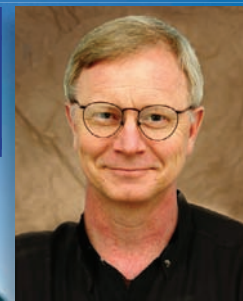
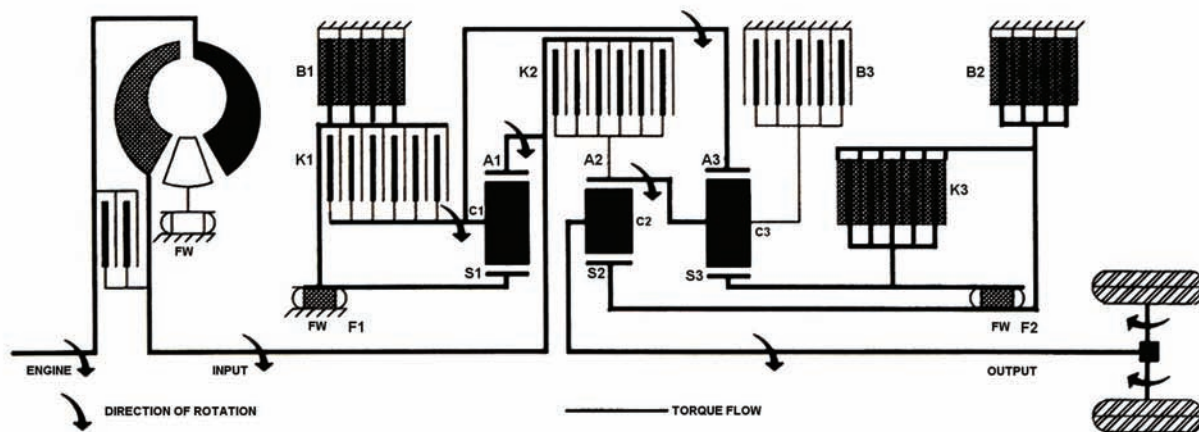


The Wooden Stick and the Mercedes:



by J. Weldon Barnett

A Look at DaimlerChrysler 722.6 Power Flow



A1	Front Annulus Gear	C3	Rear Planetary Carrier
A2	Center Annulus Gear	S1	Front Sun Gear
A3	Rear Annulus Gear	S2	Center Sun Gear
C1	Front Planetary Carrier	S3	Rear Sun Gear
C2	Center Planetary Carrier		

Figure 1, First Gear Schematic

The wooden stick, when used as a lever, is one of the simplest machines known to man, and it was probably the first machine. Before Jean Claude the caveman or one of his homies patented the stick he had to exert real Cro-Magnon muscle to lift a 100 pound rock (the Cro-Magnon caves in France are where skeletons of early man were found and therefore, cave man). Well it wasn't long before

the stick was available at French Cave Marts everywhere, and the guys just loved it.

Well now, Jean Claude didn't have to stress and strain to pick up 100-pound rocks any more. He placed the stick — or more like a tree limb — under the edge of the 100-pound rock and pressed down, and the stick became a lever, easily moving the rock.

He had leverage. His arm moved

quite a bit farther with his new tool but he only felt a fraction of the load before the rock moved. Jean Claude had a real machine that would do work for him. From this point, things happened so quickly that before Jean Claude could say, "hand me a two-by and that pry bar," about 10,000 to 40,000 years zoomed by... and we're now talking about very cool stuff, such as the DaimlerChrysler 722.6 power flow

