TRANSMISSION - OPERATION

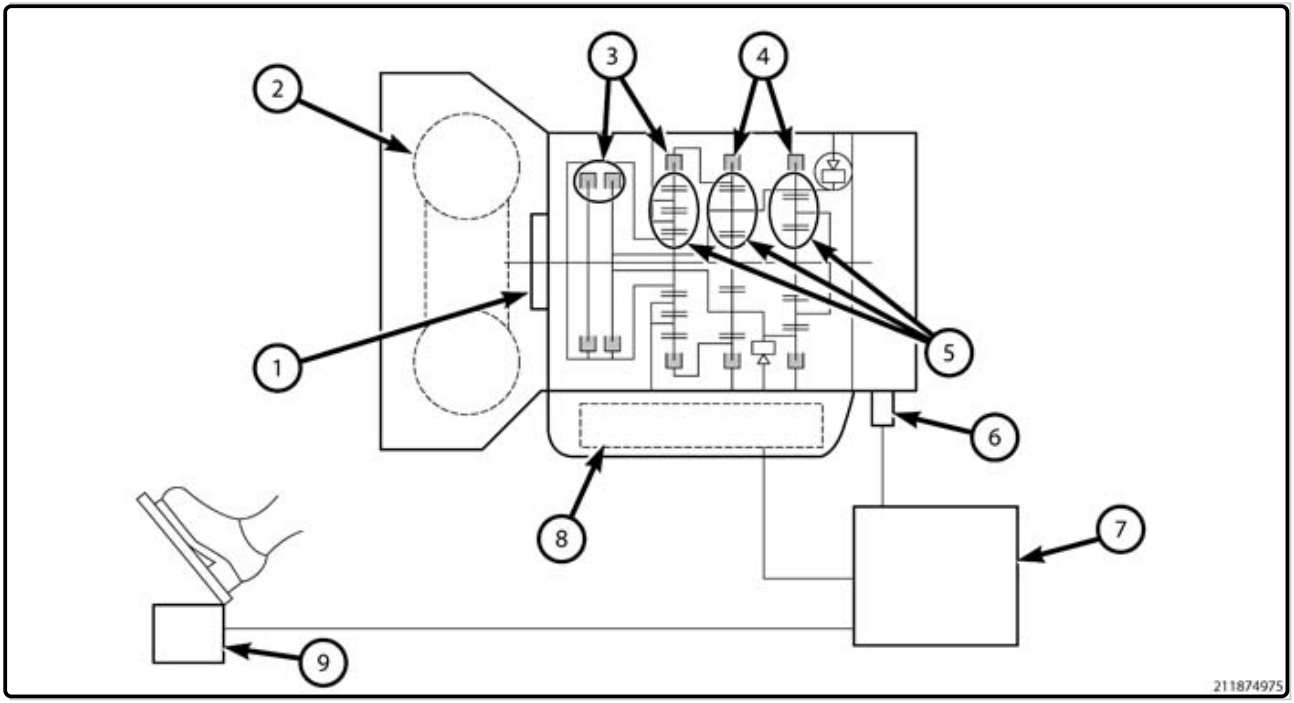
OPERATION

This transmission offers full electronic control of all automatic up and downshifts, and features real-time adaptive closed-loop shift and pressure control. Electronic shift and torque converter clutch controls help protect the transmission from damage due to high temperatures, which can occur under severe operating conditions. By altering shift schedules, line pressure, and converter clutch control, these controls reduce heat generation and increase transmission cooling.

Wide gear range and close ratio was implemented in order to improve both operational and fuel performance. The first gear ratio was lowered by 18% with respect to conventional four speed automatics to improve launch capabilities.

The hydraulic control system design (without electronic assist) provides the transmission with REVERSE, FIFTH anc THIRD. This design allows the vehicle to be driven (in “limp-in” mode) in the event of a electronic control system failure, or a situation that the Transmission Control Module (TCM) recognizes as potentially damaging to the transmission.

The TCM also performs certain self-diagnostic functions and provides comprehensive information (sensor data, DTC's, etc.) which is helpful in proper diagnosis and repair. Additionally, the ability to calibrate the TCM with the Scar tool allows for the transmission to deliver optimum shift quality to customers with diverse vehicle applications.

