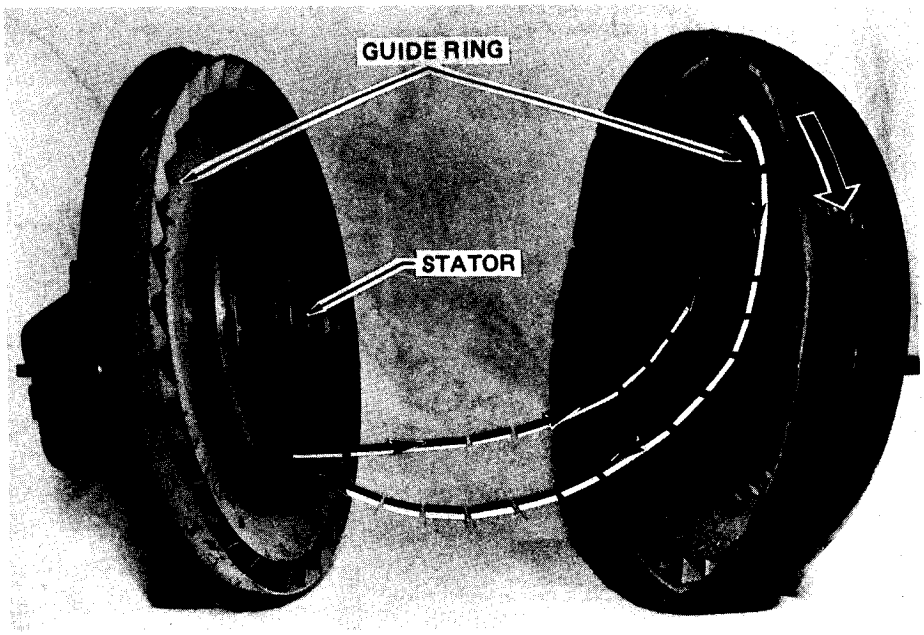
Fluid force turns the turbine and turbine shaft, and this forms a connection between engine and transmission.



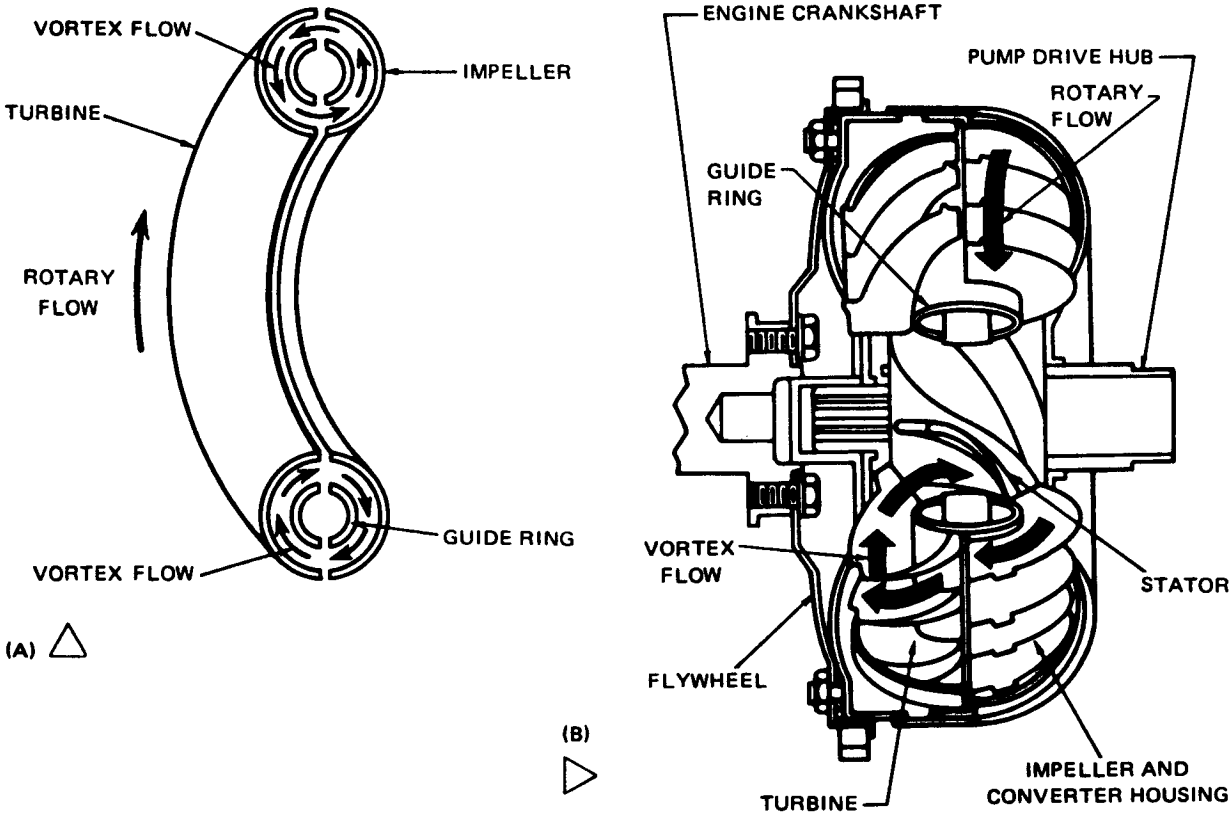
The impeller pumps fluid through the vanes of the turbine, causing it to turn.



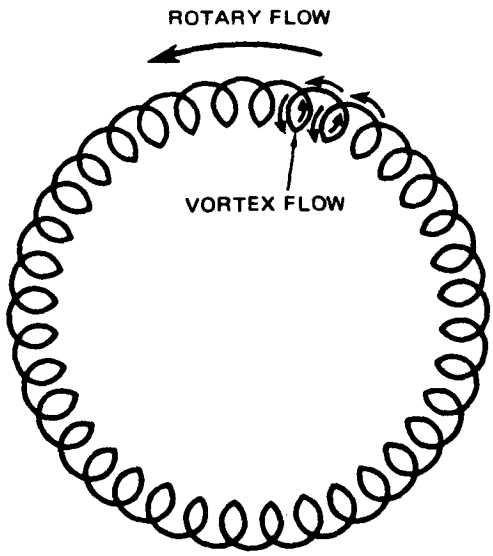
The stator reverses the flow of fluid.



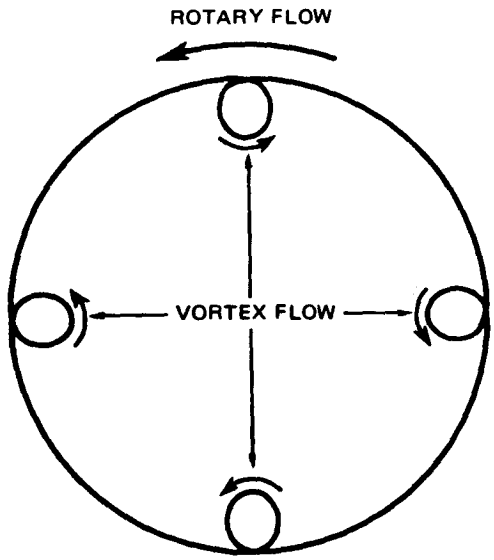
The stator turns the fluid in a helping direction to the impeller.



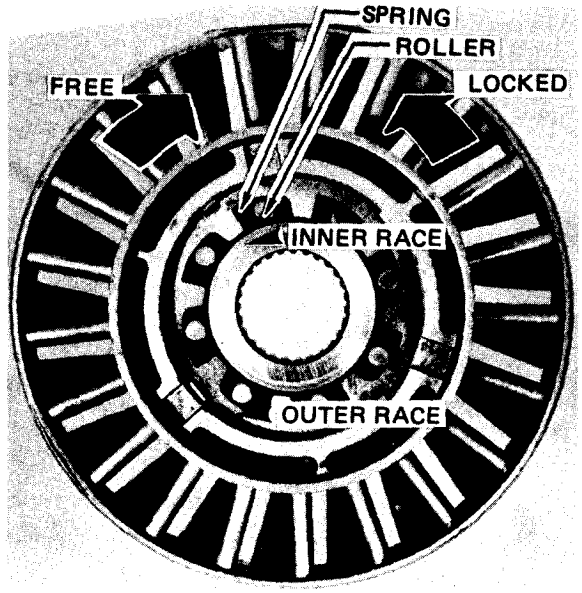
Schematic of oil flow in a torque converter.



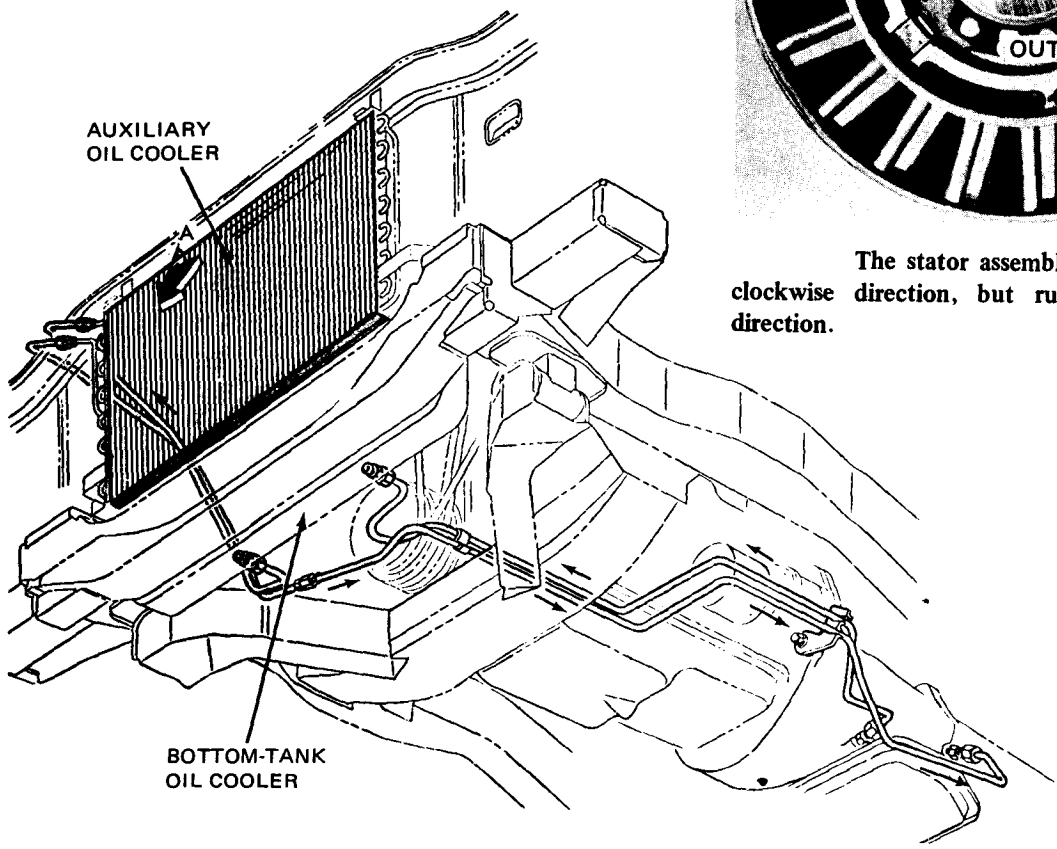
TORQUE MULTIPLICATION

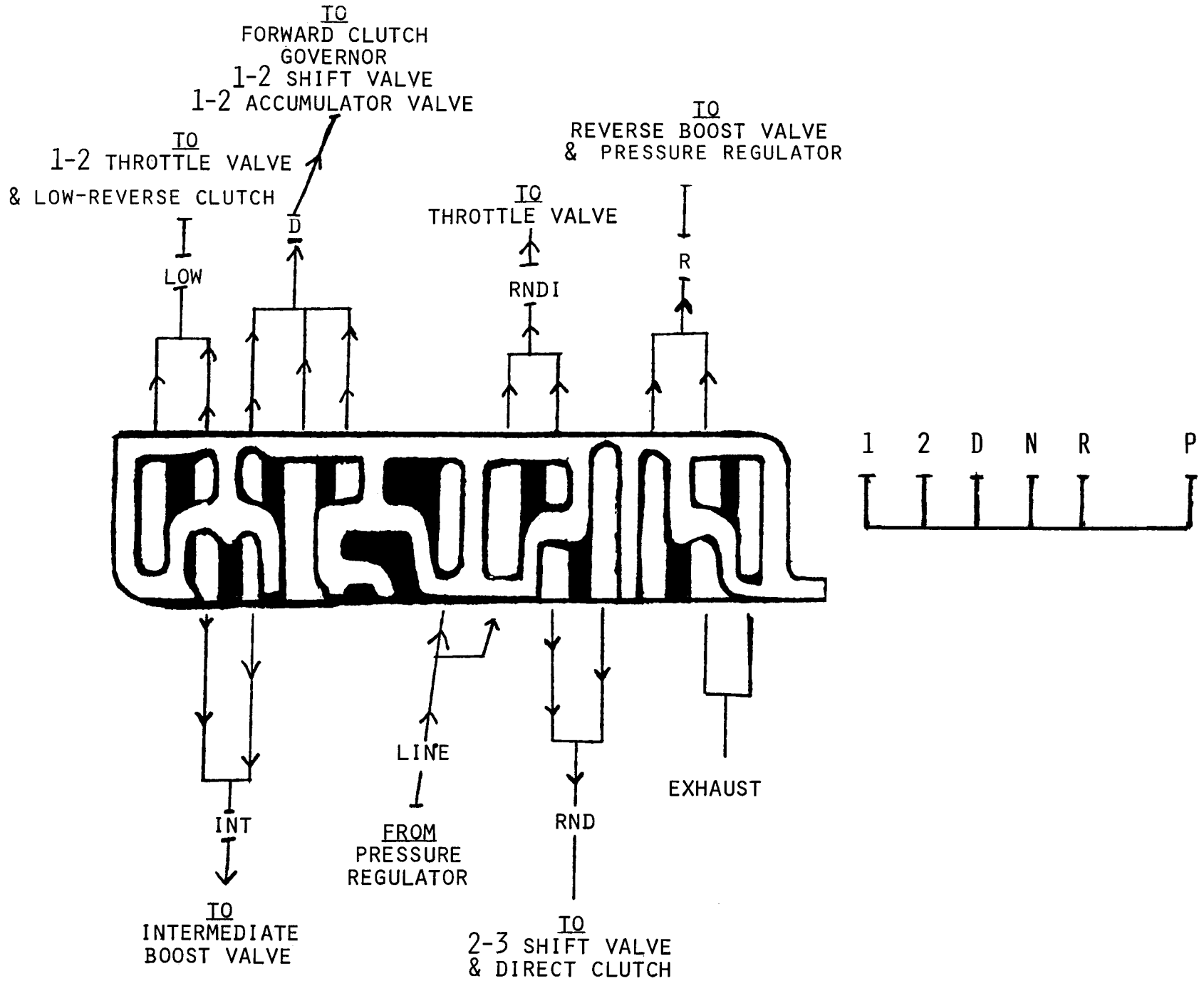


COUPLING STAGE



The stator assembly locks up in counter-clockwise direction, but runs free in clockwise direction.