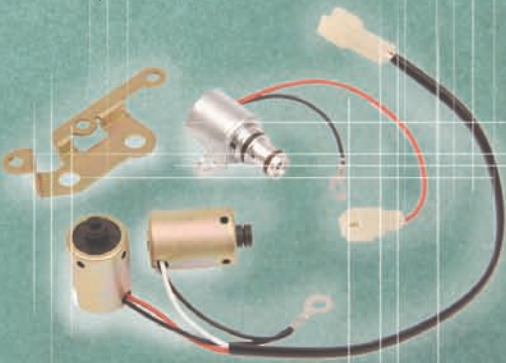
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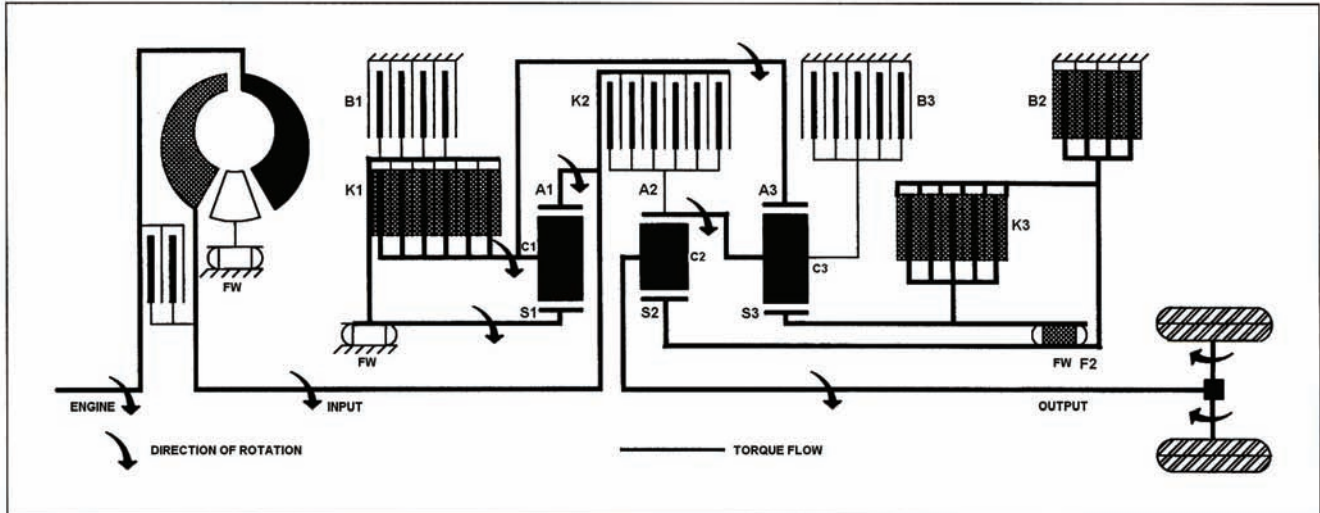


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A1	Front Annulus Gear	C3	Rear Planetary Carrier
A2	Center Annulus Gear	S1	Front Sun Gear
A3	Rear Annulus Gear	S2	Center Sun Gear
C1	Front Planetary Carrier	S3	Rear Sun Gear
C2	Center Planetary Carrier		

Figure 2, Second Gear Schematic

from one of Jean Claude’s neighbors in Germany.

How did we jump from a wooden stick to a trans? Well transmissions are full of levers, and I don’t mean just shift levers and band apply levers: I’m talking about *gears*. A gear is a *set of multiple levers (teeth) that continually applies leverage or power flow*. The gears in the 722.6 are like the stick: The stick lightened the load for Jean Claude and the gears lighten the load for the engine. It lets the engine run in the power band that offers the best fuel economy and power.

The DaimlerChrysler 722.6 appears in many different vehicles from 1996–2006. In the Dodge, Jeep and Chrysler lines at the dealer level the 722.6 goes by the designation of NAG1, which stands for New Automatic Gearbox, 1st version. These vehicles are equipped with the 722.6:

2002–2006 Freightliner Sprinter Van

2003–2006 Dodge Sprinter Van

2002–2006 Jeep Grand Cherokee

2005–2006 Dodge Magnum

2006 Dodge Charger

2005–2006 Chrysler 300 series

2004–2006 Crossfire

1999–2002 Jaguar XJR

1996–2006 Mercedes

To diagnose any system logically, first you have to understand how it works. Otherwise you’re going to need a pile of parts as high as a flagpole and an excellent supply of thread repair inserts, so you can just replace parts until you fix it. Let’s take a look at the powerflow charts to see how three planetary sets, two one way overrunning clutches (sprags), three clutches, and three brakes are used to provide five forward gears, two reverse gears, and two neutrals on the 722.6.

First Gear

[Figure 1, First Gear Schematic]

All three planetary gear sets are used to provide the gear reduction for first gear. Clutches B1, K3 and B2 are applied and the F1 and F2 sprags are holding during acceleration.

First Gear Power Flow

Front Gear Set — The front annulus gear is driven by the input shaft. The front sun gear is held by the B1 brake.

The F1 sprag holds the front sun gear while accelerating. The front pinions and carrier walk around the held front sun gear.

Rear Gear Set — The rear annulus gear is driven by the front planetary carrier. The rear sun gear is held by the K3 clutch and the B2 brake. The F2 sprag holds the rear sun gear during acceleration. The rear pinions and carrier walk around the held rear sun gear.