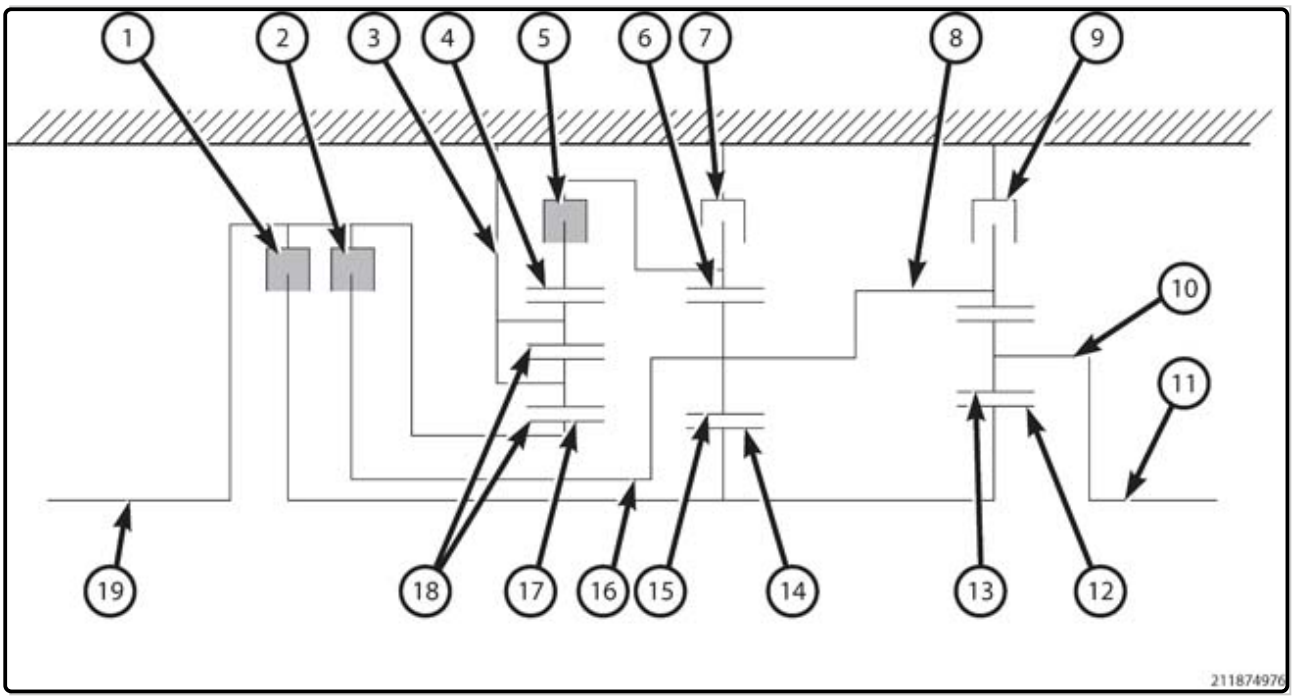


1- OIL PUMP	5- P1, P2, P3 PLANETARY GEAR
2 - TORQUE CONVERTER	6- VEHICLE SPEED SENSOR
3 - K2, K1, K3 CLUTCHES	7- TRANSMISSION CONTROL MODULE

4 - B1, B2 BRAKES

8- CONTROL VALVE (SOLENOID)