TO
FORWARD CLUTCH
GOVERNOR
1-2 SHIFT VALVE
1-2 ACCUMULATOR VALVE
TO
1-2 THROTTLE VALVE
& LOW-REVERSE CLUTCH
TO
REVERSE BOOST VALVE
& PRESSURE REGULATOR
TO
THROTTLE VALVE
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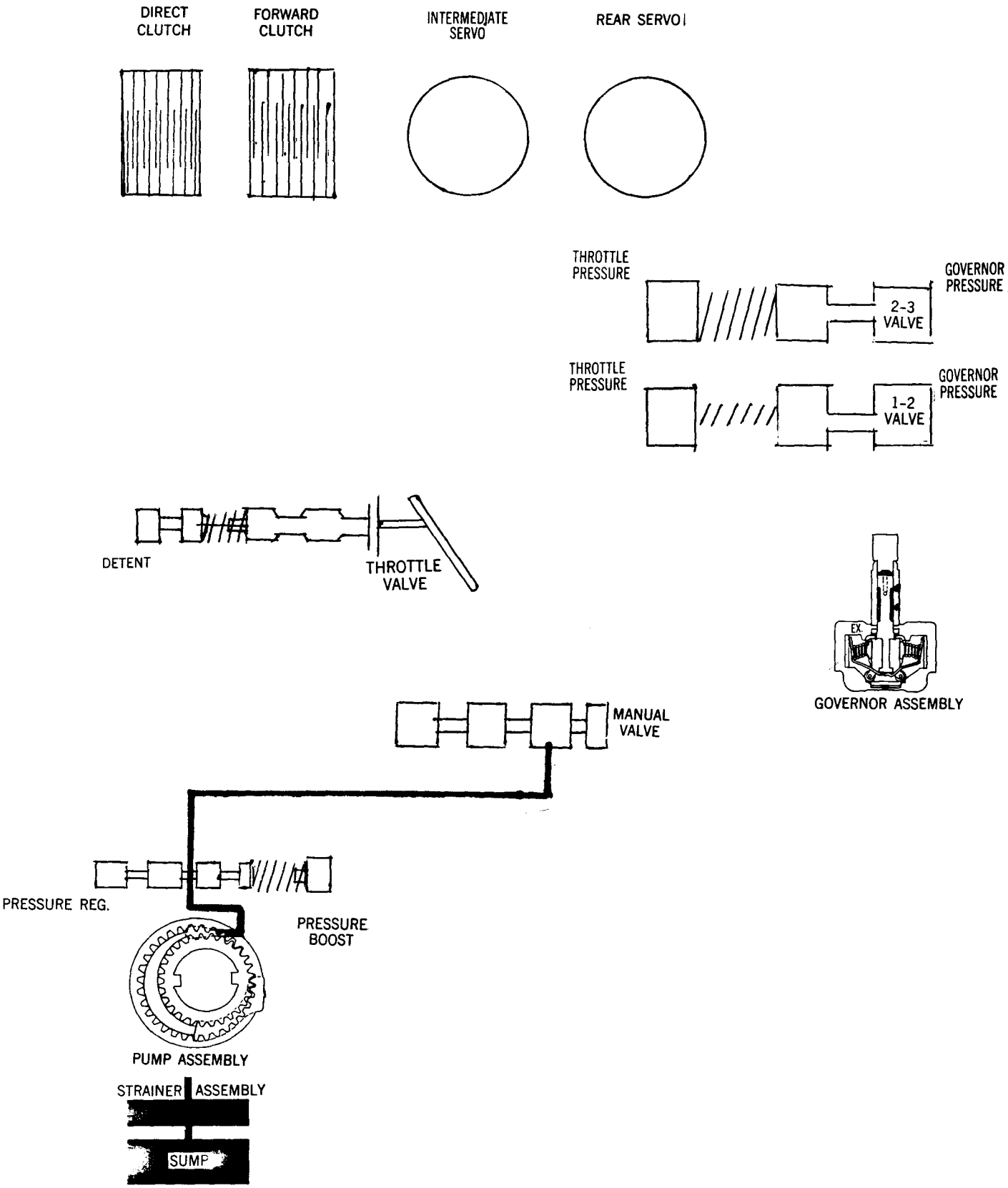
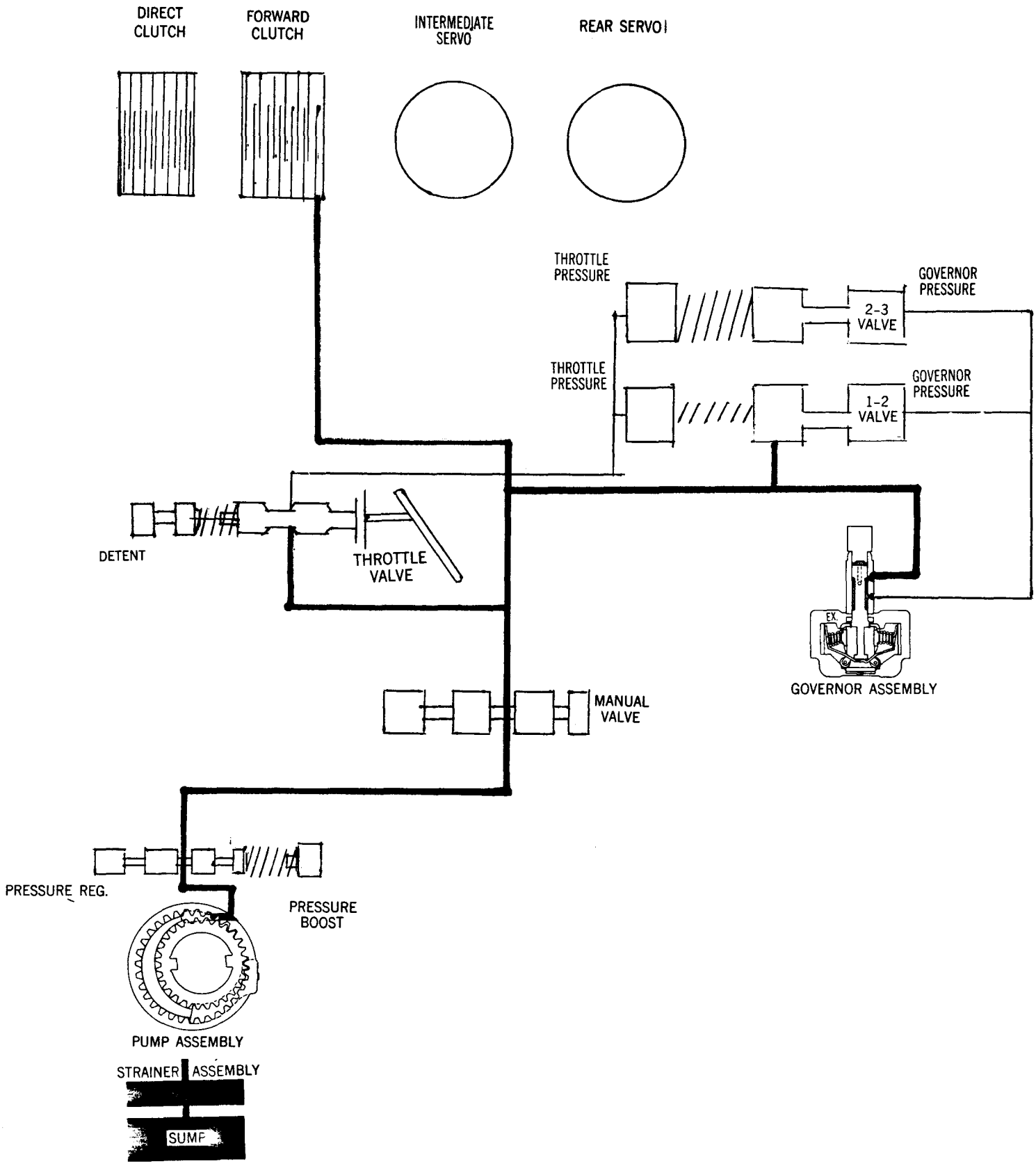
1 2 D N R P
LINE
INT
EXHAUST
RND
FROM
PRESSURE
REGULATOR
TO
INTERMEDIATE
BOOST VALVE
TO
2-3 SHIFT VALVE
& DIRECT CLUTCH


DIRECT CLUTCH
FORWARD CLUTCH
INTERMEDIATE SERVO
REAR SERVO
THROTTLE PRESSURE
GOVERNOR PRESSURE
2-3 VALVE
THROTTLE PRESSURE
GOVERNOR PRESSURE
1-2 VALVE
DETENT
THROTTLE VALVE
EX.
GOVERNOR ASSEMBLY
MANUAL VALVE
PRESSURE REG.
PRESSURE BOOST
PUMP ASSEMBLY
STRAINER ASSEMBLY
SUMP


DIRECT CLUTCH
FORWARD CLUTCH
INTERMEDIATE SERVO
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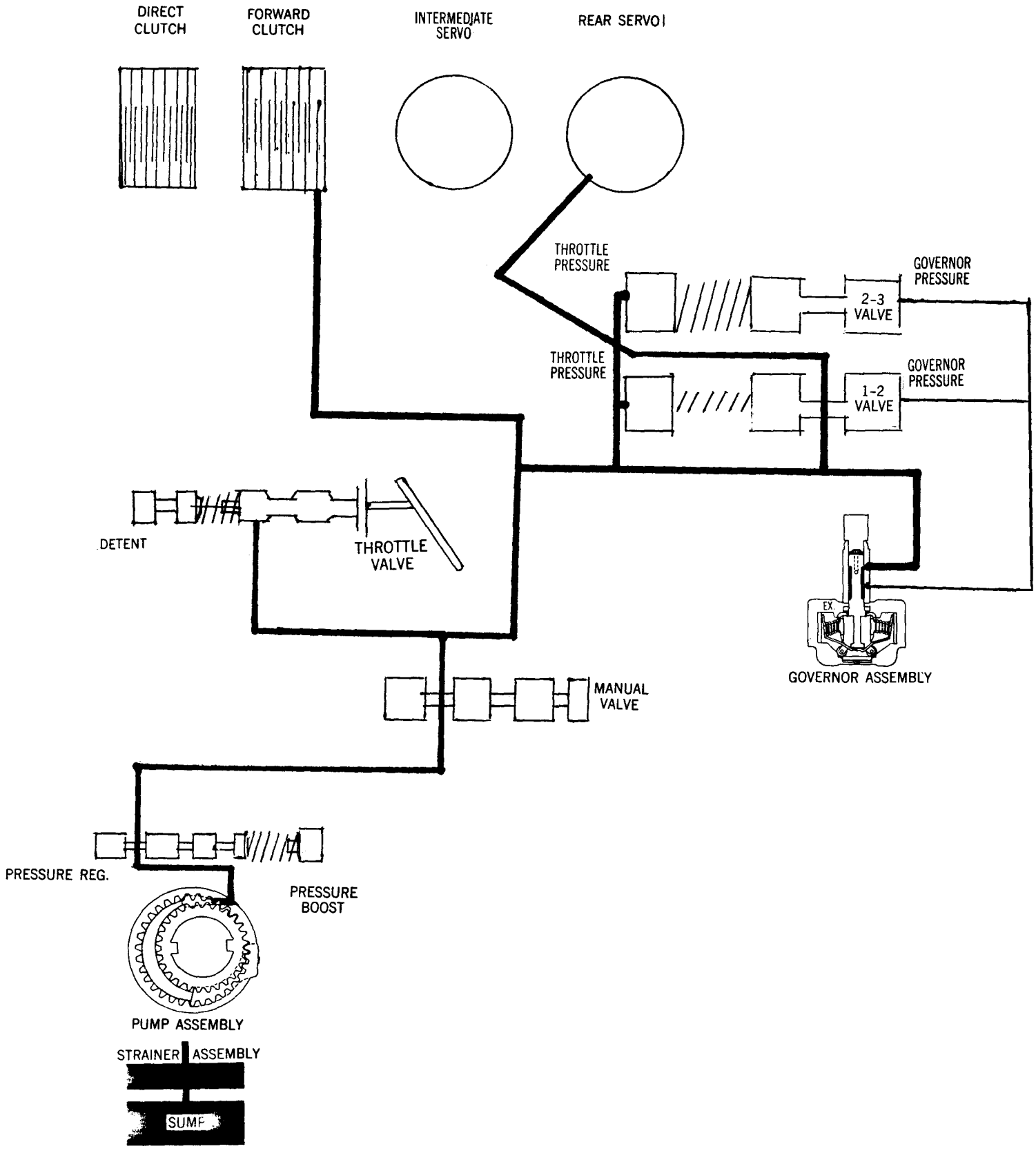
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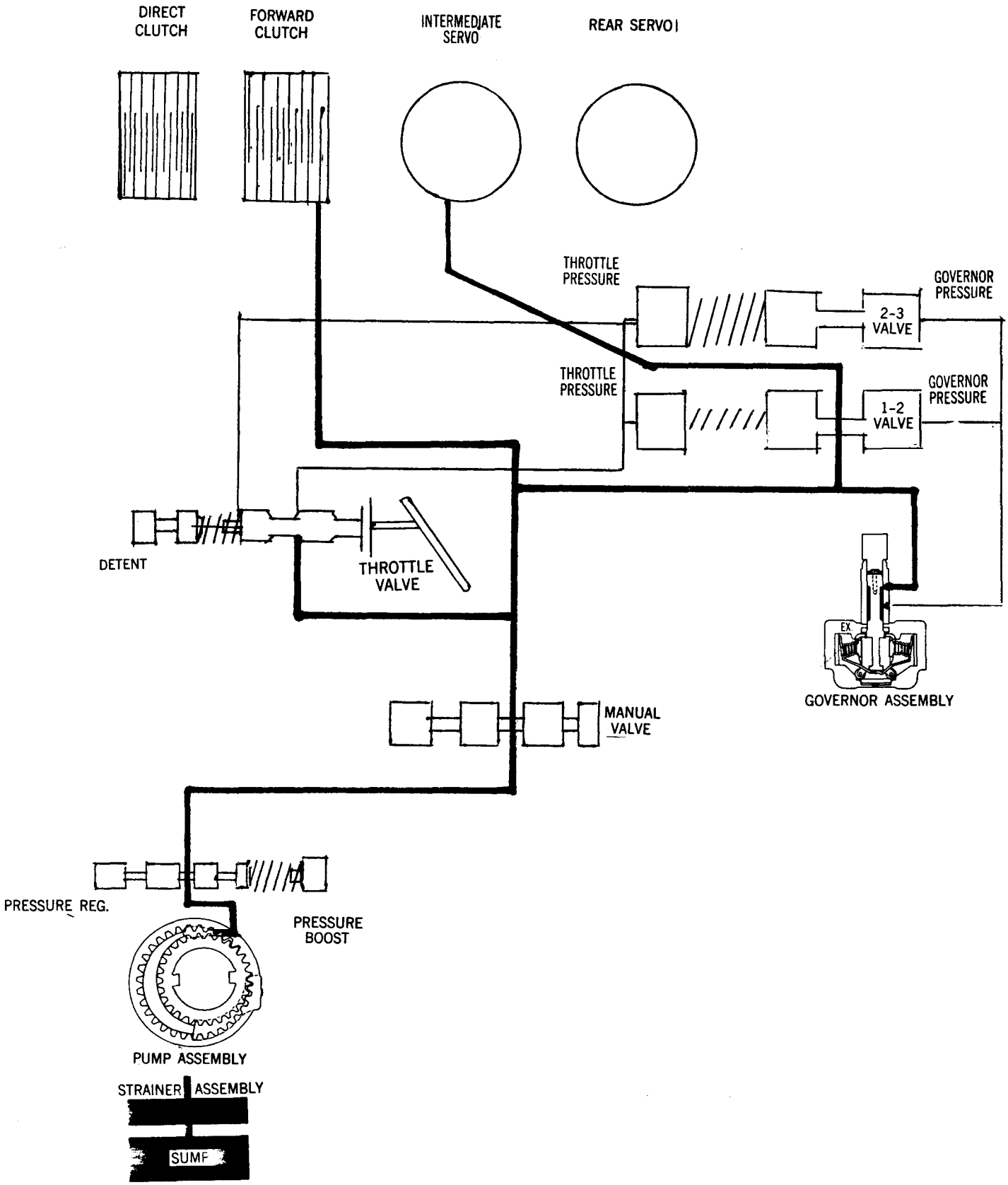
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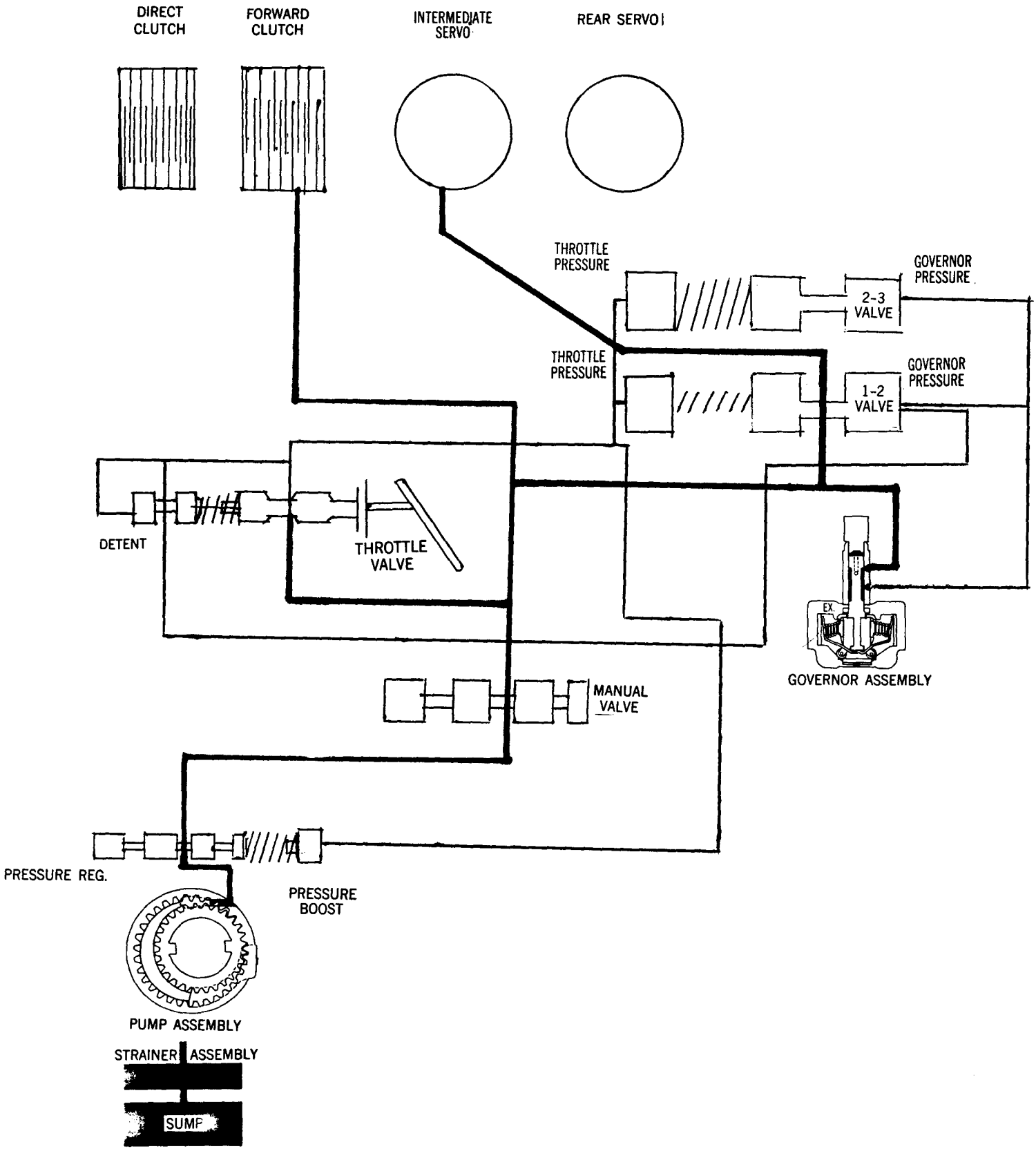
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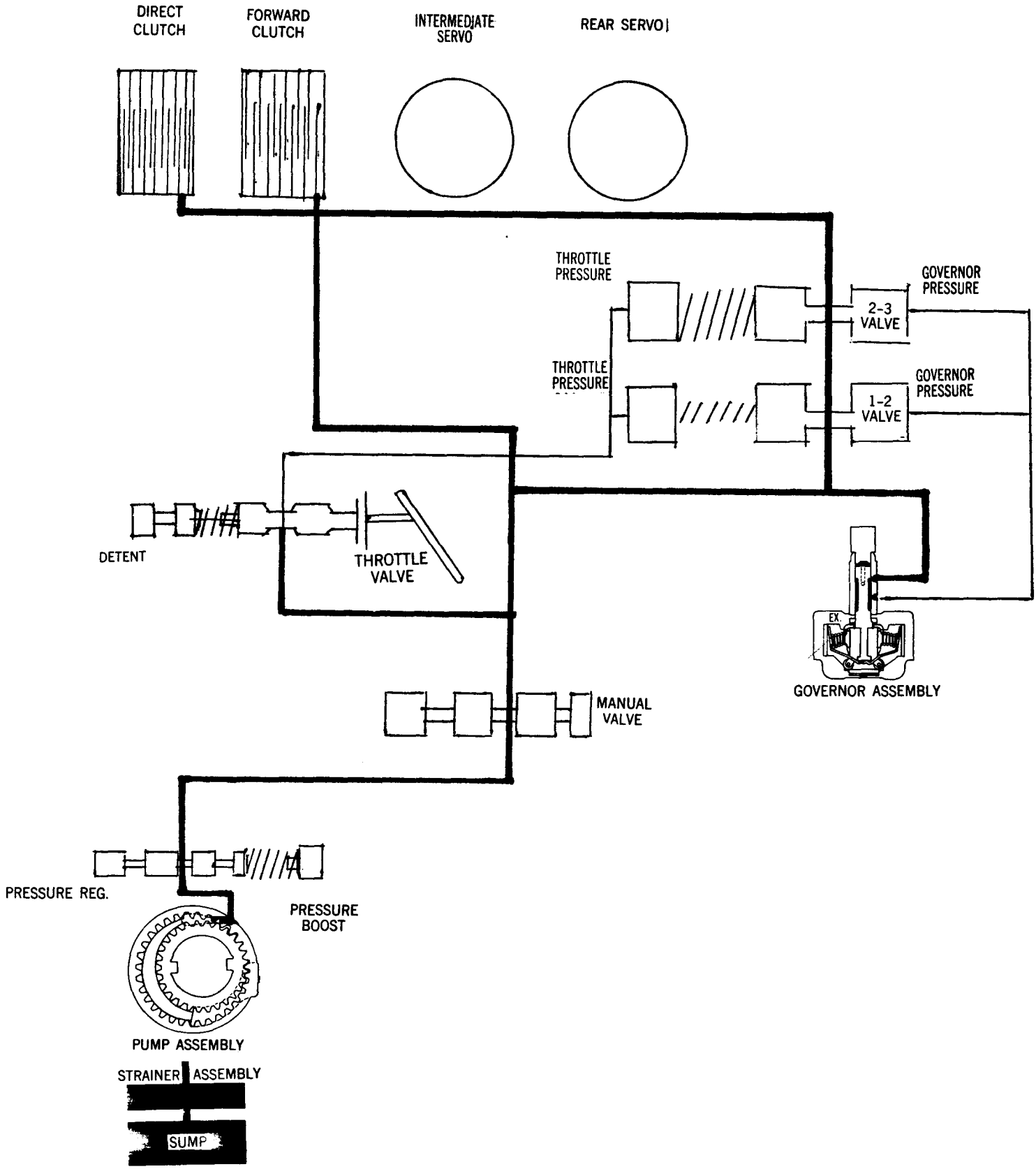
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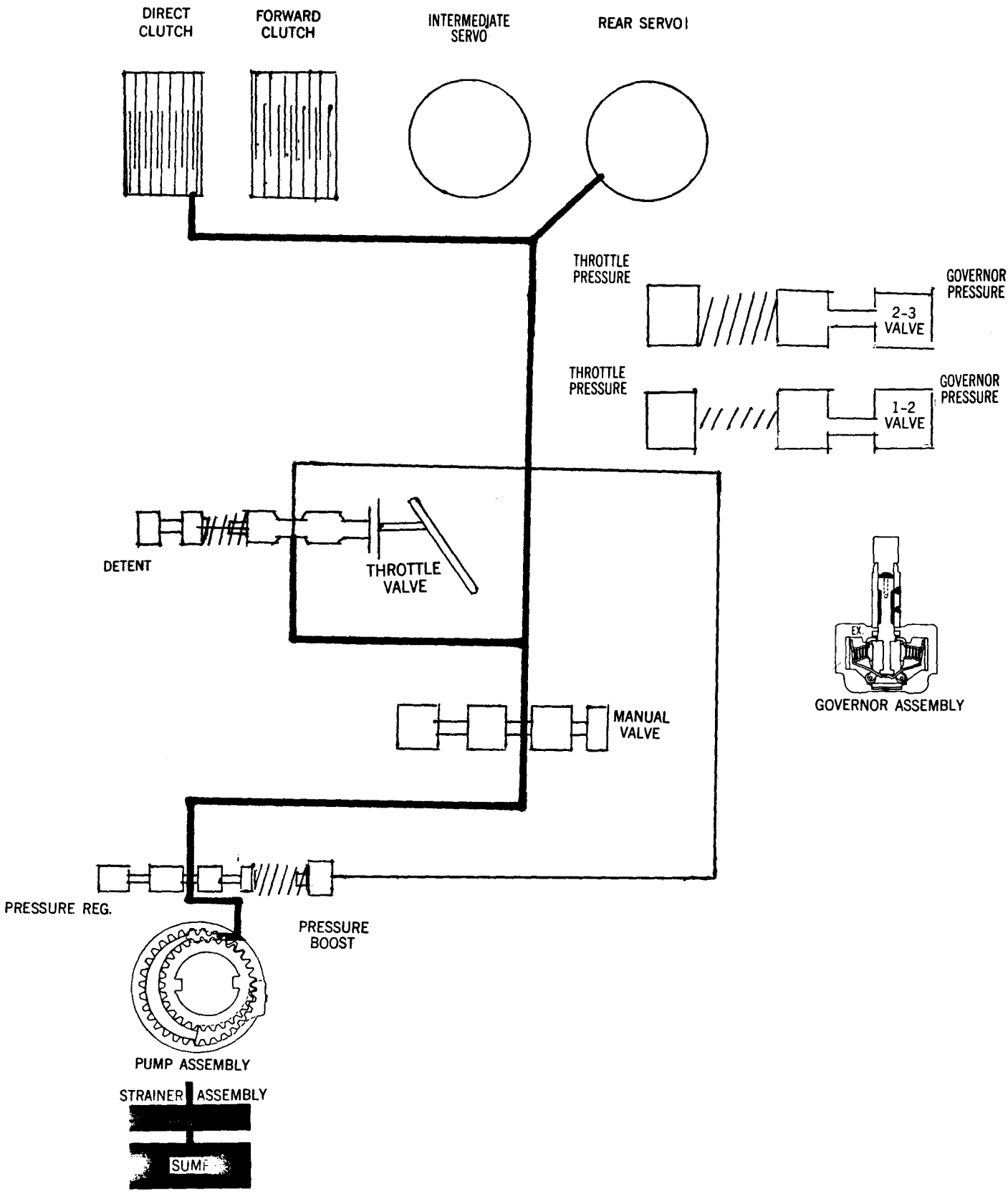
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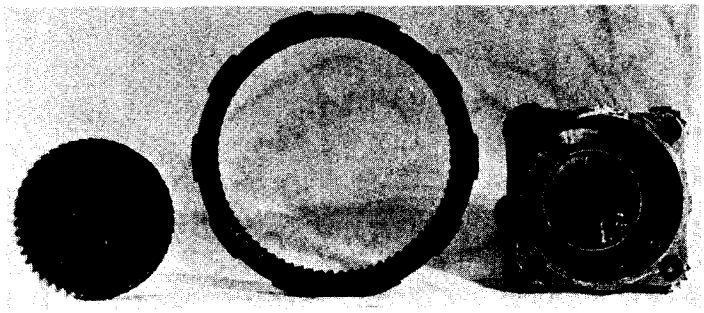
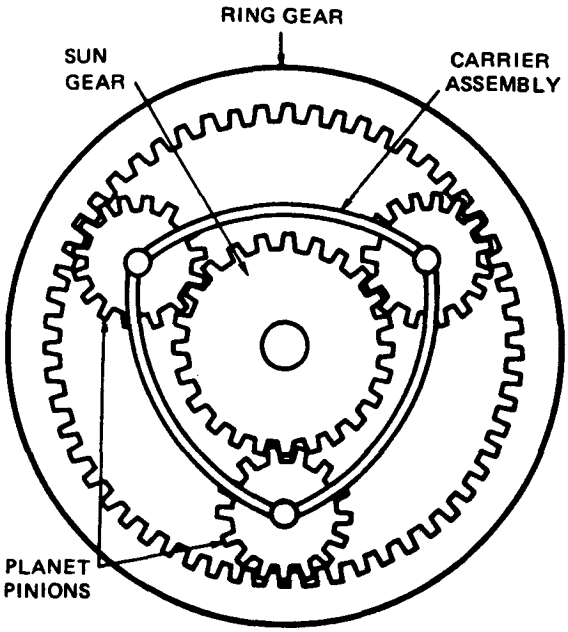
THROTTLE VALVE
EX
GOVERNOR ASSEMBLY
MANUAL VALVE
PRESSURE REG.
PRESSURE BOOST
PUMP ASSEMBLY
STRAINER ASSEMBLY
SUMP