Center Gear Set — The center annulus gear is driven by the rear pinion carrier. The center sun gear is held by the B2 brake. The center pinions and carrier walk around the held center sun gear to drive the output shaft.

D (1st) Acceleration

- Input shaft drives the front annulus gear.
- F1 holds the front sun gear.
- F2 holds the center sun gear and rear sun gear together.
- B2 holds the center sun gear.

D (1st) Deceleration (Engine Braking)

- K3 holds the center sun gear and rear sun gear together (both direc-

tions).

- B1 holds the front sun gear.

Second Gear

[Figure 2, Second Gear Schematic]

The front gear set provides direct drive while the rear and center gear sets provide gear reduction. K1, K3 and B2 clutches are applied and the F2 sprag holds during acceleration.

Second Gear Power Flow

Front Gear Set — The front annulus gear is driven by the input shaft. The front sun gear and front carrier are held together by the K1 clutch, preventing the front pinions from rotating. The front carrier is driven at input shaft speed.

Rear Gear Set — The rear annulus gear is driven by the front carrier at

input shaft speed. The rear sun gear is held by the K3 clutch and B2 brake. The F2 sprag holds the rear sun gear during acceleration. The rear pinions and carrier walk around the held rear sun gear.

Center Gear Set — The center annulus gear is driven by the rear pinion carrier. The center sun gear is held by the B2 brake. The center pinions and carrier walk around the held center sun gear to drive the output shaft.