9- ACCELERATOR PEDAL POSITION



1 - K1 CLUTCH

2 - K2 CLUTCH

3 - P1 PLANETARY ANNULUS

4 - P1 PLANETARY ANNULUS GEAR

5 - K3 CLUTCH

6 - P3 PLANETARY ANNULUS GEAR

7 - B1 BRAKE

8 - P3 PLANETARY ANNULUS GEAR

9 - B2 BRAKE

10- P3 PLANETARY ANNULUS

11 - OUTPUT SHAFT

12 - P3 PLANETARY SUN GEAR

13 - P3 PLANETARY PINION GEARS

14 - P3 PLANETARY SUN GEAR

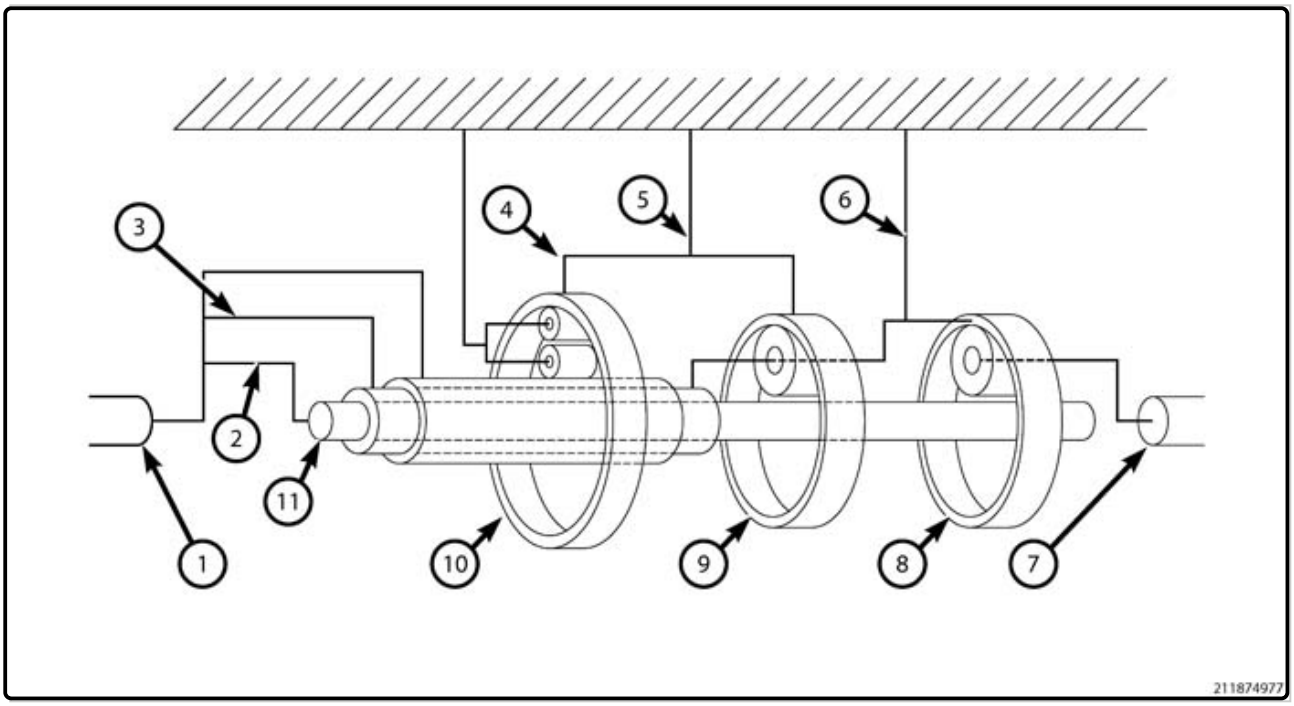
15 - P3 PLANETARY PINION GEAR

16 - P3 PLANETARY ANNULUS

17 - P1 PLANETARY SUN GEAR

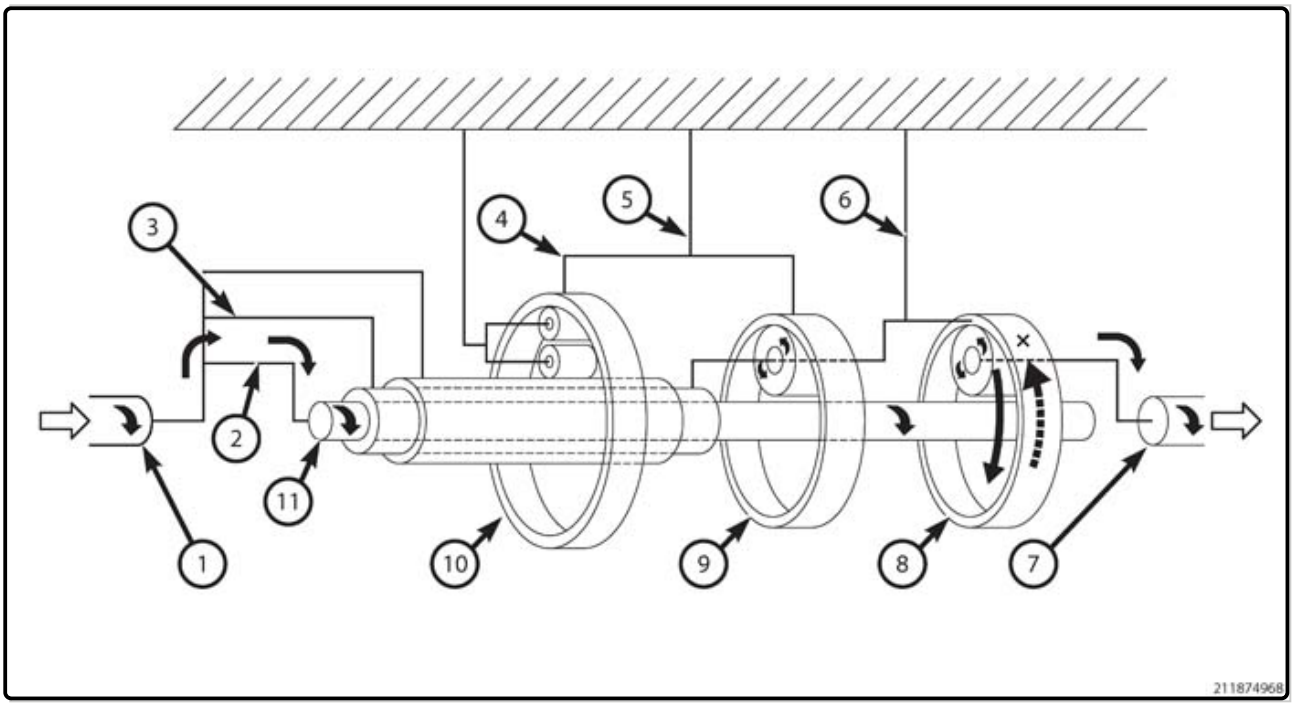
18 - P1 PLANETARY PINION GEAR

19- INPUT SHAFT



1 - INPUT SHAFT	
2 - K1 CLUTCH	7- OUTPUT SHAFT
3 - K2 CLUTCH	8- P3 PLANETARY ANNULUS
4 - K3 CLUTCH	9- P2 PLANETARY ANNULUS
5 - B1 BRAKE	10- P1 PLANETARY ANNULUS
6 - B2 BRAKE	11 - SUN GEAR SHAFT

FIRST GEAR POWER FLOW



1 - INPUT SHAFT	
2 - K1 CLUTCH	7- OUTPUT SHAFT
3 - K2 CLUTCH	8- P3 PLANETARY ANNULUS
4 - K3 CLUTCH	9- P2 PLANETARY ANNULUS
5 - B1 BRAKE	10 - P1 PLANETARY ANNULUS
6 - B2 BRAKE	11 - SUN GEAR SHAFT