SIMPLE PLANETARY GEAR SETS



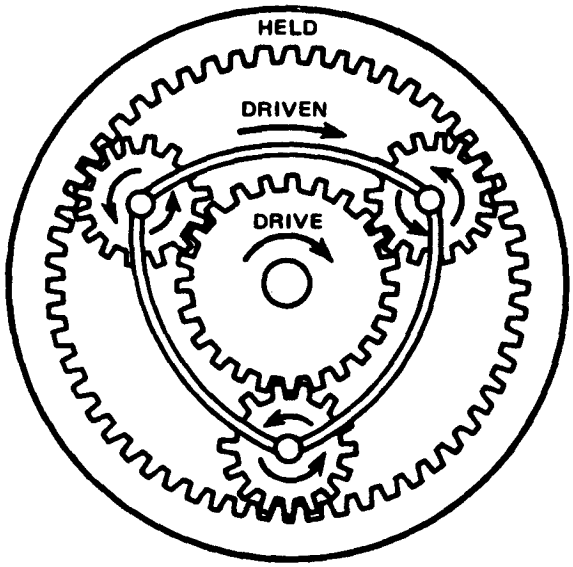
Members of a
planetary gear set (disassembled)



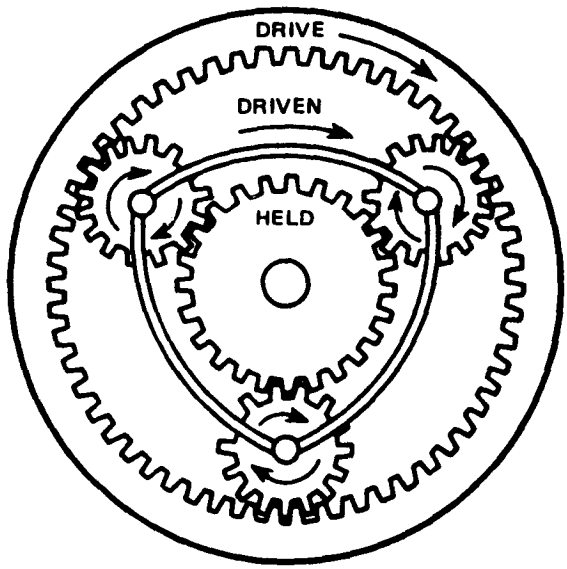
Arrangement of gears in the planetary gear set.

Condition	Drive	Hold	Driven	Direction	Speed Ratio
1	sun	ring	carrier	forward	low
2	ring	sun	carrier	forward	intermediate
3	any 2 (or)	any 2	unit locked	forward	direct
4	carrier	sun	ring	forward	1st overdrive
5	carrier	ring	sun	forward	2nd overdrive
6	sun	carrier	ring	reverse	low
7	ring	carrier	sun	reverse	overdrive
8	none	none	none	none	neutral

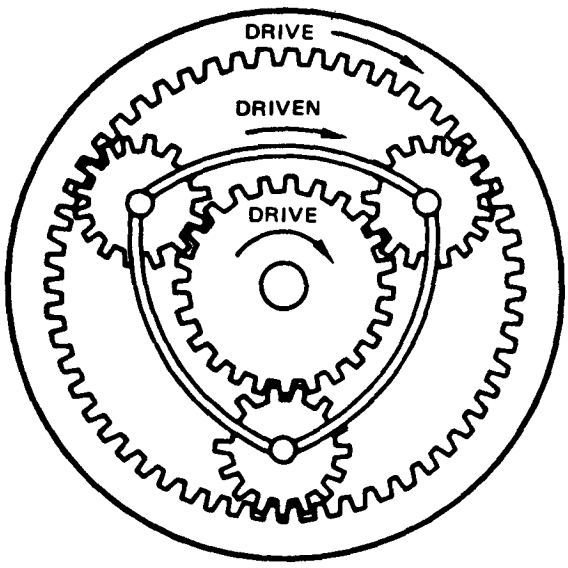
Combinations possible with a simple planetary gear set.



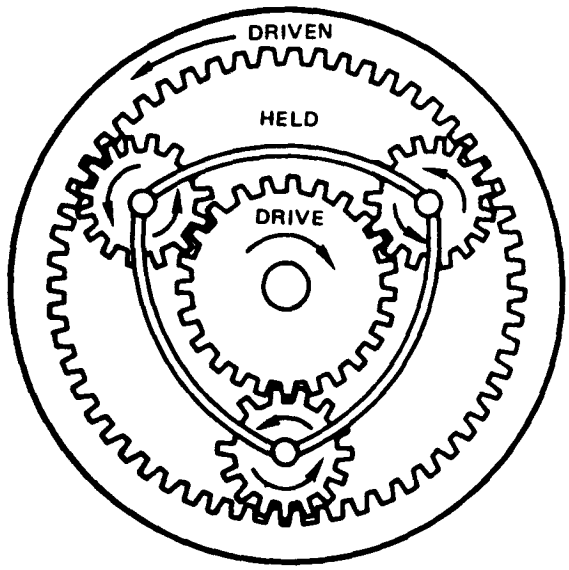
The lowest possible speed ratio with a simple planetary gear set is obtained by driving the sun gear and holding the ring gear.



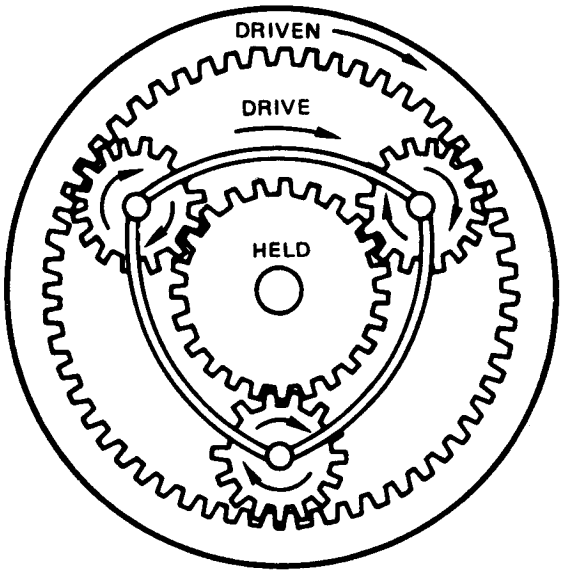
Intermediate or second speed in a simple planetary gear set.



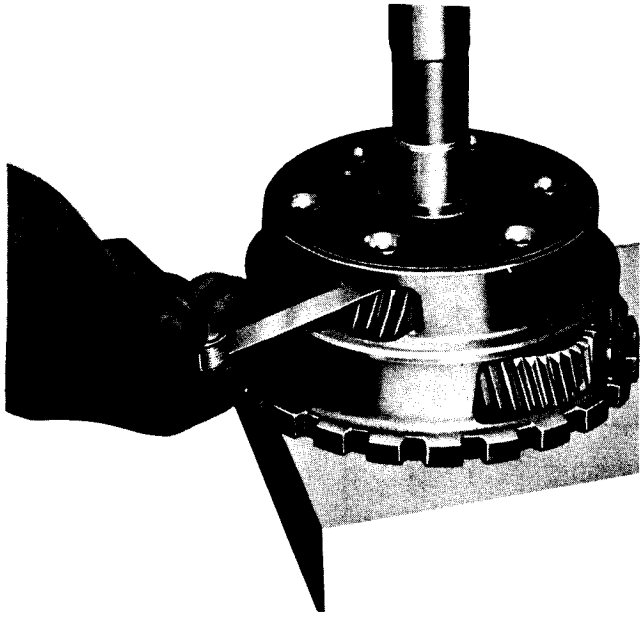
Direct, or third, speed in a planetary gear set.