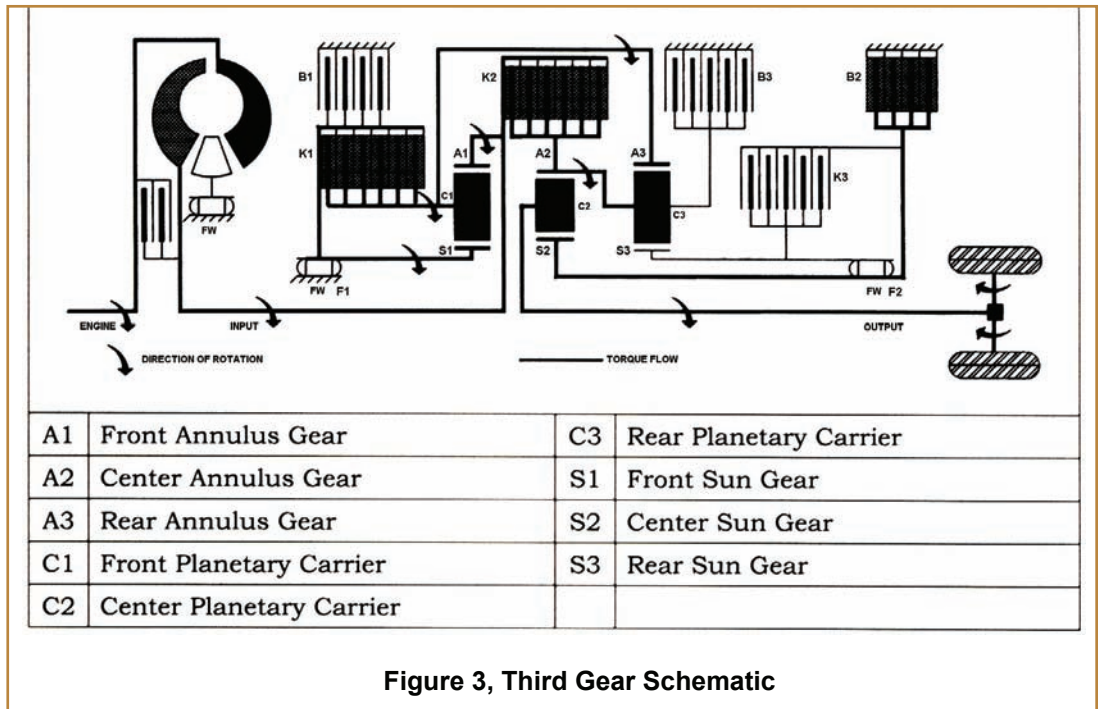


Figure 3, Third Gear Schematic

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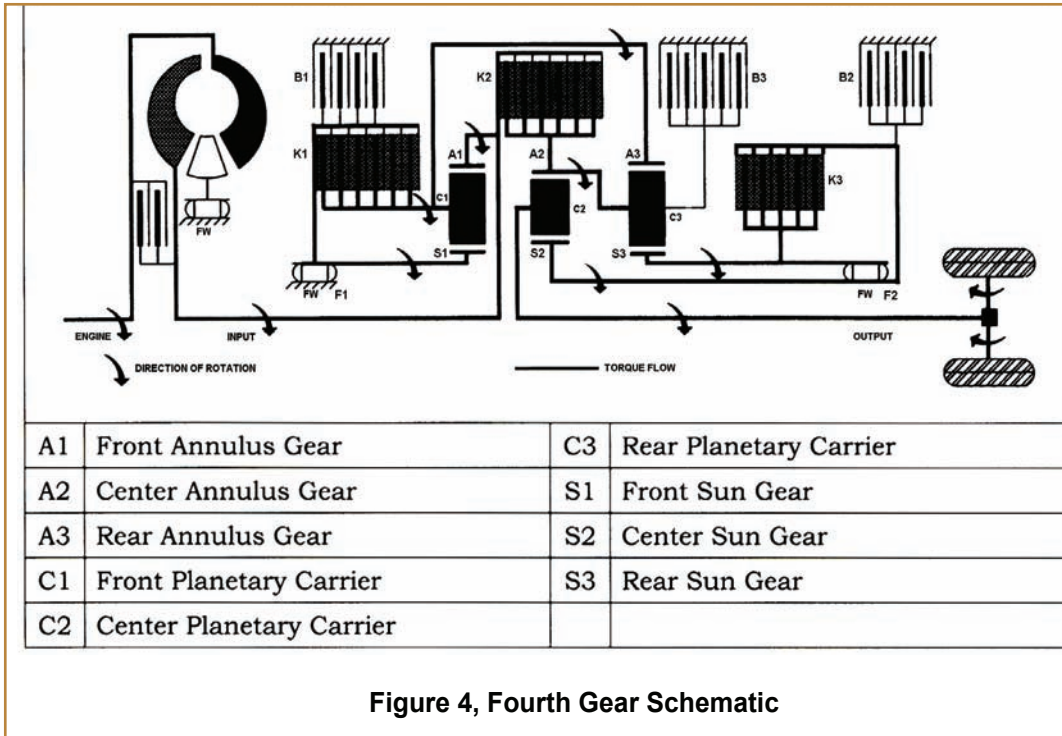
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Third Gear Power Flow

Front Gear Set — The front annulus gear is driven by the input shaft. The front sun gear and front carrier are held together by the K1 clutch, preventing the front pinions from rotating. The front carrier is driven at input shaft speed.

Rear Gear Set — The rear annulus gear is driven by the front pinion carrier at input shaft speed. The rear carrier is driven by the K2 clutch at input shaft speed, preventing the rear pinions from rotating. The rear carrier is driven at input shaft speed.

Center Gear Set — The center annulus gear is driven by the rear carrier and K2 clutch at input shaft speed. The center sun gear is held by the B2 brake. The center pinions and carrier walk around the held center sun gear to drive the output shaft.