FIRST GEAR

	K1	K2	K3	B1	B2	GEAR RATIO
FIRST GEAR	X				X	3.74:1
X = in operation						

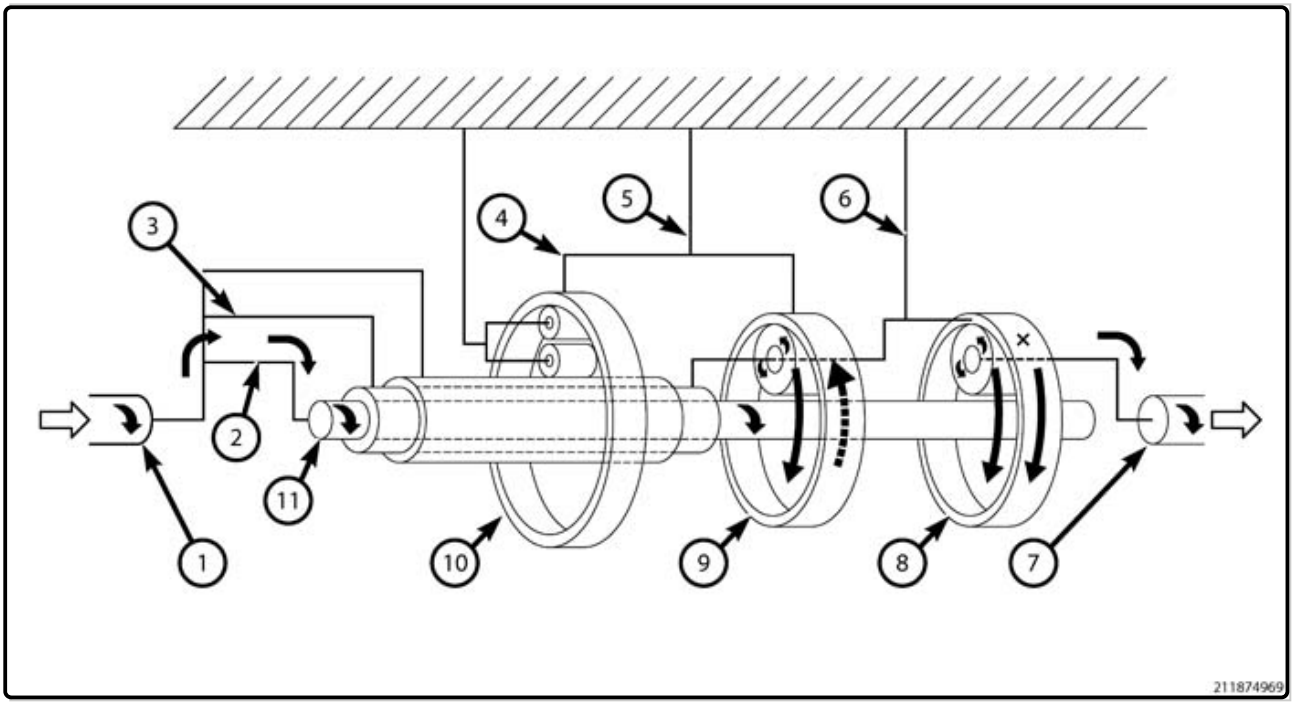
When oil pressure is applied to K1 clutch (2) and the input shaft (1) and sun gear shaft (11) which are directly connected; as a result of the clockwise turning effect of the input shaft (1), the sun gear shaft (11) rotates clockwise.

The rotation of the sun gear shaft (11) is transmitted as counterclockwise turning effect to the P3 planetary pinion gear as it attempts to rotate the P3 planetary annulus gear counterclockwise.

The P3 planetary pinion gear rotates clockwise (revolves centering on the sun gear shaft (11), while rotating clockwise on its own axis.

This conveys a clockwise turning effect to the P3 planetary annulus (8) and the output shaft (7) connected to it.

SECOND GEAR POWER FLOW



1 - INPUT SHAFT	
2 - K1 CLUTCH	7- OUTPUT SHAFT
3 - K2 CLUTCH	8- P3 PLANETARY ANNULUS
4 - K3 CLUTCH	9- P2 PLANETARY ANNULUS
5 - B1 BRAKE	10 - P1 PLANETARY ANNULUS
6 - B2 BRAKE	11 - SUN GEAR SHAFT

SECOND GEAR

	K1	K2	K3	B1	B2	GEAR RATIO
SECOND GEAR	X			X		2.00:1
X = in operation						

When oil pressure is applied to K1 clutch (2) and the input shaft (1) and the sun gear shaft (11) which are directly connected ; the sun gear shaft (11) rotates clockwise.

The clockwise rotation of the sun gear shaft (11) is transmitted as counterclockwise turning effect to the P2 planetary pinion gear and attempts to rotate the P2 planetary annulus gear counterclockwise.