The planetary gear system in reverse reduction.



The planetary gear system in overdrive.



CHECKING PINION GEAR CLEARANCE

BASIC LAWS OF SIMPLE PLANETARY GEARS

SUN	CARRIER	RING	SPEED	TORQUE	DIRECTION
INPUT	OUTPUT	HELD	MAXIMUM REDUCTION	INCREASE	SAME AS INPUT
HELD	OUTPUT	INPUT	MINIMUM REDUCTION	INCREASE	SAME AS INPUT
OUTPUT	INPUT	HELD	MAXIMUM INCREASE	REDUCTION	SAME AS INPUT
HELD	INPUT	OUTPUT	MINIMUM INCREASE	REDUCTION	SAME AS INPUT
INPUT	HELD	OUTPUT	REDUCTION	INCREASE	OPPOSITE OF INPUT
OUTPUT	HELD	INPUT	INCREASE	REDUCTION	OPPOSITE OF INPUT

WHEN ANY TWO MEMBERS ARE HELD TOGETHER, SPEED AND DIRECTION ARE THE SAME AS INPUT; RATIO 1:1

IF THE CARRIER IS -

1. THE OUTPUT, UNDERDRIVE RESULTS, OR SPEED DECREASE.
2. THE INPUT, OVERDRIVE RESULTS, OR SPEED INCREASE.
3. THE HELD MEMBER, OUTPUT DIRECTION IS REVERSED.

2 SPEED RAVENEAU COMPOUND

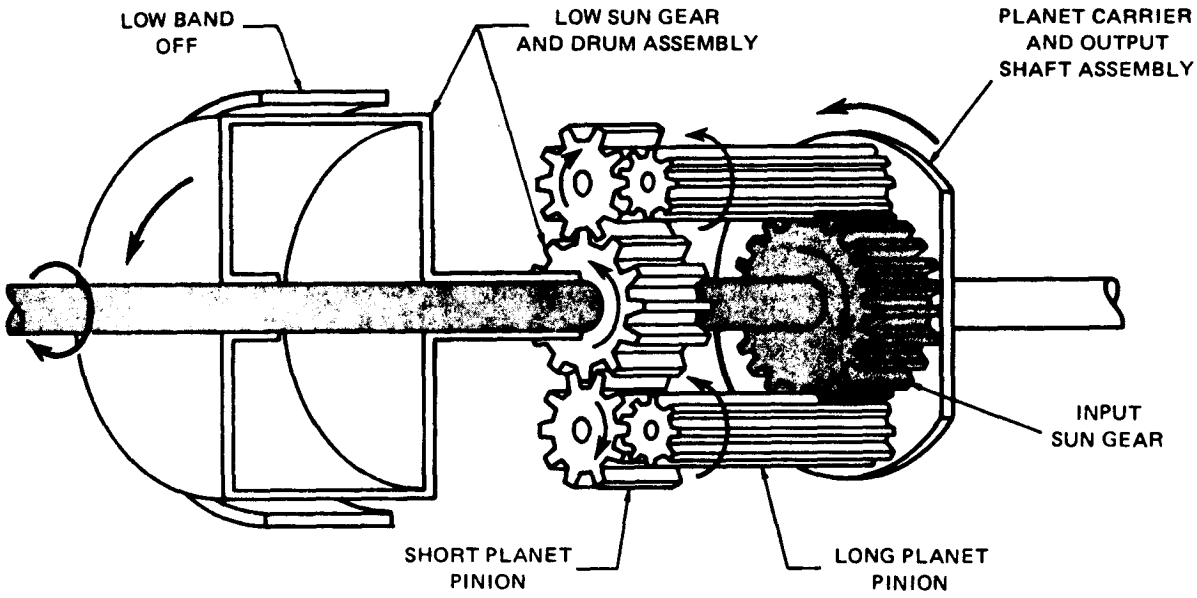
	SECONDARY SUN GEAR	PRIMARY SUN GEAR	RING	PLANET CARRIER	SPEED	TORQUE	DIRECTION
LOW	HELD	INPUT	FREE-WHEELS	OUTPUT	MINIMUM REDUCTION	INCREASE	CLOCKWISE
DIRECT	INPUT	INPUT		OUTPUT	DIRECT		CLOCKWISE
REVERSE	C/CW	INPUT	HELD	OUTPUT	REDUCTION	INCREASE	COUNTER CLOCKWISE
NEUTRAL	TURNS	TURNS	TURNS	STATIONARY	NONE	NONE	STATIONARY

THIS GEARSET USED IN:

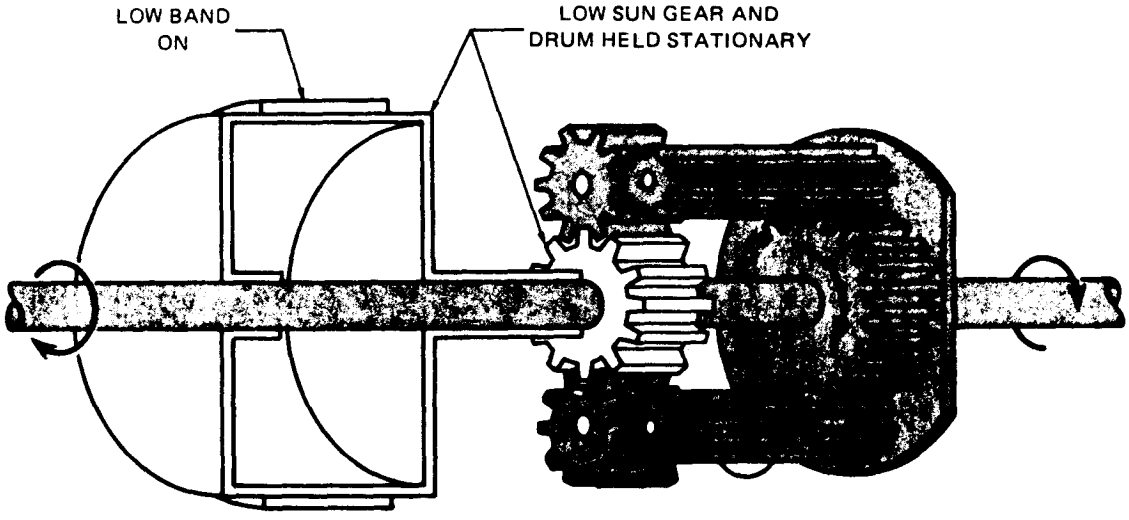
CHEVROLET POWERGLIDE
FORD TWO SPEED
TOYOTA TWO SPEED
TURBOHYDRO 300

BAND AND CLUTCH APPLICATION

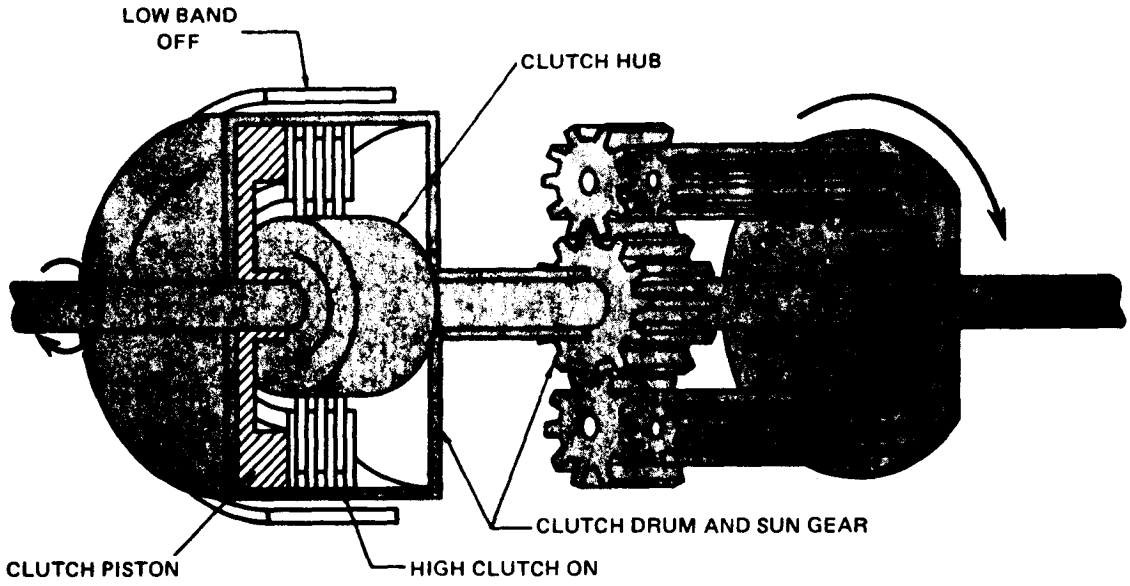
	FRONT BAND	DIRECT CLUTCH	REVERSE BAND OR CLUTCH
NEUTRAL	RELEASED	RELEASED	RELEASED
FIRST	APPLIED HOLDS SECONDARY SUN GEAR	RELEASED	RELEASED
DIRECT	RELEASED	APPLIED CAUSES SECONDARY SUN TO TURN AT SAME SPEED AND DIRECTION AS PRIMARY SUN	RELEASED
REVERSE	RELEASED	RELEASED	APPLIED HOLDS RING GEAR



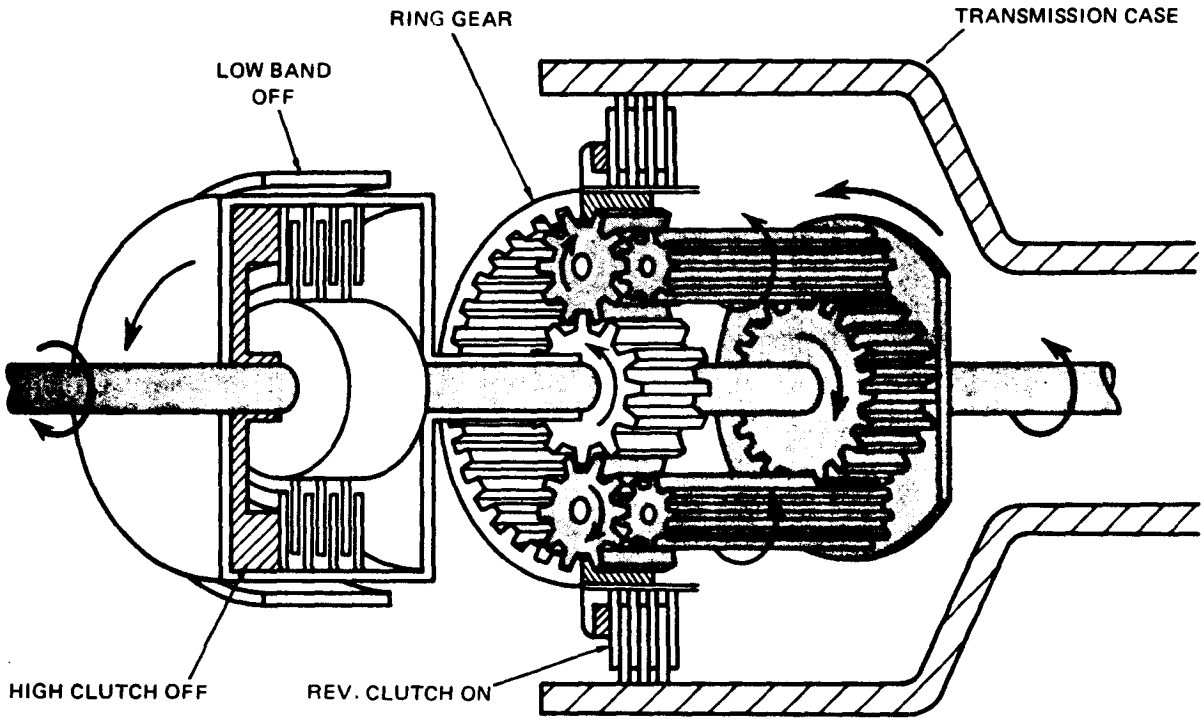
Power flow in neutral.



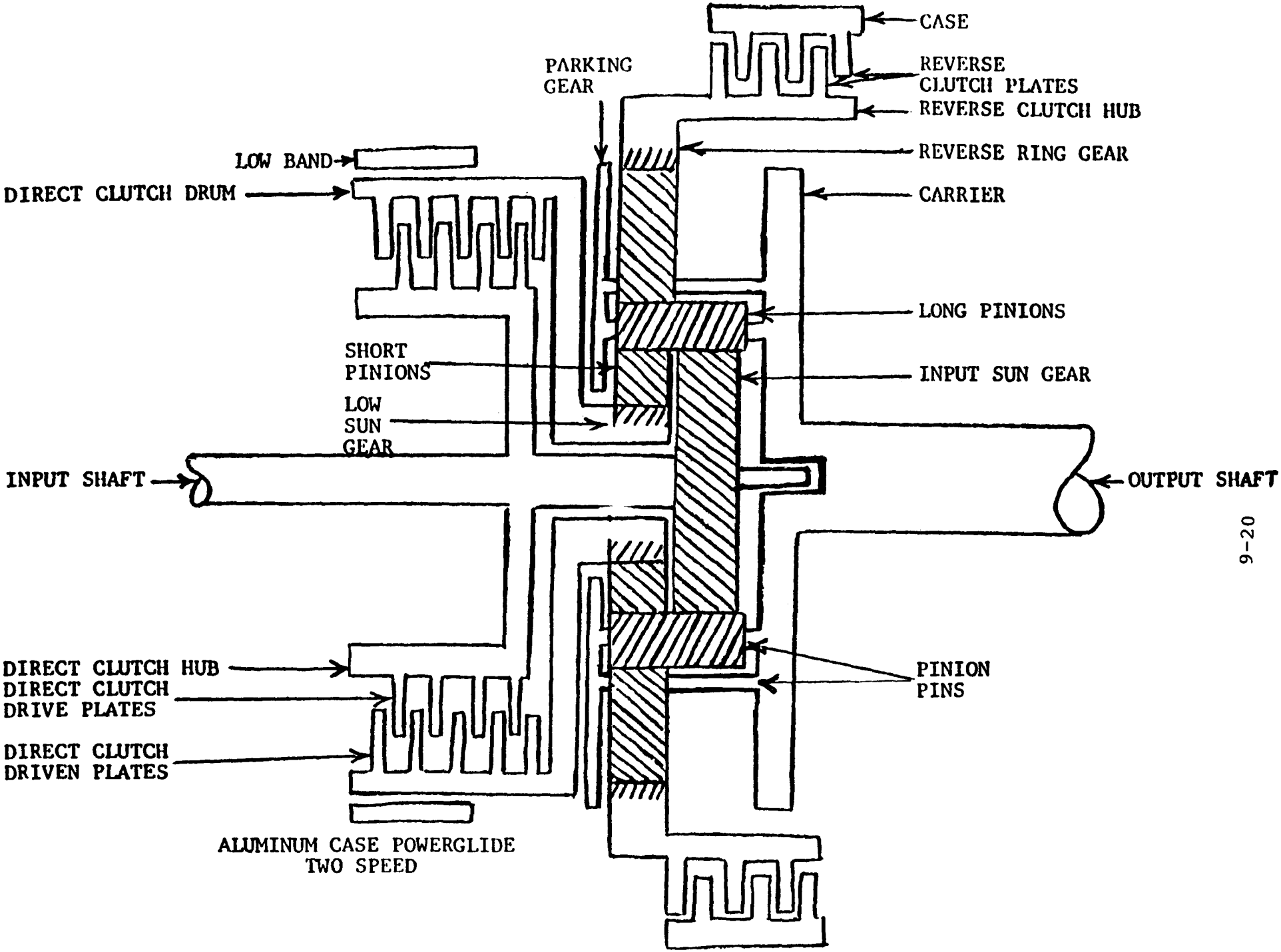
Power flow in low.



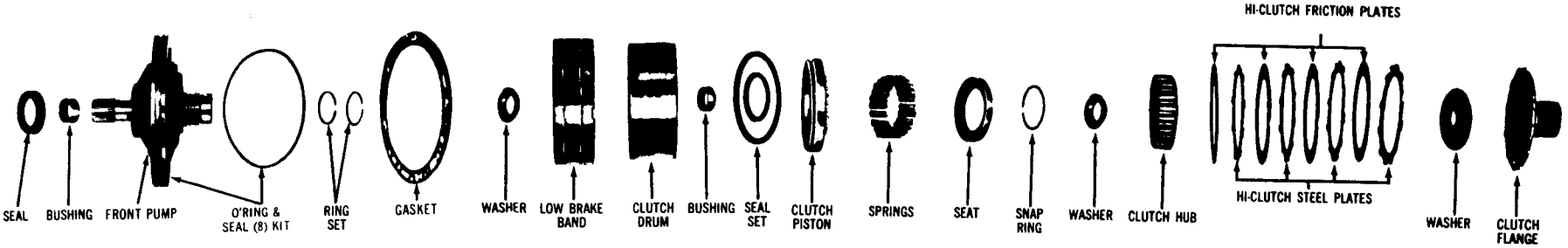
Power flow in drive range high.