D (3rd) Acceleration

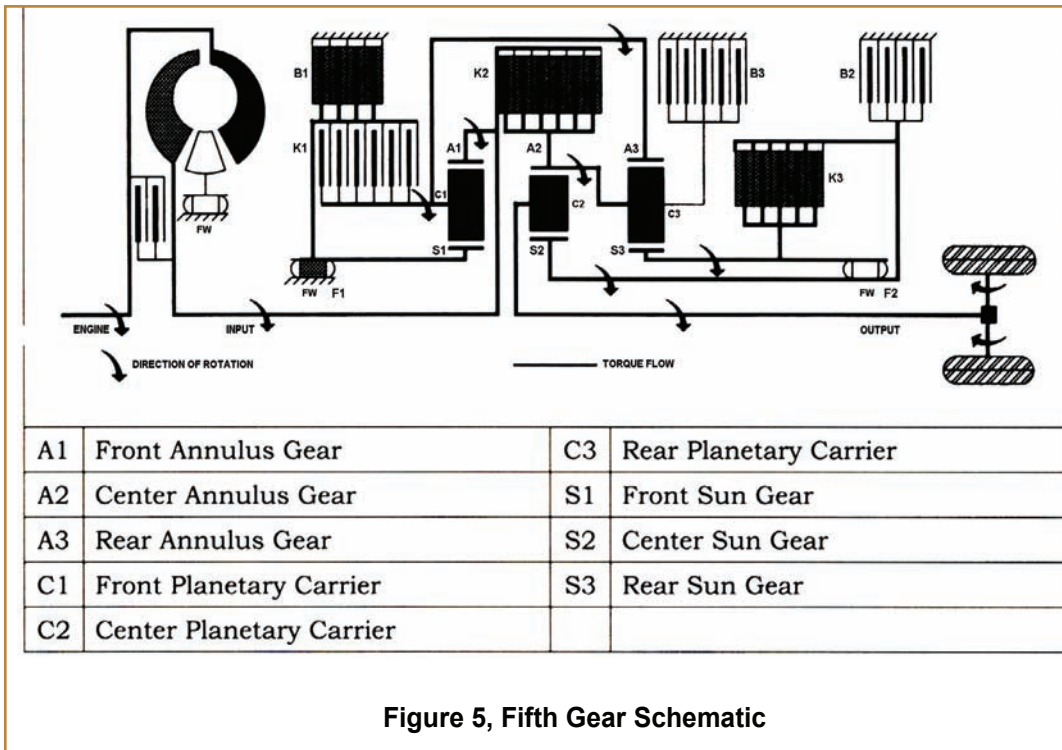
- Input shaft drives the front annulus gear.
- K1 locks the front sun gear and front planetary carrier together for a ratio of 1:1 through the front planetary gear set.
- K2 drives the center annulus gear and the rear planetary carrier.
- B2 holds the center sun gear.

D (3rd) Deceleration

Not applicable; engine braking is provided.

Fourth Gear

[Figure 4, Fourth Gear Schematic]
 All three gear sets provide direct drive. K1, K2 and K3 clutches are applied.



D (2nd) Acceleration

- Input shaft drives the front annulus gear.
- K1 locks the front sun gear and front carrier together for a 1:1 ratio through the front planetary gear set.
- F2 holds the center sun gear and rear sun gear together.
- B2 holds the center sun gear.

D (2nd) Deceleration

K3 holds the center sun gear and rear sun gear together (both directions).

Third Gear

[Figure 3, Third Gear Schematic]
 The front and rear gear sets provide drive, while the center gear set provides the gear reduction. K1, K2, and B2 clutches are applied.

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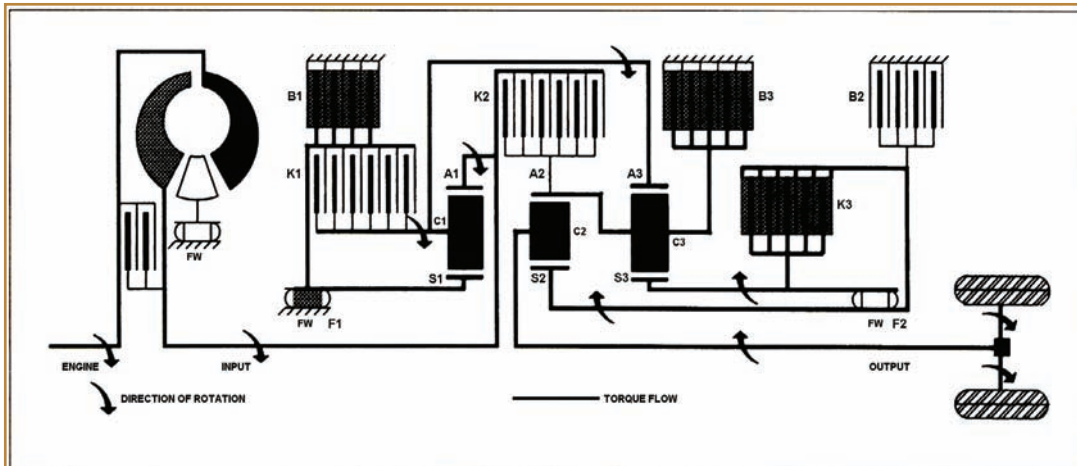
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A1	Front Annulus Gear	C3	Rear Planetary Carrier
A2	Center Annulus Gear	S1	Front Sun Gear
A3	Rear Annulus Gear	S2	Center Sun Gear
C1	Front Planetary Carrier	S3	Rear Sun Gear
C2	Center Planetary Carrier		

Figure 6, Normal Reverse Schematic

Fourth Gear Power Flow

Front Gear Set — The front annulus gear is driven by the input shaft. The K1 clutch holds the front sun gear and front carrier together, preventing the front pinions from rotating. The front carrier is driven at input shaft speed.