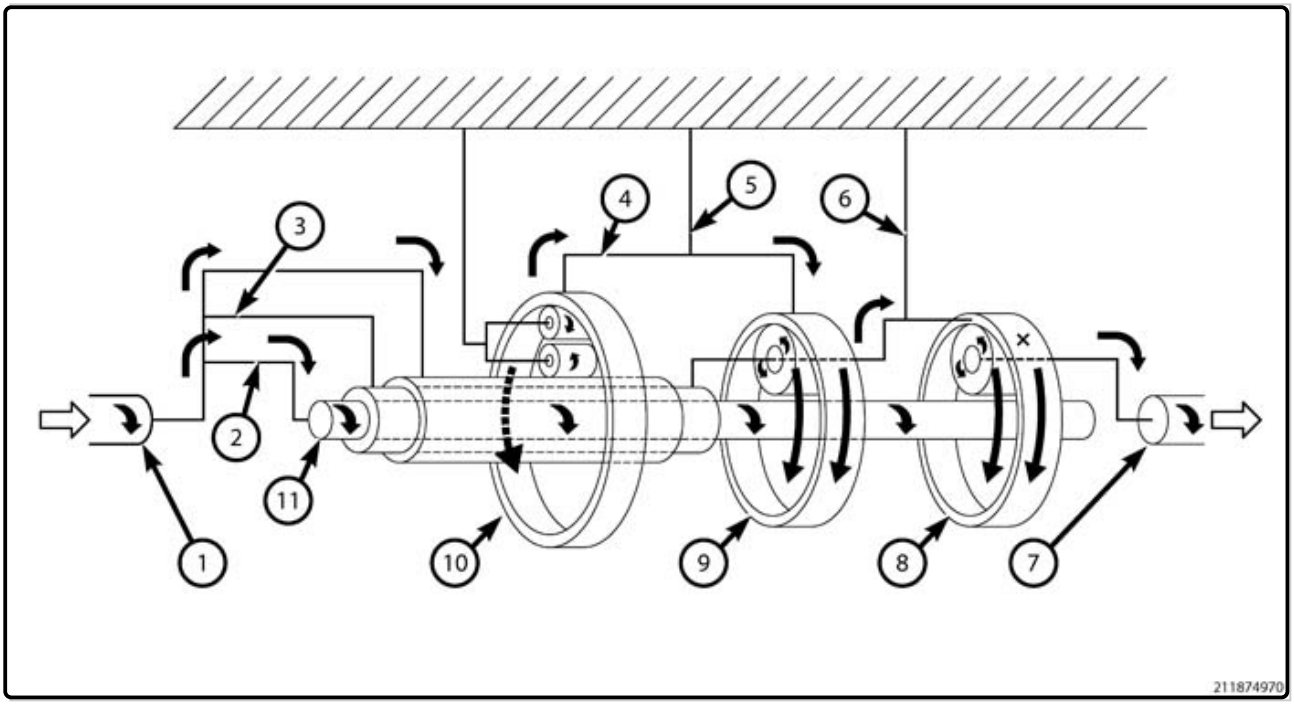
Since the P2 planetary annulus gear is fixed by the B1 brake (5), the P2 planetary pinion gear rotates counterclockwise, and the clockwise turning effect is conveyed to the P2 planetary annulus (10).

As a result, a clockwise turning effect is given to the P3 planetary annulus gear that is connected to the P2 planetary annulus (10).

The clockwise turning effect of the sun gear shaft (11) is also conveyed to the P3 planetary pinion gear, the P3 planetary annulus gear is also decelerated and is rotating clockwise.

The P3 planetary pinion gear revolves clockwise while rotating counterclockwise on its own axis, and the clockwise turning effect is conveyed to the output shaft (8) that is connected to the P3 planetary annulus (8).

THIRD GEAR POWER FLOW



1 - INPUT SHAFT	
2 - K1 CLUTCH	7- OUTPUT SHAFT
3 - K2 CLUTCH	8- P3 PLANETARY ANNULUS
4 - K3 CLUTCH	11- P2 PLANETARY ANNULUS
5 - B1 BRAKE	10 - P1 PLANETARY ANNULUS
6 - B2 BRAKE	11 - SUN GEAR SHAFT

THIRD GEAR

	K1	K2	K3	B1	B2	GEAR RATIO
THIRD GEAR	X		X			1.34:1
X = in operation						

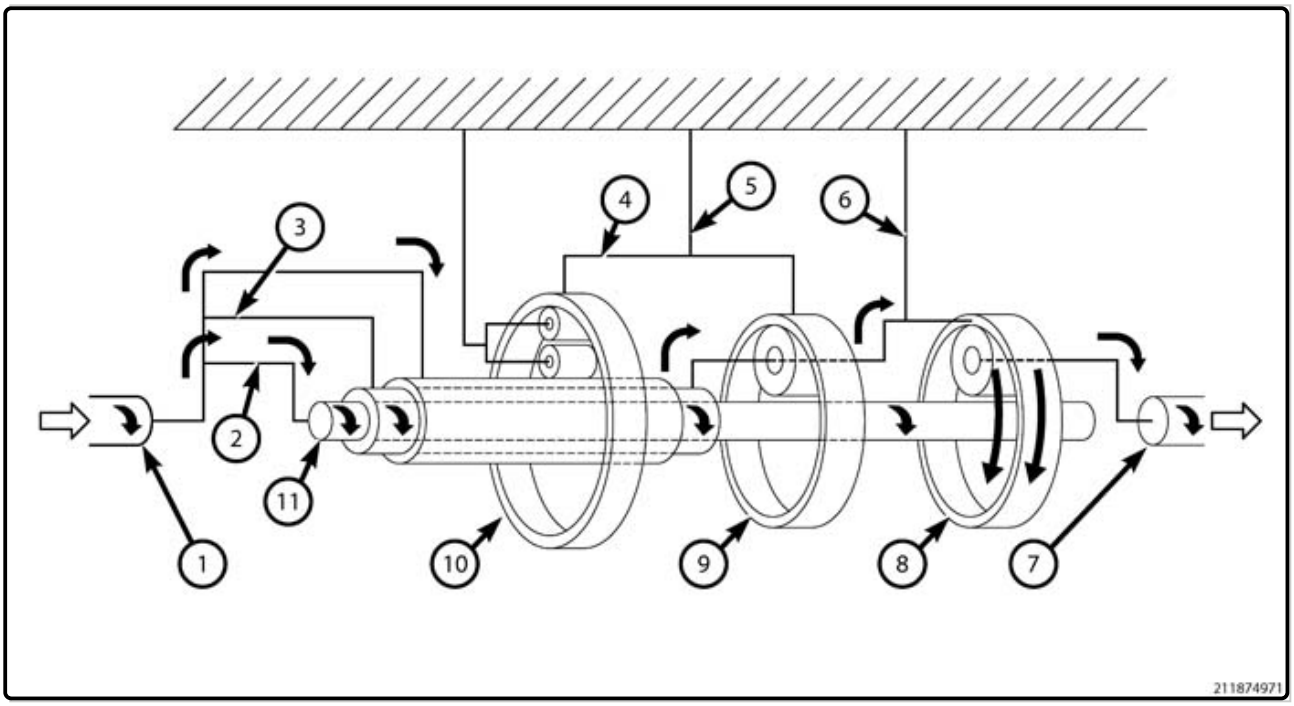
When oil pressure is applied to the K3 clutch (4), the clockwise turning effect of the P1 planetary annulus gear is conveyed and the P2 planetary annulus gear rotates clockwise.