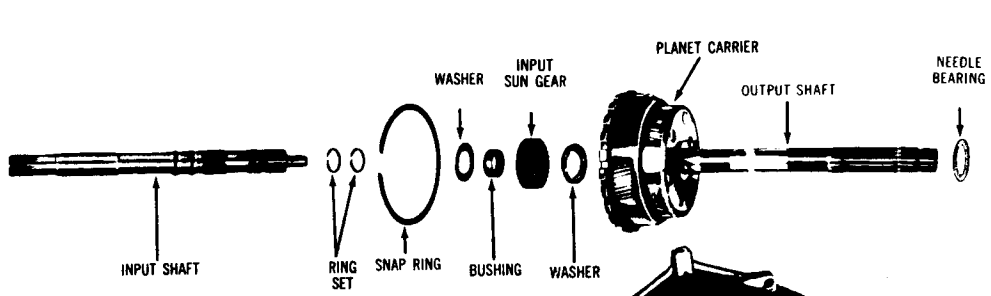


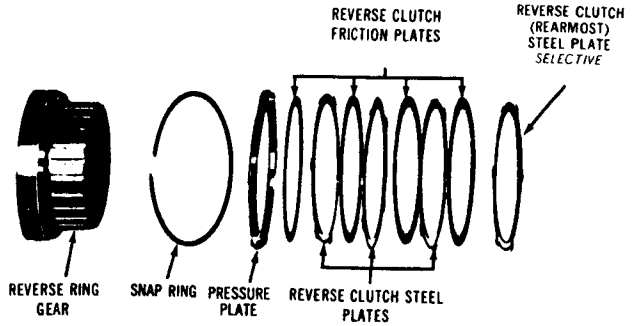
Power flow for reverse.

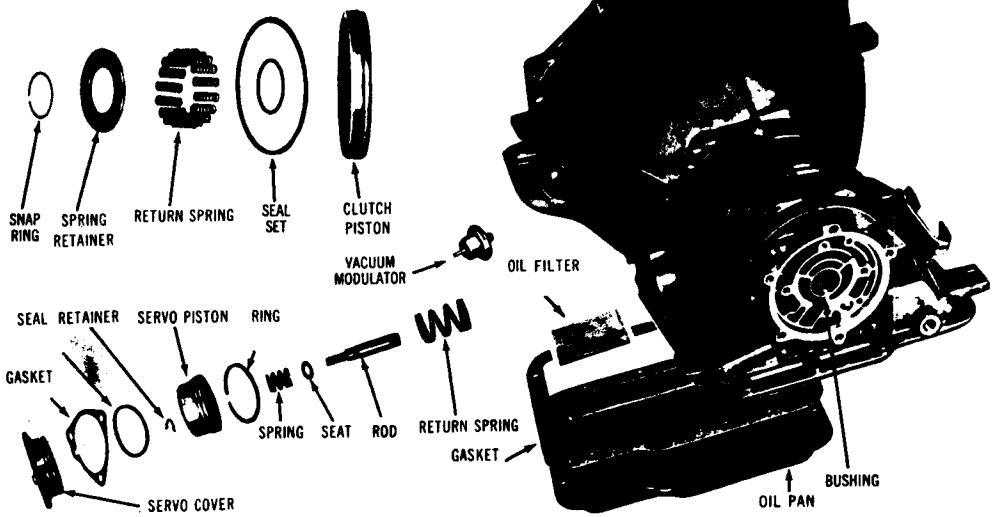

CASE
PARKING GEAR
REVERSE CLUTCH PLATES
REVERSE CLUTCH HUB
LOW BAND
REVERSE RING GEAR
DIRECT CLUTCH DRUM
CARRIER
LONG PINIONS
SHORT PINIONS
INPUT SUN GEAR
LOW SUN GEAR
INPUT SHAFT
OUTPUT SHAFT
DIRECT CLUTCH HUB
DIRECT CLUTCH DRIVE PLATES
PINION PINS
DIRECT CLUTCH DRIVEN PLATES
ALUMINUM CASE POWERGLIDE TWO SPEED

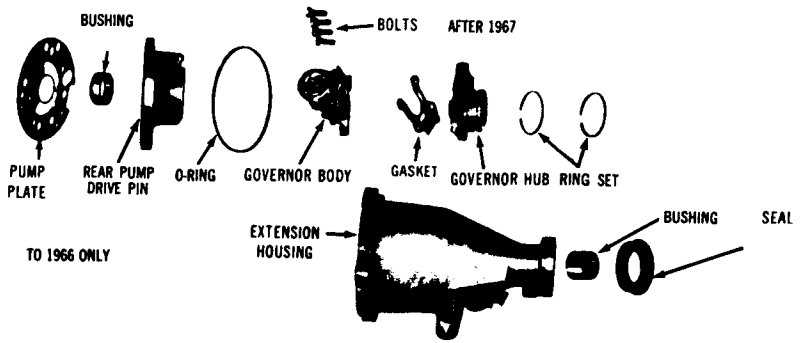
POWERGLIDE POW-R-FLO M-35

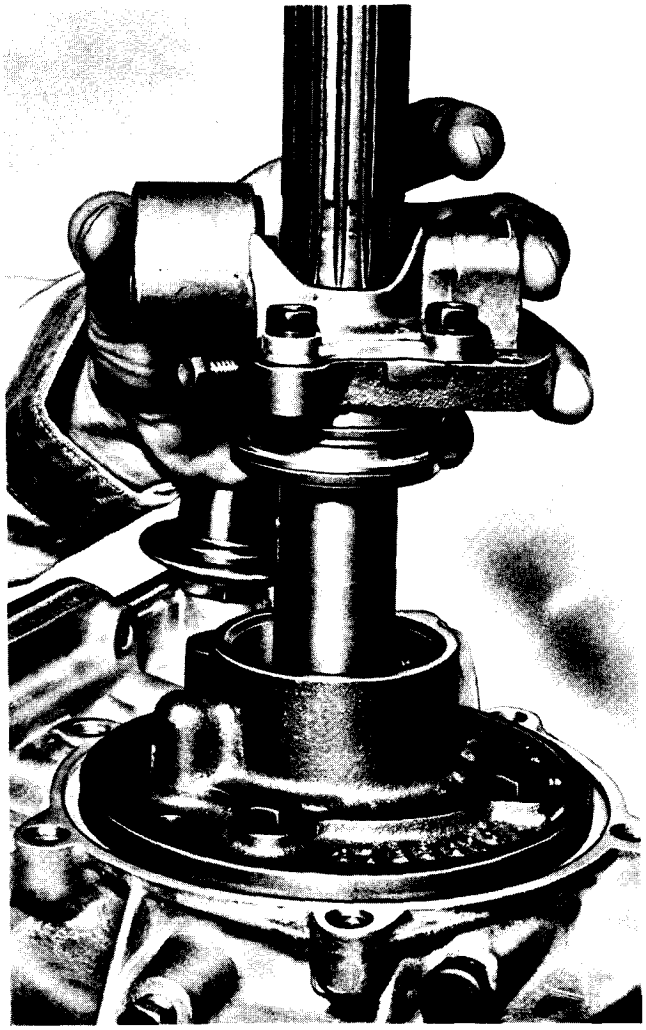


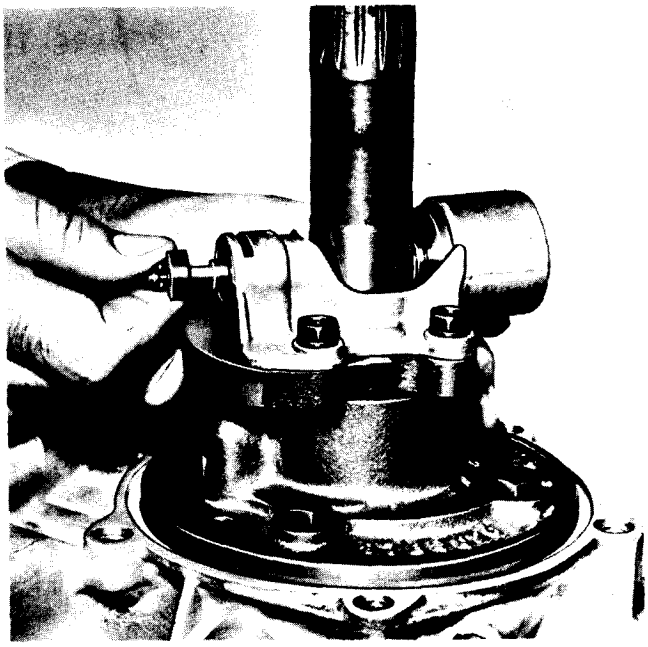




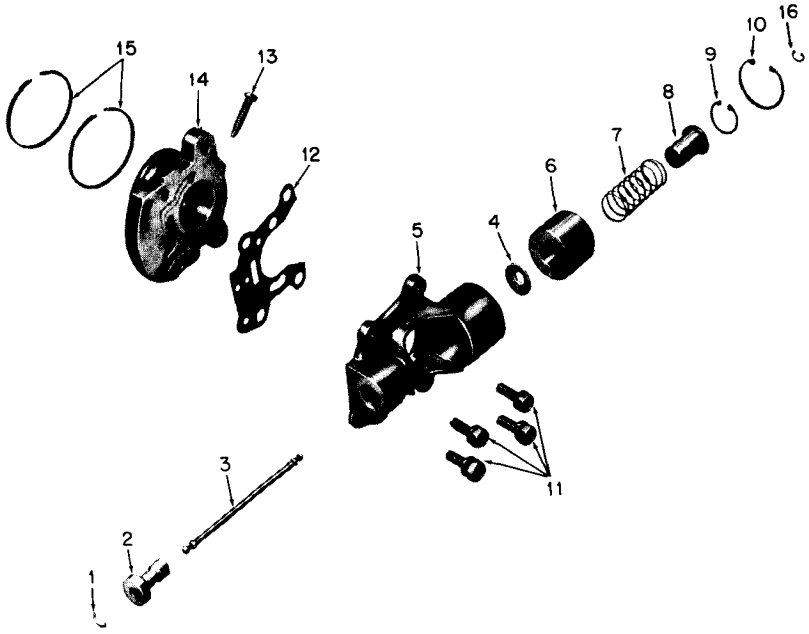






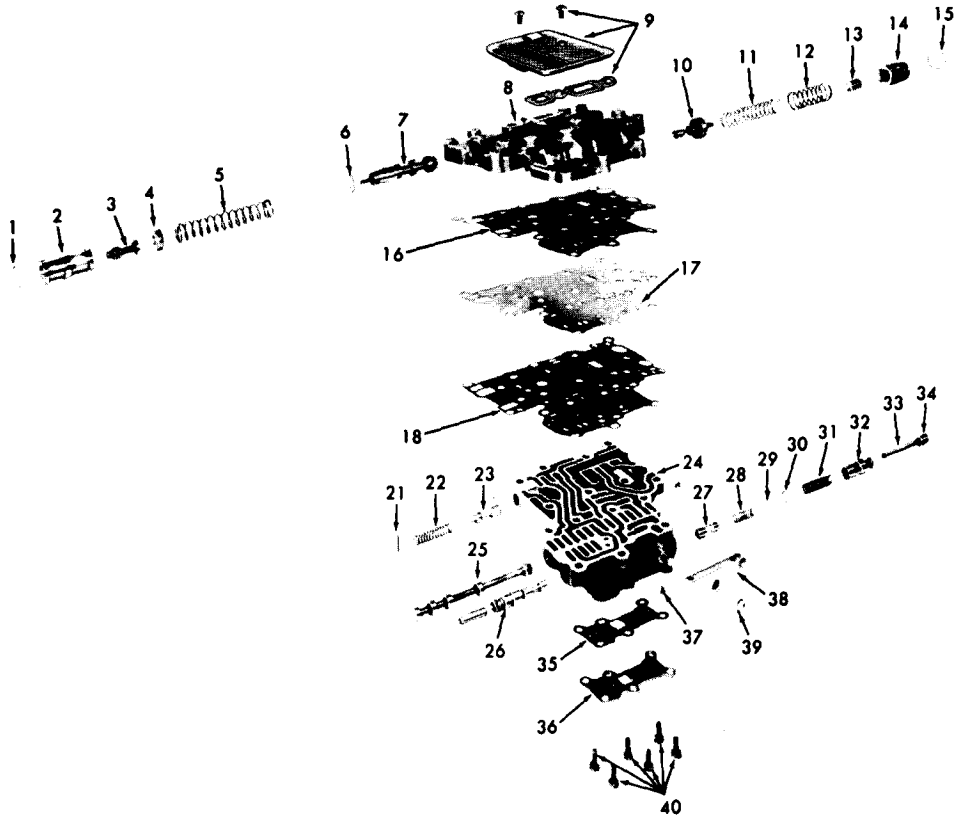


POWERGLIDE GOVERNOR
(TORQUEFLITE SIMILAR)

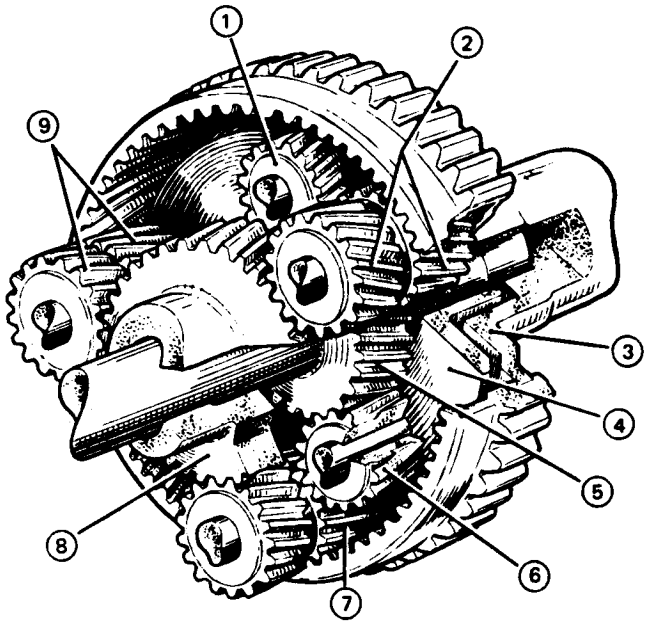


1. Valve-to-shaft retaining snap ring
2. Valve
3. Shaft
4. Urethane washer
5. Body
6. Outer weight
7. Spring
8. Inner weight
9. Inner-weight-to-outer-weight retaining snap ring
10. Outer-weight-to-body retaining snap ring
11. Body-to-hub screws and lock washers
12. Gasket
13. Hub-drive screw
14. Hub
15. Hub oil-seal ring
16. Inner-weight-to-shaft retaining snap ring