Rear Gear Set — The rear annulus gear is driven by the front pinion carrier at input shaft speed. The rear carrier is driven by the K2 clutch at input shaft speed, preventing the rear pinions from rotating. The rear carrier is driven at input shaft speed.

Center Gear Set — The center annulus gear is driven by the rear carrier and K2 clutch at input shaft speed. The center sun gear is driven by the rear sun gear through the K3 clutch at input shaft speed, preventing the pinions from rotating. The center carrier drives the output shaft.

D (4th) Acceleration

- Input shaft drives the front annulus gear.
- K1 locks the front sun gear and front carrier together for a 1:1 ratio through the front planetary gear set.
- K2 drives the center annulus and rear planetary carrier.
- K3 hold the center sun gear and rear sun gear together (both directions).

D (4th) Deceleration

Not applicable; engine braking is provided.

Fifth Gear (Overdrive)

[Figure 5, Fifth Gear Schematic]

All three planetary gear sets are used to provide fifth gear ratio. B1, K2 and K3 clutches are applied and the F1 sprag holds during acceleration.

Fifth Gear Power Flow

Front Gear Set — The front annulus gear is driven by the input shaft. The front sun gear is held by the B1 brake. The F1 sprag holds the front sun gear during acceleration. The front pinions and carrier walk around the held sun gear at reduced speed.

Rear Gear Set — The rear annulus gear is driven by the front pinion carrier at reduced speed. The rear carrier is driven by the K2 clutch at input shaft speed. The rear pinions walk around the inside of the rear annulus gear. The rear sun gear is driven in overdrive.

Center Gear Set — The center annulus gear is driven by the K2 clutch at input shaft speed. The center sun gear is driven by the rear sun gear through the K3 clutch, which is being driven in overdrive. The center sun gear drives the center pinions at reduced speed. The center pinions walk around the inside of

the center annulus gear. Even though the center carrier is driven at reduced speed, the center and rear sun gears are forcing the center carrier and output shaft to rotate faster than the input shaft, to provide an overdrive ratio.

D (5th) Acceleration

- Input shaft drives the front annulus gear.
- F1 holds front sun gear (one direction).
- K2 drives center annulus and rear planetary carrier.
- K3 locks the center sun gear and rear sun gear together.

D (5th) Deceleration

B1 holds front sun gear in both directions.

Reverse (Normal/Standard Mode)

[Figure 6, Normal Reverse Schematic]

All three gear sets are used to achieve normal reverse gear ratio. B1, B3 and K3 clutches are applied and the F1 sprag holds during acceleration.

Normal Reverse Gear Power Flow

Front Gear Set — The front annulus gear is driven by the input shaft. The front sun gear is held by the B1 brake. The F1 sprag holds the front sun gear during acceleration. The front pinions and carrier walk around the held front sun gear.

Rear Gear Set — The rear annulus gear is driven by the front carrier. The rear carrier is held by the B3 brake. The rear pinions drive the rear sun gear in reverse.

Center Gear Set — The center sun gear is driven by the rear sun gear through the K3 clutch. The center annulus gear is held by the B3 brake. The center pinions walk around the inside of the held annulus gear to drive the center carrier and output shaft in reverse.