When oil pressure is applied to the K1 clutch (2), the input shaft (1) and the sun gear shaft (11) are directly connected, the sun gear shaft (11) rotates clockwise.

As a result, the P2 planetary pinion gear revolves clockwise while rotating clockwise on its own axis, thus a clockwise turning effect is given to the P3 planetary annulus gear that is connected to the P2 planetary annulus (9) .

This rotation and clockwise turning effect of the sun gear shaft (11) gives turning effect to the P3 planetary pinion gear to revolve clockwise while rotating clockwise on its own axis, and a clockwise turning effect then given to the P3 planetary annulus (8) and also to the output shaft (7).

FOURTH GEAR POWER FLOW



1 - INPUT SHAFT

2 - K1 CLUTCH	7- OUTPUT SHAFT
3 - K2 CLUTCH	8- P3 PLANETARY ANNULUS
4 - K3 CLUTCH	9- P2 PLANETARY ANNULUS
5 - B1 BRAKE	10 - P1 PLANETARY ANNULUS
6 - B2 BRAKE	11 - SUN GEAR SHAFT

FOURTH GEAR

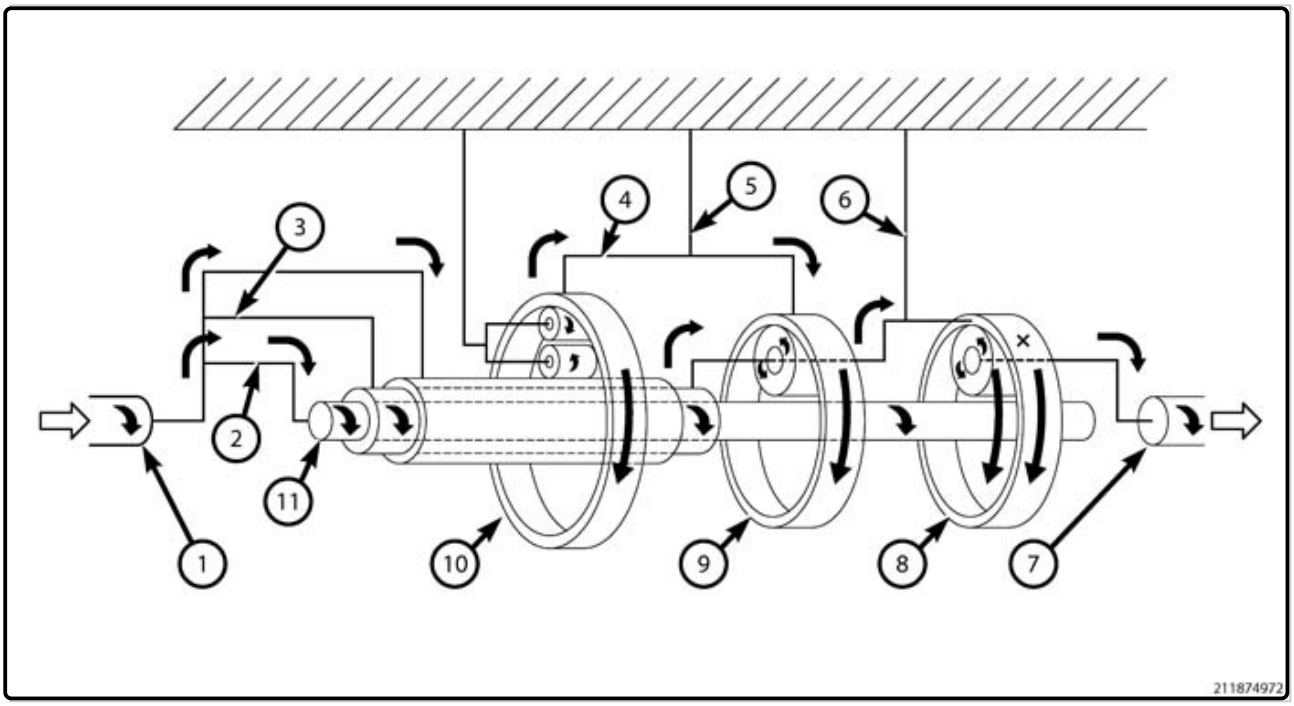
	K1	K2	K3	B1	B2	GEAR RATIO
FOURTH GEAR	X	X				1.00:1
X = in operation						

When oil pressure is applied to K1 clutch (2), and the input shaft (1) and the sun gear shaft (11) are directly connected, the sun gear shaft (11) rotates clockwise.