POWERGLIDE VALVE BODY

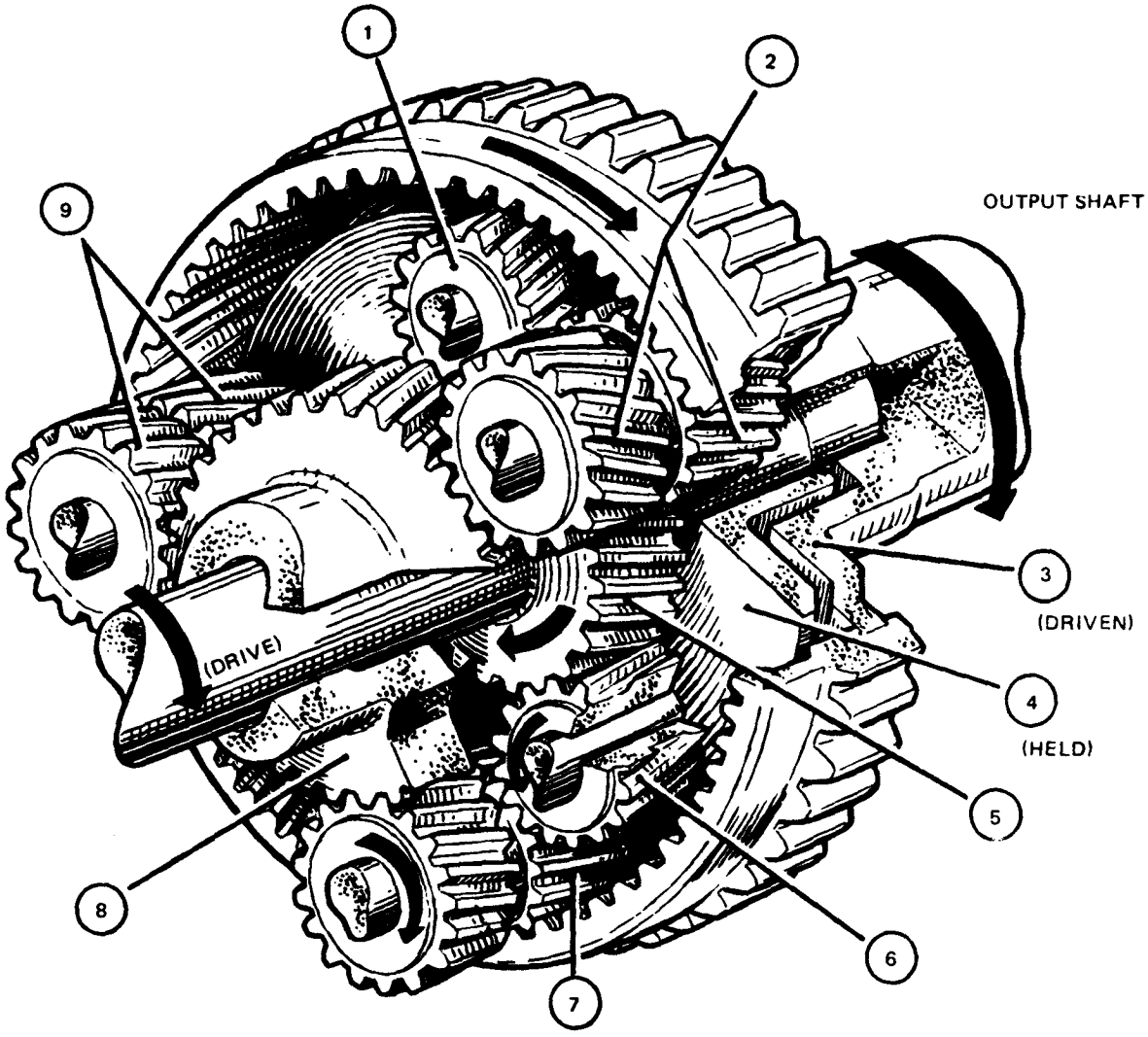


1. Snap ring
2. Hydraulic-modulator-valve sleeve
3. Hydraulic modulator valve
4. Pressure-regulator-spring retainer
5. Pressure-regulator spring
6. Pressure-regulator-spring seat
7. Pressure-regulator valve
8. Lower valve body
9. Suction screen, gasket and attaching screws
10. Low-and-drive valve
11. Low-and-drive-valve inner spring
12. Low-and-drive-valve outer spring
13. Low-and-drive regulator valve
14. Low-and-drive-regulator-valve sleeve and cap
15. Snap ring
16. Transfer-plate-to-lower-valve-body gasket
17. Transfer plate
18. Transfer-plate to-upper-valve-body gasket
21. High-speed-down-shift-timing-valve stop pin
22. High-speed-down-shift-timing-valve spring
23. High-speed-down-shift timing valve
24. Upper valve body
25. Manual control valve
26. Vacuum-modulator valve. Plunger and spring (exc. L4)
27. Throttle valve
28. Throttle-valve spring
29. Throttle-valve-spring seal
30. Throttle-valve-spring-regulator guide washer
31. Detent-valve spring
32. Detent valve
33. Throttle-valve spring regulator
34. Throttle-valve-spring-regulator nut
35. Upper-valve-body plate gasket
36. Upper-valve-body plate
37. Detent-valve-and-spring retaining stud
38. Range-selector detent lever
39. Snap ring
40. Upper-valve-body-plate-to-upper-valve-body attaching bolts and washer



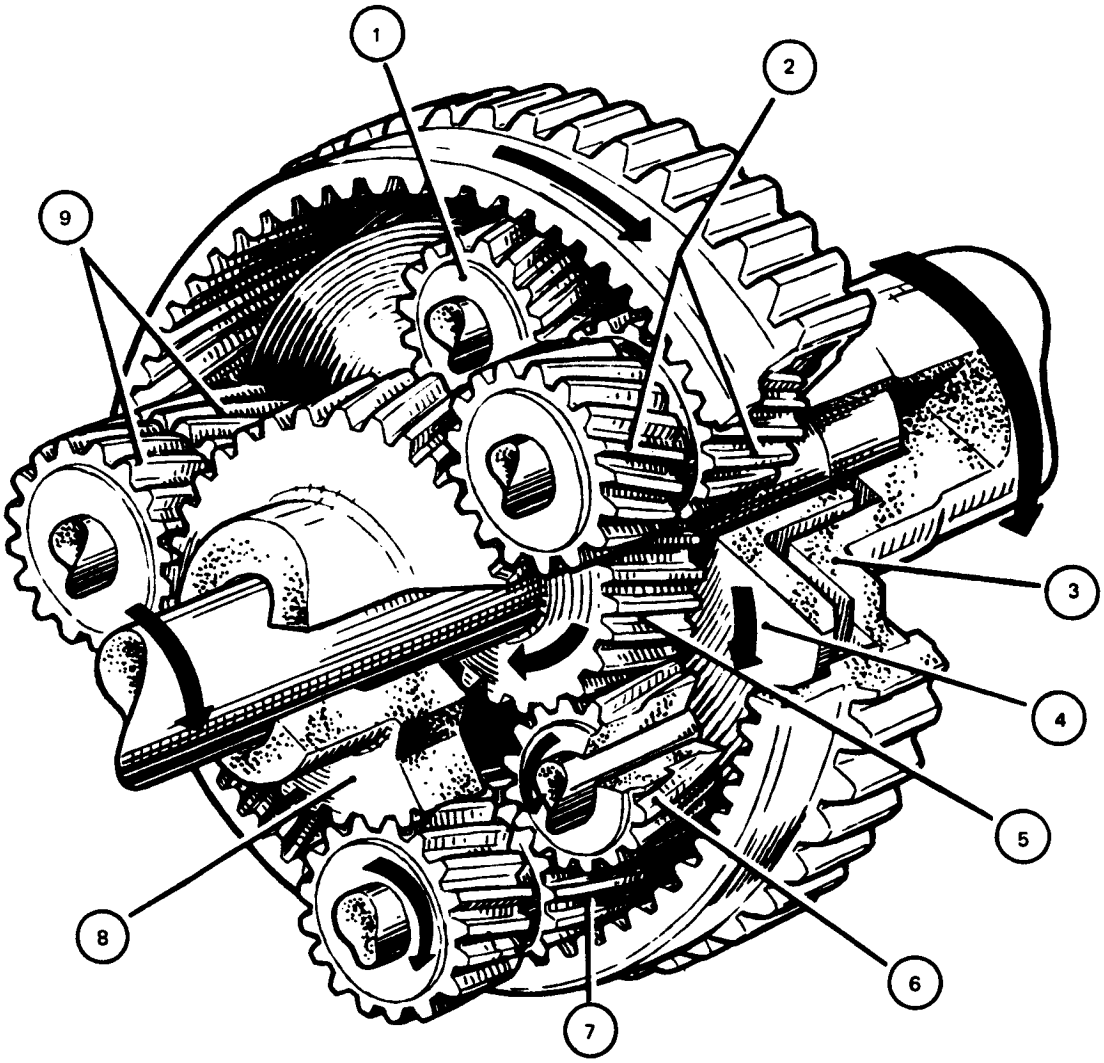
1 & 6	Short Planet Pinion (Third pinion not shown)
2, 7 & 9	Long Planet Pinion
3	Ring Gear (Annulus) and Output Shaft
4	Planet Carrier
5	Forward Sun Gear
8	Reverse Sun Gear

Planetary set, cutaway view.



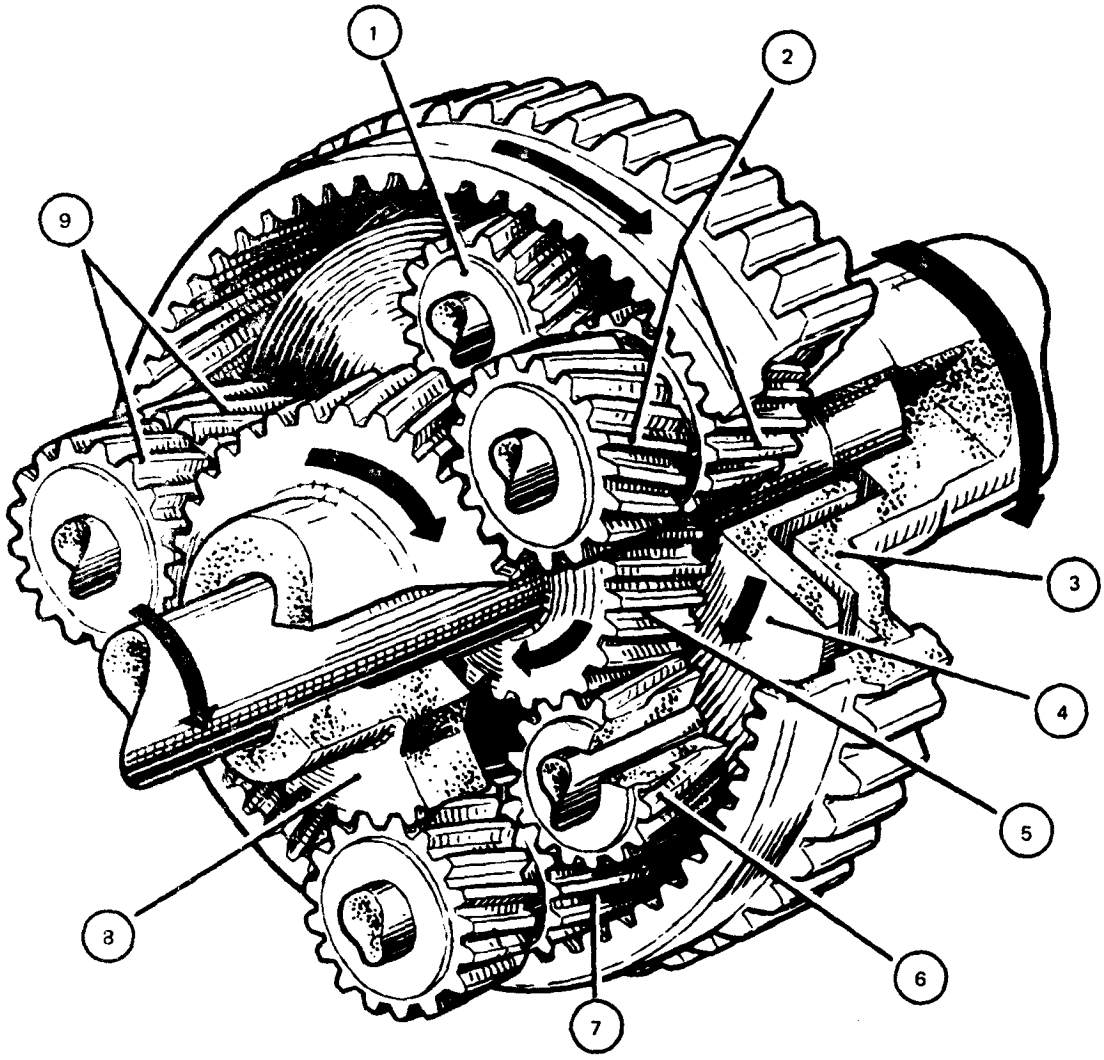
1 & 6	Short Planet Pinion (Third pinion not shown)
2, 7 & 9	Long Planet Pinion
3	Ring Gear (Annulus) and Output Shaft
4	Planet Carrier
5	Forward Sun Gear
8	Reverse Sun Gear

Gear set in drive range low.



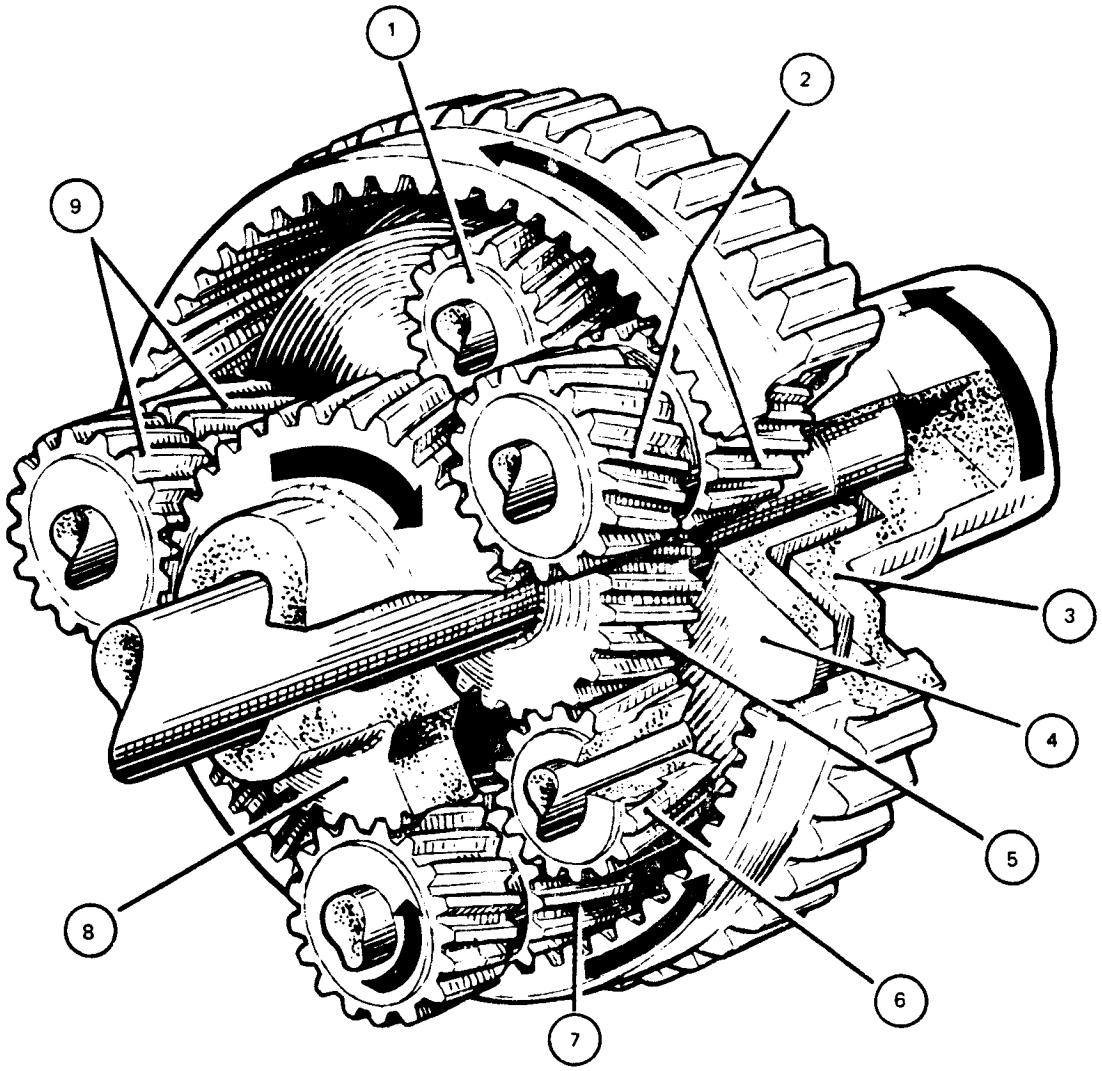
1 & 6	Short Planet Pinion (Third pinion not shown)
2, 7 & 9	Long Planet Pinion
3	Ring Gear (Annulus) and Output Shaft
4	Planet Carrier
5	Forward Sun Gear
8	Reverse Sun Gear

Gear set in second gear. Planet carrier must walk around stopped reverse sun gear.



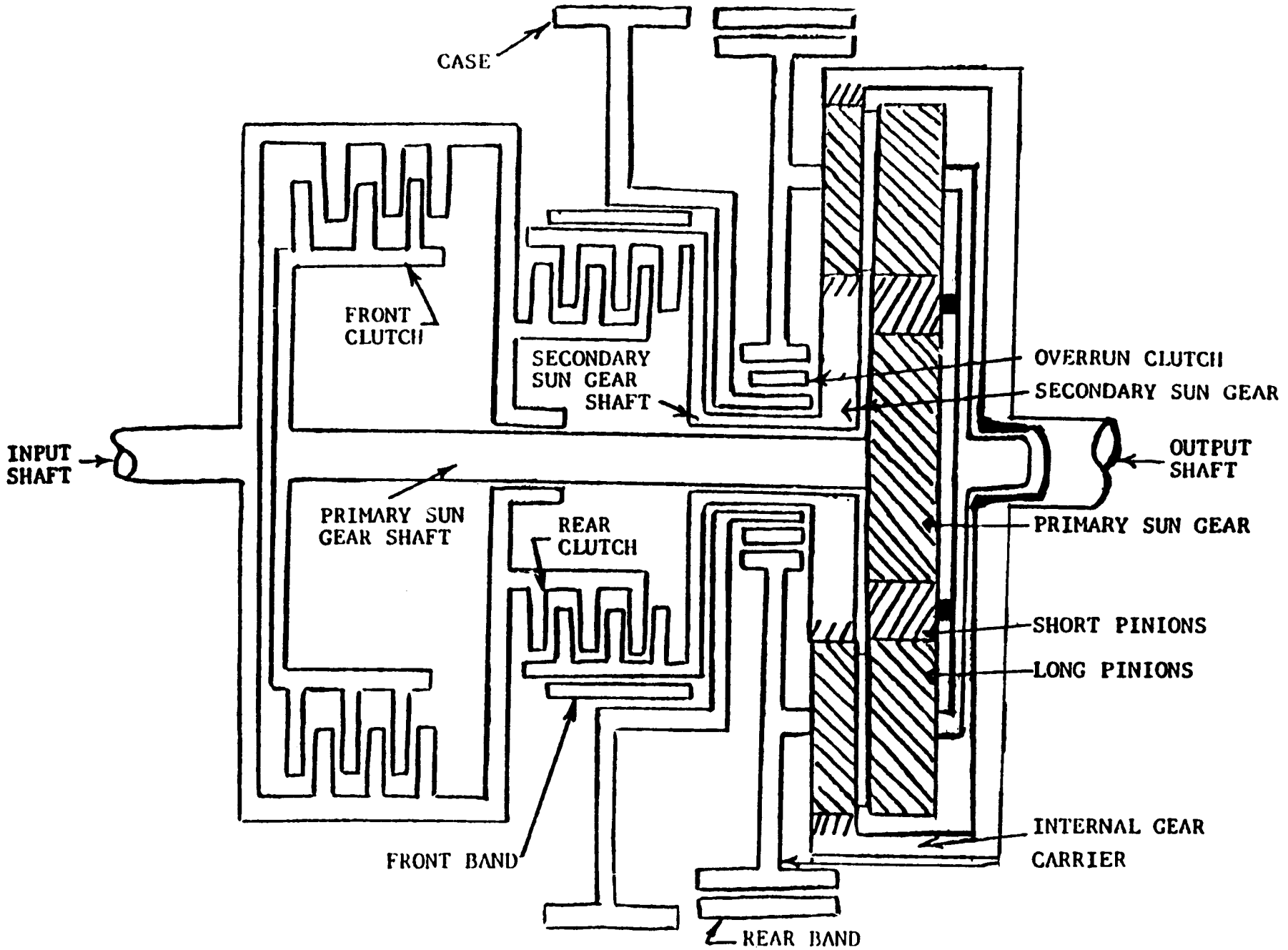
1 & 6	Short Planet Pinion (Third pinion not shown)
2, 7 & 9	Long Planet Pinion
3	Ring Gear (Annulus) and Output Shaft
4	Planet Carrier
5	Forward Sun Gear
8	Reverse Sun Gear

Gear set in third or direct.