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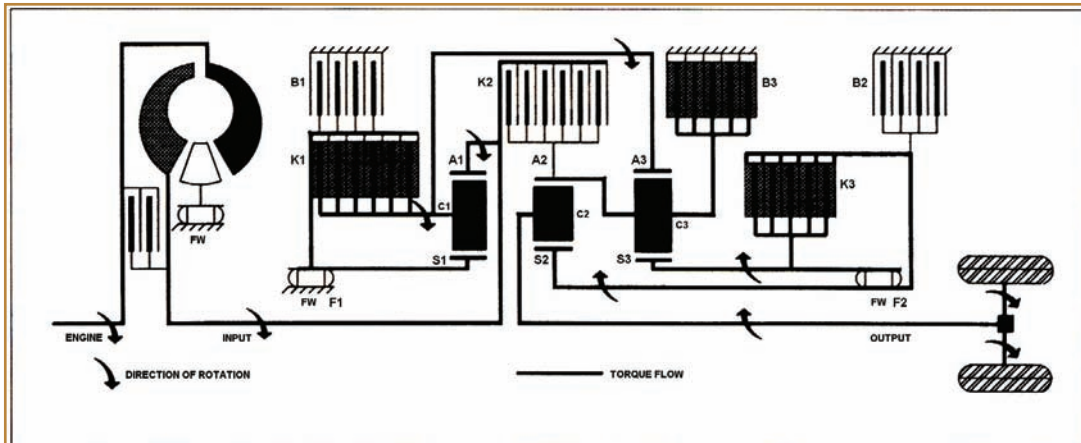
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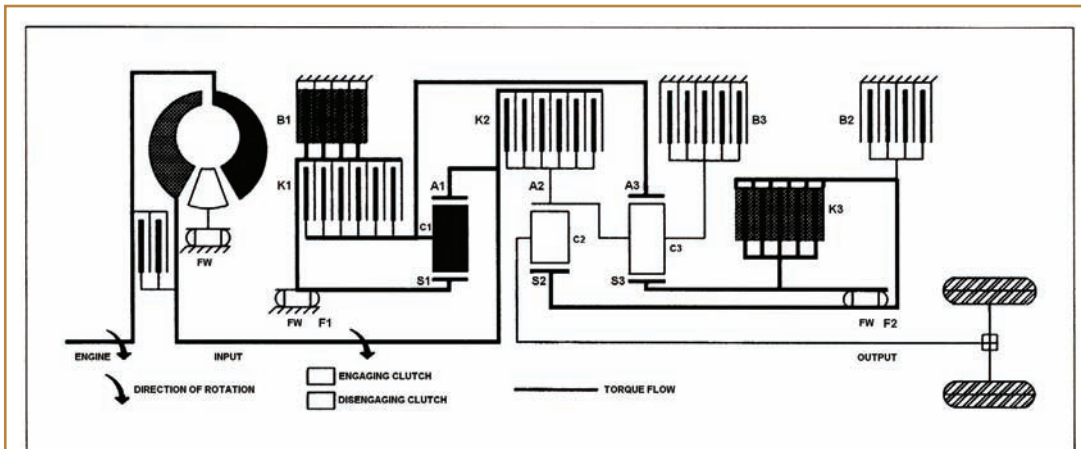
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A1	Front Annulus Gear	C3	Rear Planetary Carrier
A2	Center Annulus Gear	S1	Front Sun Gear
A3	Rear Annulus Gear	S2	Center Sun Gear
C1	Front Planetary Carrier	S3	Rear Sun Gear
C2	Center Planetary Carrier		

Figure 7, Reverse 1 (4x4 Low or Winter Mode) Gear Schematic



A1	Front Annulus Gear	C3	Rear Planetary Carrier
A2	Center Annulus Gear	S1	Front Sun Gear
A3	Rear Annulus Gear	S2	Center Sun Gear
C1	Front Planetary Carrier	S3	Rear Sun Gear
C2	Center Planetary Carrier		

Figure 8, Standard Neutral Schematic

Normal Reverse Acceleration

- Input shaft drives the front annulus gear.
- F1 holds front sun gear (one direction).
- K3 locks the center sun gear and rear sun gear together.
- B3 holds the rear planetary carrier/center annulus gear.

Normal Reverse Deceleration

B1 holds front sun gear (both directions).

Reverse 1 (4x4 Low or Winter Mode)

[Figure 7, Reverse 1 Gear Schematic]

The front gear set provides direct

drive while the rear and center gear sets provide the reverse gear ratio for 4 x 4 / winter mode. K1, B3 and K3 clutches are applied.

Reverse 1 Gear Power Flow

Front Gear Set — The front annulus gear is driven by the input shaft. The front sun gear and front carrier are held together by the K1 clutch, preventing the front pinions from rotating. The front carrier is driven at input shaft speed.

Rear Gear Set — The rear annulus gear is driven by the front carrier at input shaft speed. The rear carrier is held by the B3 brake. The rear sun gear is driven by the rear pinions in reverse.

Center Gear Set — The center sun gear is driven by the rear sun gear through the K3 clutch. The center annulus gear is held by the B3 brake. The center pinions walk around the inside of the held center annulus gear to drive the center carrier and output shaft in reverse.

Reverse 1 Acceleration

- Input shaft drives the front annulus gear.
- B3 holds the rear planetary carrier/center annulus gear.
- K3 holds the center sun gear and rear sun gear together.
- K1 locks the front sun gear to the front carrier (front planetary gear set is 1:1).

Reverse 1 Deceleration

Not applicable.