When oil pressure is applied to K2 clutch, then the P3 planetary gear rotates clockwise via the P2 planetary gear (9).

This action gives a clockwise turning effect to the P3 planetary annulus (8) and the clockwise turning effect is given to the output shaft (7) .

FIFTH GEAR POWER FLOW



1 - INPUT SHAFT	
2 - K1 CLUTCH	7- OUTPUT SHAFT
3 - K2 CLUTCH	8- P3 PLANETARY ANNULUS
4 - K3 CLUTCH	9- P2 PLANETARY ANNULUS
5 - B1 BRAKE	10 - P1 PLANETARY ANNULUS
6 - B2 BRAKE	11 - SUN GEAR SHAFT

FIFTH GEAR

	K1	K2	K3	B1	B2	GEAR RATIO
FIFTH GEAR		X	X			0.77:1
X = in operation						

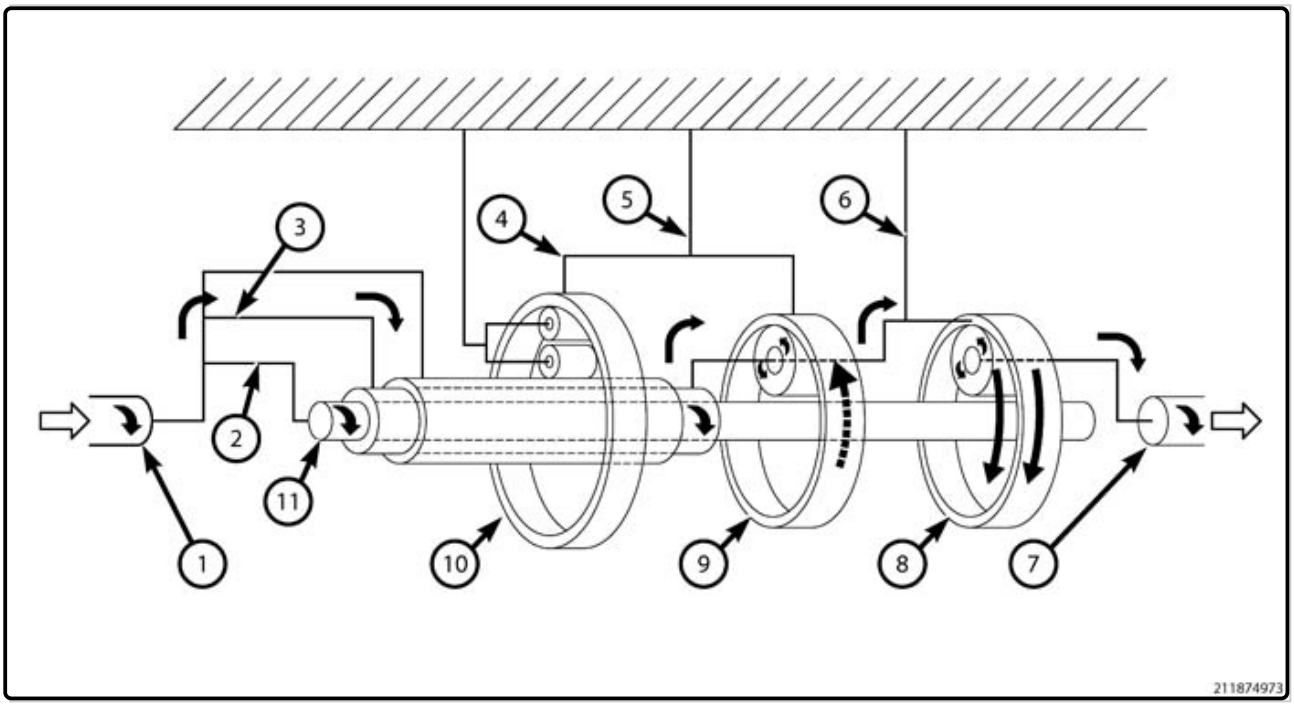
When oil pressure is applied to the K3 clutch (4), a clockwise turning effect of the P1 planetary annulus gear is transmitted and the P2 planetary annulus gear rotates clockwise.

When oil pressure is applied to the K2 clutch (3), a clockwise turning effect is given to the P2 planetary annulus (9).

As the P2 planetary annulus gear rotates, the clockwise turning effect of the sun gear shaft (11) is obtained.

Then, a clockwise turning effect of the P3 planetary annulus gear that is connected to the P2 planetary annulus (9) and a clockwise turning effect of the sun gear shaft gives a clockwise turning effect to the P3 planetary annulus (8), and a clockwise turning effect is also given to the output shaft (7).