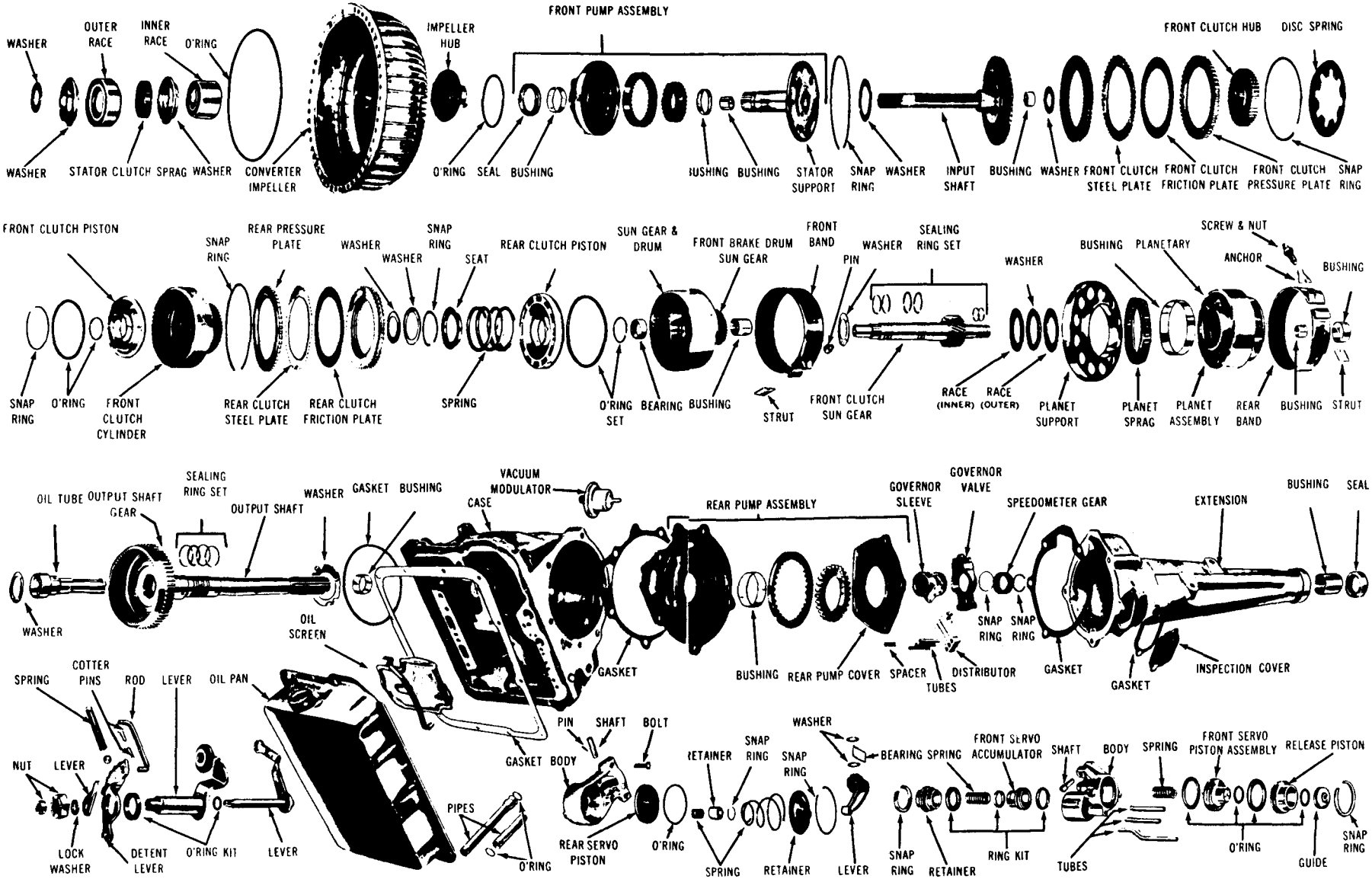
1 & 6	Short Planet Pinion (Third pinion not shown)
2, 7 & 9	Long Planet Pinion
3	Ring Gear (Annulus) and Output Shaft
4	Planet Carrier
5	Forward Sun Gear
8	Reverse Sun Gear

Gear set in reverse.



FORD 3 SPEED (CAST IRON CASE)

TYPICAL 3-SPEED RAVENEAU



3 SPEED SIMPSON COMPOUND

	FRONT RING GEAR	FRONT PLANET CARRIER	SUN GEAR	REAR PLANET CARRIER	REAR RING GEAR	SPEED	TORQUE	DIRECTION
LOW	INPUT	TURNS CW	TURNS C/CW	HELD	OUTPUT	MAXIMUM REDUCTION	MAXIMUM INCREASE	SAME AS INPUT
SECOND	INPUT	OUTPUT TURNS CW	HELD	TURNS CW	TURNS CW	REDUCTION	INCREASE	SAME AS INPUT
DIRECT	INPUT	OUTPUT TURNS CW	INPUT	TURNS CW	OUTPUT TURNS CW	DIRECT	DIRECT	SAME AS INPUT
REVERSE	TURNS C/CW	TURNS C/CW	INPUT	HELD	OUTPUT TURNS C/CW	REDUCTION	INCREASE	OPPOSITE OF INPUT
NEUTRAL	STATIONARY	STATIONARY	STATIONARY	STATIONARY	STATIONARY	NONE	NONE	STATIONARY

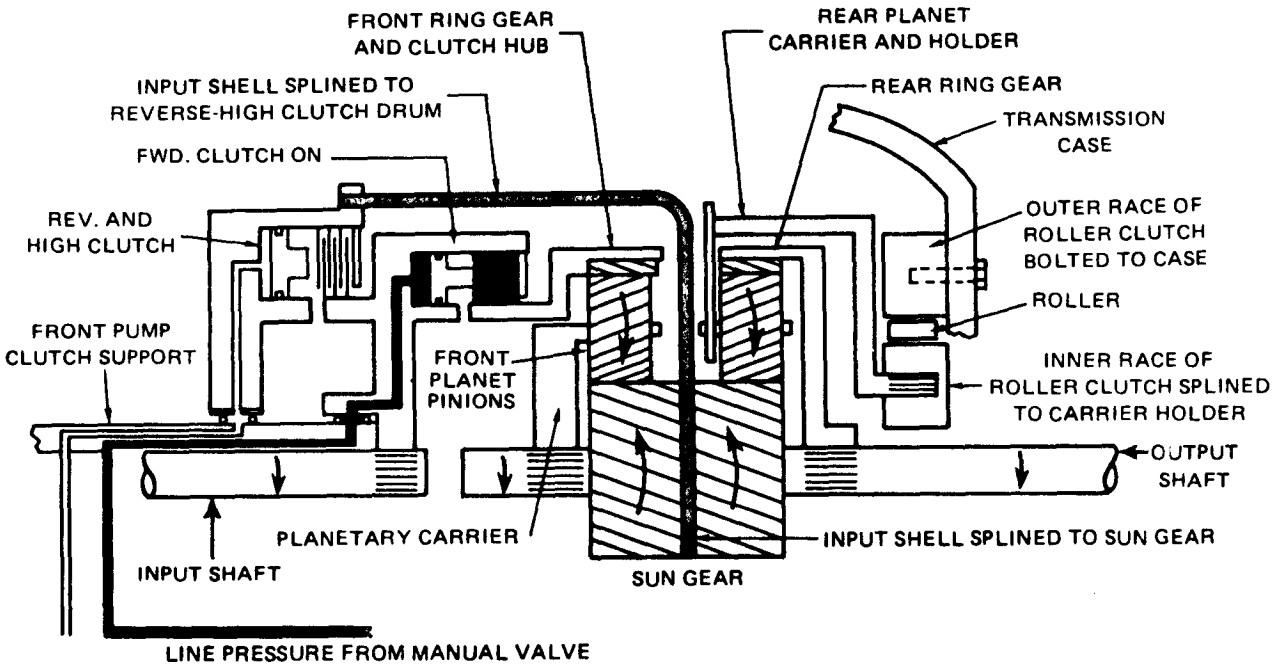
THIS GEAR SET USED IN:

GENERAL MOTORS - TH200 - TH250 - TH350 - TH375B - TH125 - TH325
FORD - C3 - C4 - C6 - JATCO
CHRYSLER - TORQUE FLITE
AMERICAN MOTORS - TORQUE COMMAND
FOREIGN - JATCO

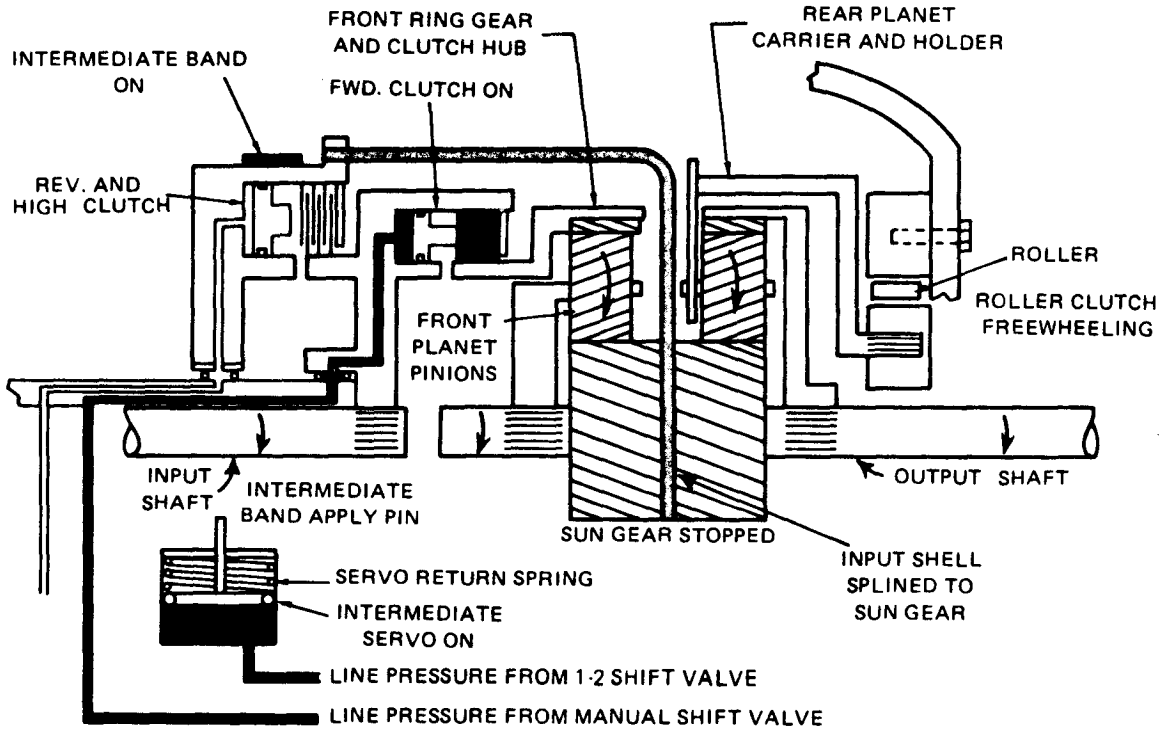
CLUTCH AND BAND APPLICATION

SIMPSON COMPOUND GEAR SET

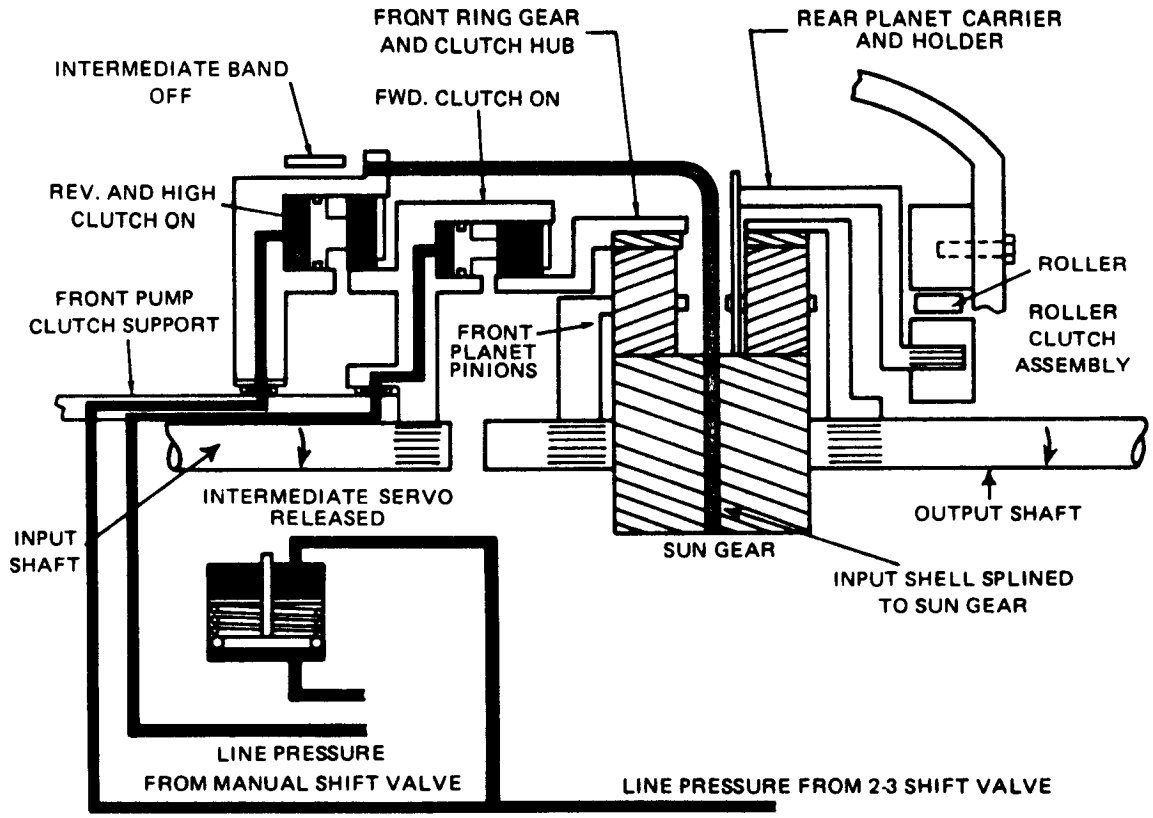
	INTERMEDIATE CLUTCH	INTERMEDIATE OVERRUNNING CLUTCH	FRONT CLUTCH	REAR CLUTCH	FRONT BAND	REAR BAND OR REVERSE CLUTCH	LOW OVERRUNNING CLUTCH
NEUTRAL			RELEASED	RELEASED	RELEASED	RELEASED	
BREAKAWAY LOW			RELEASED	APPLIED	RELEASED	RELEASED	HOLDING
SECOND			RELEASED	APPLIED	APPLIED	RELEASED	OVERRUNS
DIRECT			APPLIED	APPLIED	RELEASED	RELEASED	OVERRUNS
MANUAL LOW			RELEASED	APPLIED	RELEASED	APPLIED	ASSISTS
TH350-TH 375B ONLY DRIVE RANGE 2ND	APPLIED	HOLDING	RELEASED	APPLIED	RELEASED	RELEASED	OVERRUNS
DRIVE RANGE DIRECT	APPLIED	OVERRUNS	APPLIED	APPLIED	RELEASED	RELEASED	OVERRUNS
TH350 TH375B MANUAL 2ND	APPLIED	ASSISTS	RELEASED	APPLIED	APPLIED	RELEASED	OVERRUNS