SIXTH GEAR POWER FLOW



1 - INPUT SHAFT	
2 - K1 CLUTCH	7- OUTPUT SHAFT
3 - K2 CLUTCH	8- P3 PLANETARY ANNULUS
4 - K3 CLUTCH	9- P2 PLANETARY ANNULUS
5 - B1 BRAKE	10- P1 PLANETARY ANNULUS
6 - B2 BRAKE	11 - SUN GEAR SHAFT

SIXTH GEAR

	K1	K2	K3	B1	B2	GEAR RATIO
SIXTH GEAR		X		X		0.63:1
X = in operation						

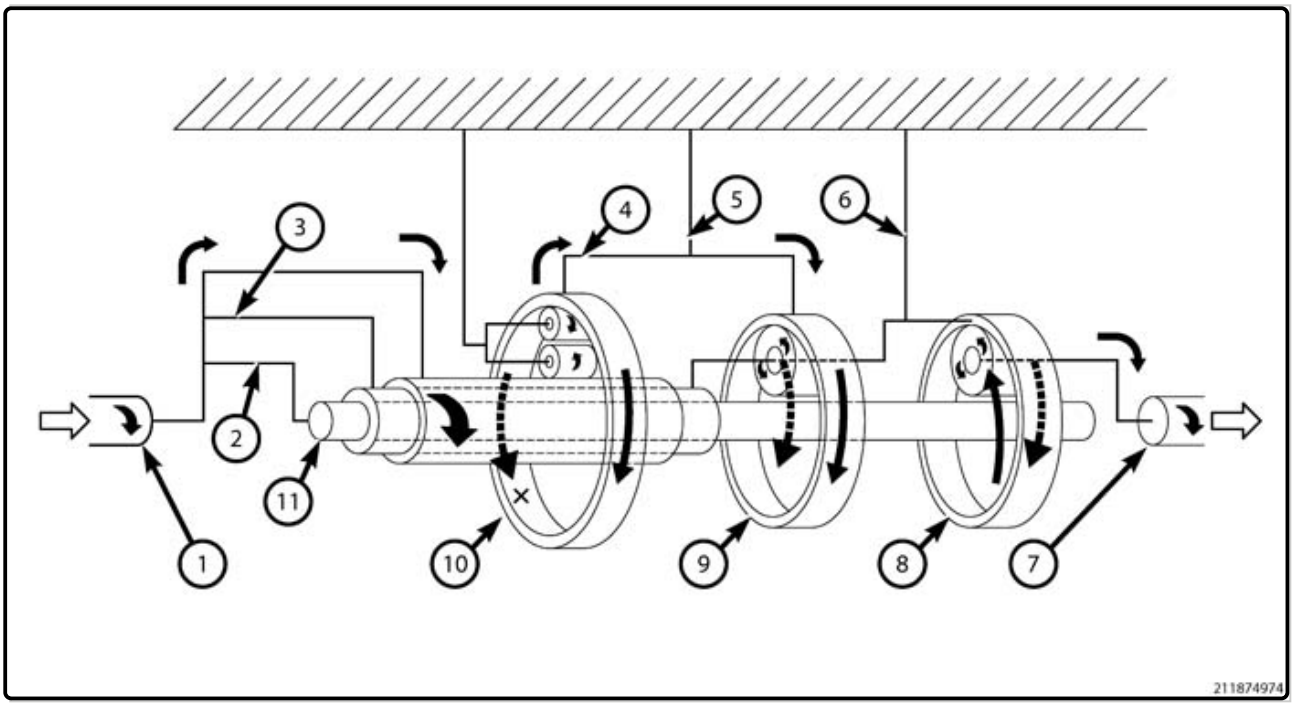
Oil pressure is applied to the K2 clutch (3), and a clockwise turning effect is given to the P2 planetary annulus (9) .

Oil pressure is applied to the B1 brake, and since the P2 planetary annulus gear is fixed, the P2 planetary pinion gear rotates counterclockwise on it's own axis while revolving clockwise.

As a result, the sun gear shaft (11) obtains a clockwise turning effect.

The clockwise turning effect of the sun gear shaft (11) and the P3 planetary annulus gear connected to the P2 planetary annulus (9) gives a clockwise turning effect to the P3 planetary annulus, and the clockwise turning effect is then also given to the output shaft.

REVERSE GEAR POWER FLOW



1 - INPUT SHAFT

2 - K1 CLUTCH	7- OUTPUT SHAFT
3 - K2 CLUTCH	8- P3 PLANETARY ANNULUS
4 - K3 CLUTCH	9- P2 PLANETARY ANNULUS
5 - B1 BRAKE	10 - P1 PLANETARY ANNULUS
6 - B2 BRAKE	11 - SUN GEAR SHAFT

REVERSE GEAR

	K1	**K2**	**K3**	**B1**	**B2**	**GEAR RATIO**
REVERSE GEAR			X		X	- 3.54:1
X = in operation						

When oil pressure is applied to the K3 clutch (4) and a clockwise turning effect of the P1 planetary annulus gear is transmitted; the P2 planetary annulus gear rotates clockwise.

Oil pressure is then applied to the B2 brake to fix the P3 planetary annulus gear and P2 planetary annulus (9) that is connected to it .

As a result the P2 planetary pinion gear rotates clockwise with it's position fixed giving a counterclockwise turning effect to the sun gear shaft (11) .

As a result of the clockwise turning effect given to the sun gear shaft (11) , and the fixed P3 planetary annulus gear , the P3 planetary pinion gear revolves counterclockwise while rotating clockwise on it's own axis, and the counterclockwise turning effect is then given to the P3 planetary annulus (8) and also to the output shaft (7) .