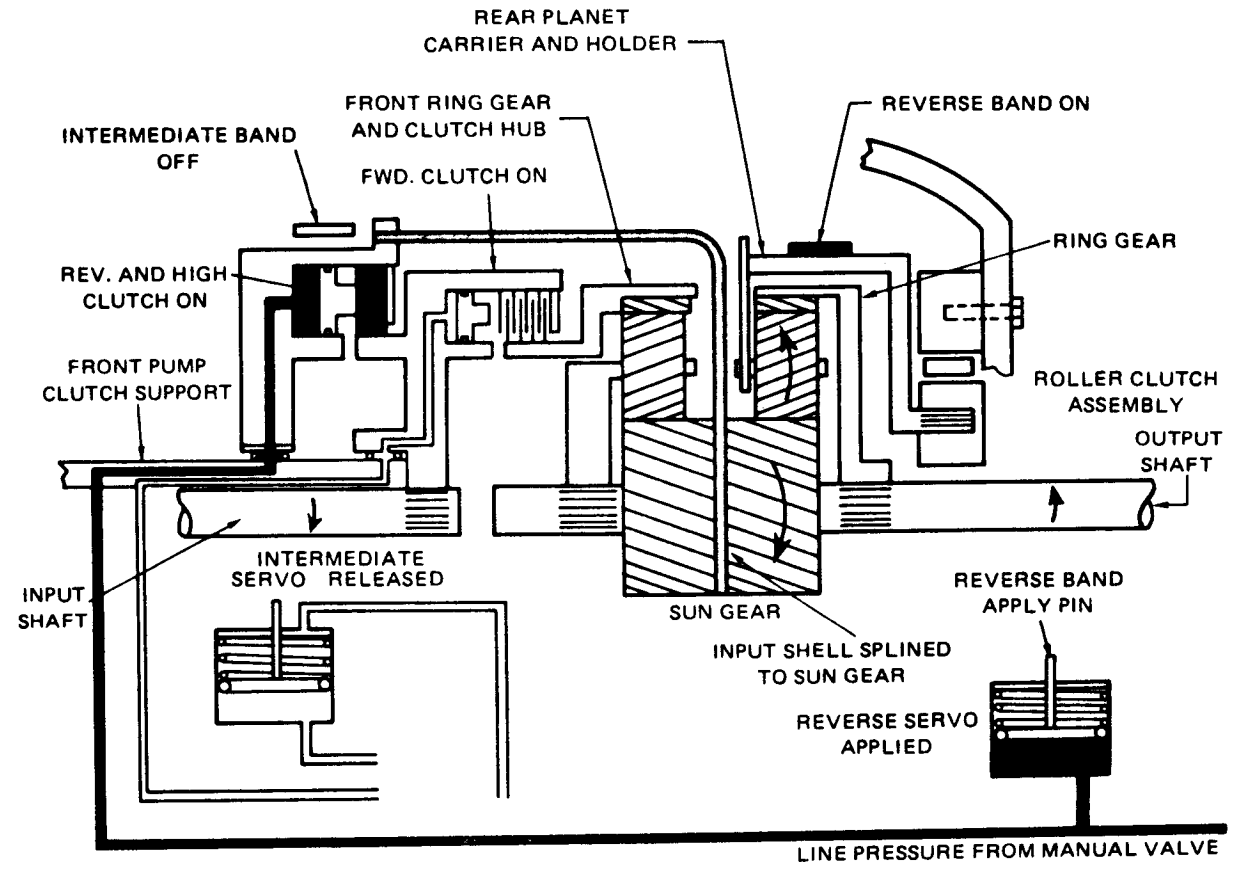
Drive range low.



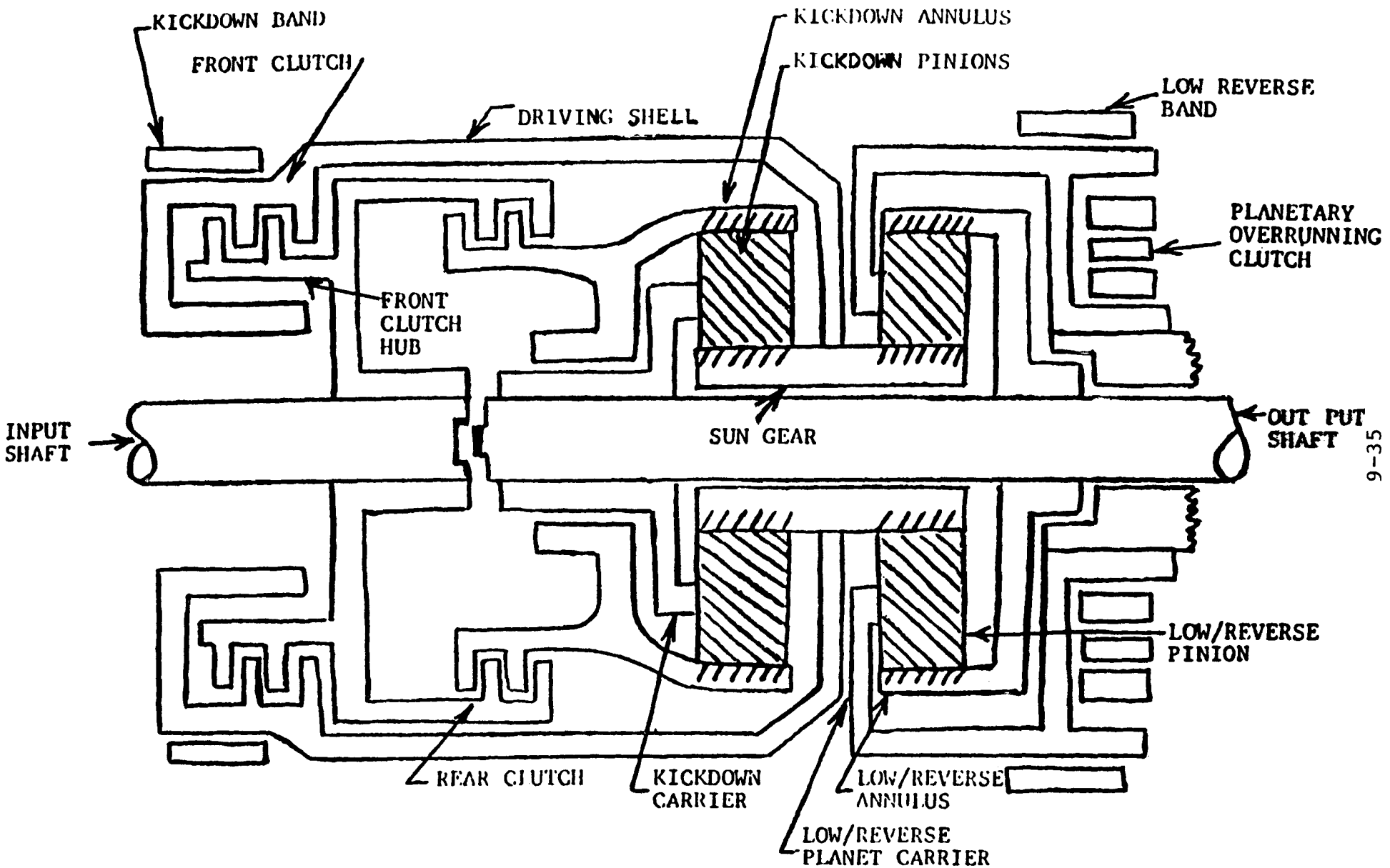
Drive range intermediate.



Drive range high.



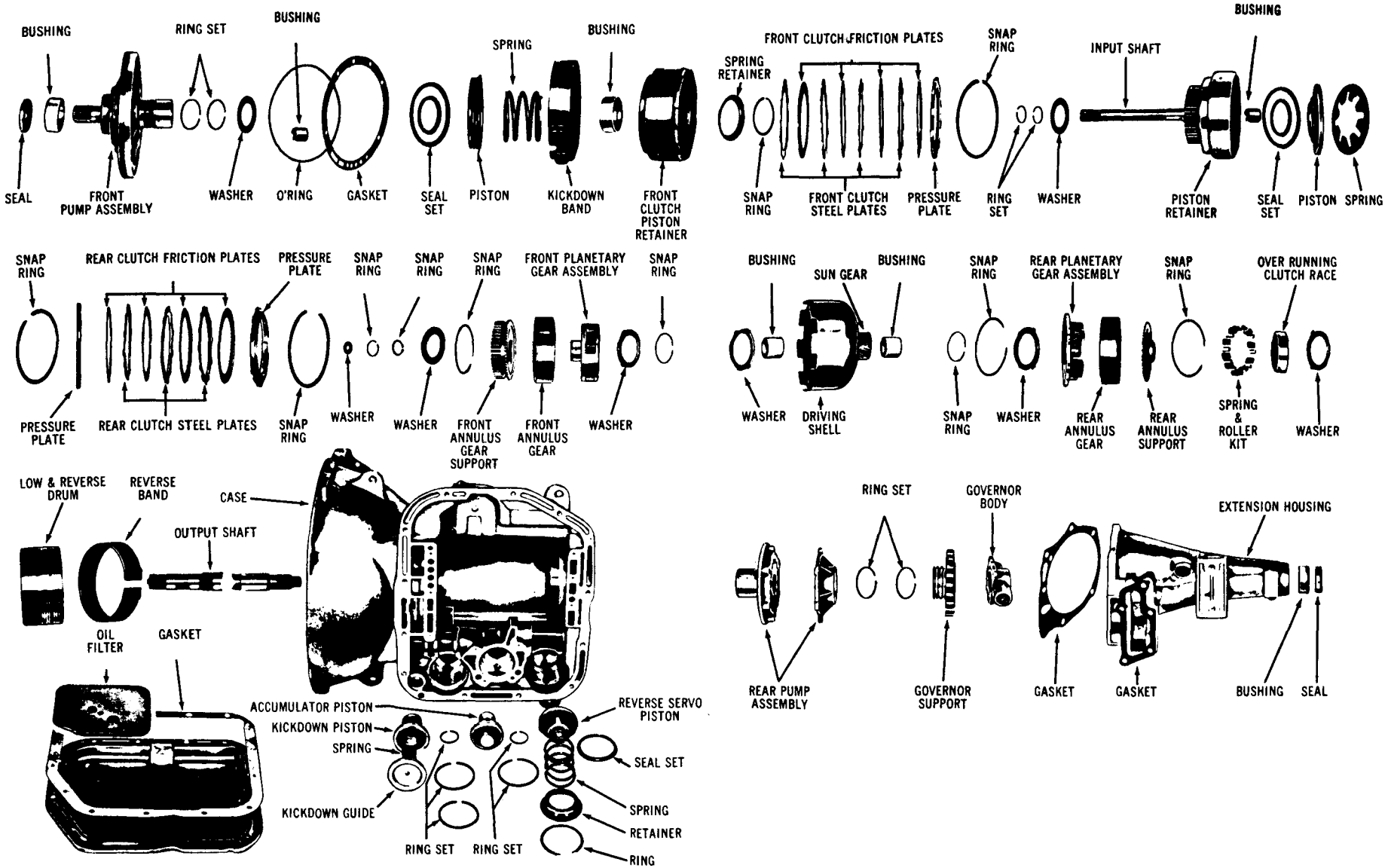
Reverse.

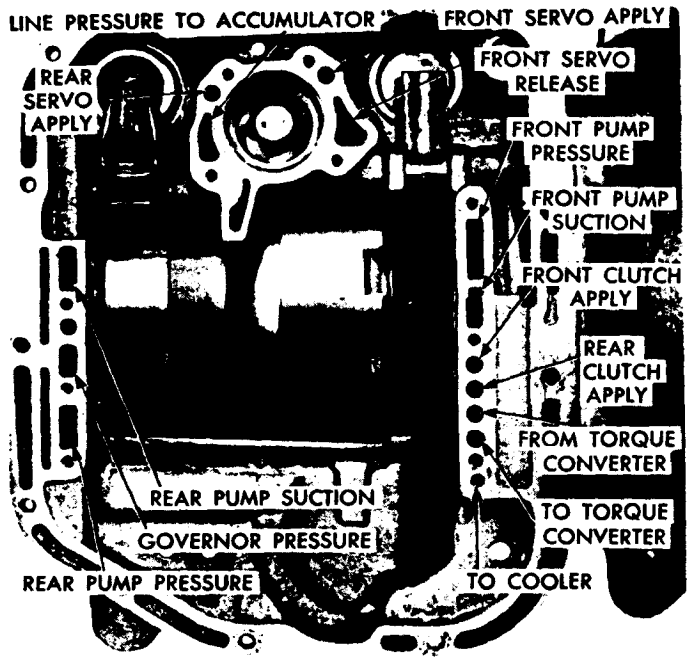


ALUMINUM CASE TORQUE FLIGHT 6

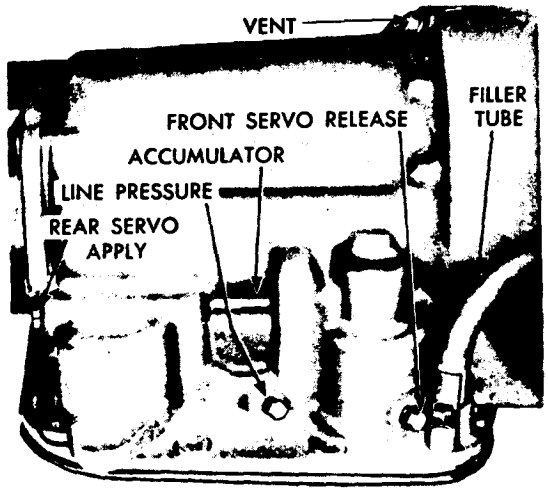
MODIFIED FOR STR-

TYPICAL 3-SPEED SIMPSON



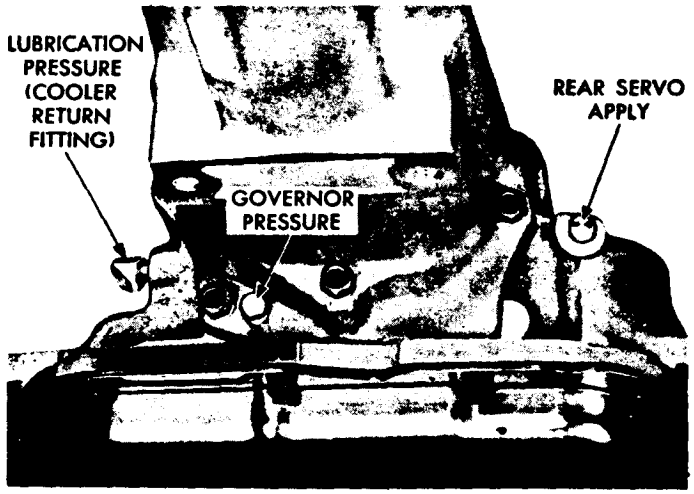


AIR PRESSURE CHECK POINTS



OIL PRESSURE CHECK POINTS

RIGHT SIDE



OIL PRESSURE CHECK POINTS - REAR OF CASE

POWERGLIDE

BEGINNING ENDPLAY _____ SPECS _____ ASSEMBLED ENDPLAY _____

INSTRUCTOR CHECK POINTS

REVERSE PISTON RETAINER _____
REVERSE CLUTCH FINAL _____
REAR PUMP WEAR PLATE _____
NON REAR PUMP GASKET _____
SUN TO SUN BEARING _____
DIRECT CLUTCH FINAL _____
INPUT SHAFT TURNS _____
AIR TEST _____
CORRECT VALVE BODY GASKETS _____
LINKAGE SETUP _____
DYNO TEST _____

SPECS

FRONT PUMP

GEAR TO BODY S/B ___ IS ___
GEAR TO CRESCENT S/B ___ IS ___
END CLEARANCE S/B ___ IS ___
TIMING VALVE HEIGHT S/B ___ IS ___

CLUTCHES

DIRECT CLUTCH S/B ___ IS ___
COUNT: STEEL___ FRICTION___
REVERSE CLUTCH S/B ___ IS ___
COUNT: STEEL___ FRICTION___

BANDS

LOW BAND TORQUE TO _____
BACK OFF _____

PLANETARY PINIONS

PINION CLEARANCE SPEC _____
LONG _____ _____ _____
SHORT _____ _____ _____

AIR TESTS

LOW BAND _____
DIRECT CLUTCH _____
REVERSE CLUTCH _____
GOVERNOR _____

TORQUEFLITE

BEGINNING ENDPLAY _____ SPECS _____ ASSEMBLED ENDPLAY _____

INSTRUCTOR CHECK POINTS		SPECS	AIR TESTS	
PUMP BUSHING STAKED	_____	**FRONT PUMP**	FRONT CLUTCH	_____
ONE-WAY CLUTCH ASSEMBLY	_____	GEAR END CLEARANCE YEAR _____ S/B ___ IS ___	FRONT BAND	_____
OUTPUT SHAFT SNAP RING	_____		REAR CLUTCH	_____
FRONT CLUTCH FINAL	_____	**CLUTCHES**	REAR BAND	_____
REAR CLUTCH FINAL	_____	FRONT CLUTCH S/B ___ IS ___	GOVERNOR	_____
INPUT SHAFT TURNS	_____	REAR CLUTCH S/B ___ IS ___		
AIR TEST	_____			
ACCUMULATOR SPRING	_____	**BANDS**		
VALVE BODY BALL COUNT AND LOCATION	_____	FRONT BAND TORQUE TO _____ BACK OFF _____		
VALVE BODY LINKAGE	_____	REAR BAND TORQUE TO _____ BACK OFF _____		
DYNO TEST	_____			
		PLANETARY PINIONS		
		GEAR SET ENDPLAY S/B ___ IS ___		
		PINION CLEARANCE SPEC _____		
		FRONT _____ _____ _____ _____		
		REAR _____ _____ _____ _____		