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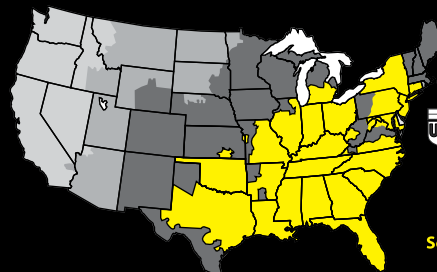
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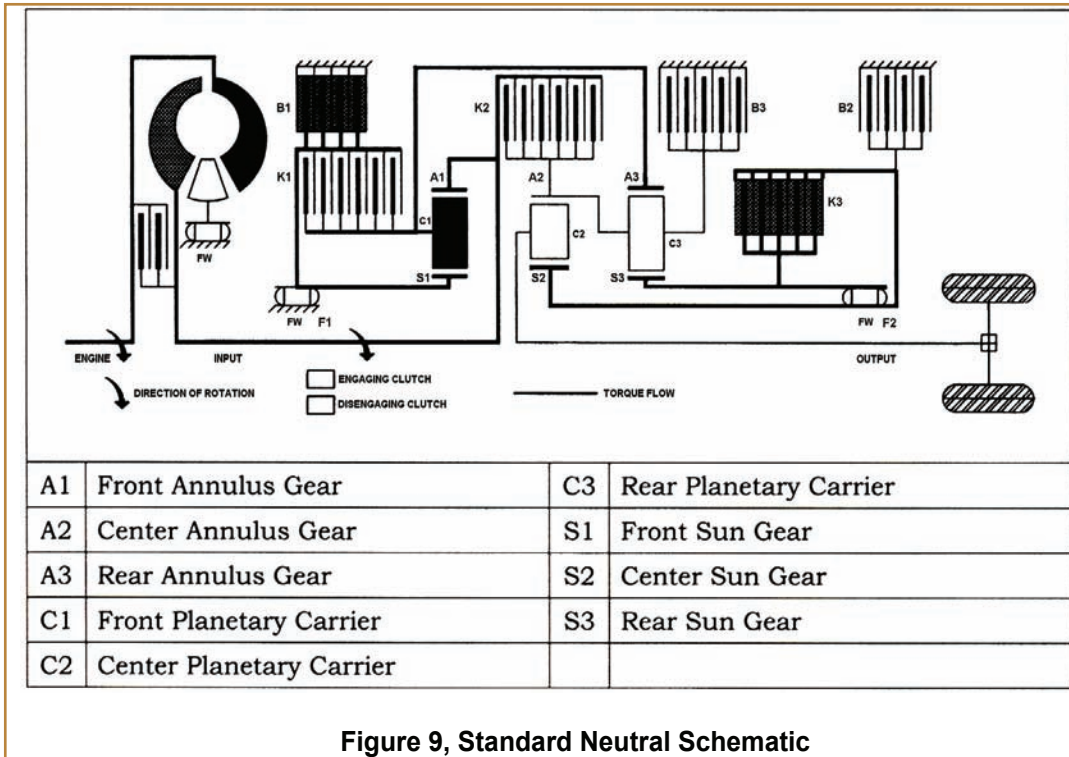


Figure 9, Standard Neutral Schematic

Neutral (Standard Mode)

[Figure 9, Standard Neutral Schematic]

No power flows to the output shaft.

B1 and K3 clutches are applied.

Front Gear Set — The front annulus gear is driven by the input shaft. The front sun gear is held by the B1 brake

in preparation for first or reverse. The front pinions and carrier walk around the held sun gear.

Rear Gear Set — The rear annulus gear is driven by the front carrier. The rear carrier and rear sun gear are free to rotate.

Center Gear Set — There is no input member for the center gear set because no power flow has been transmitted from the rear gear set. The K3 clutch is applied to hold the rear and center sun gear together in preparation for first or reverse, and aren't held to the case by the B2 brake.

Neutral (Default Mode)

[Figure 10, Neutral (Default Mode)]

No power flows through the gear

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sets. K1 and K3 clutches are applied.

Front Gear Set — The front annulus is driven by the input shaft. The K1 clutch is applied to hold the front sun gear and front carrier together. The front carrier is driven at input shaft speed in preparation for default second or normal reverse.

Rear Gear Set — The rear annulus gear is driven by the front carrier at input shaft speed. The rear carrier and rear sun gear are free to rotate.

Center Gear Set — There is no input member for the center gear set because no power flow has been transmitted from the rear gear set. The K3 clutch is applied to hold the rear and center sun gears together in preparation for default sec-

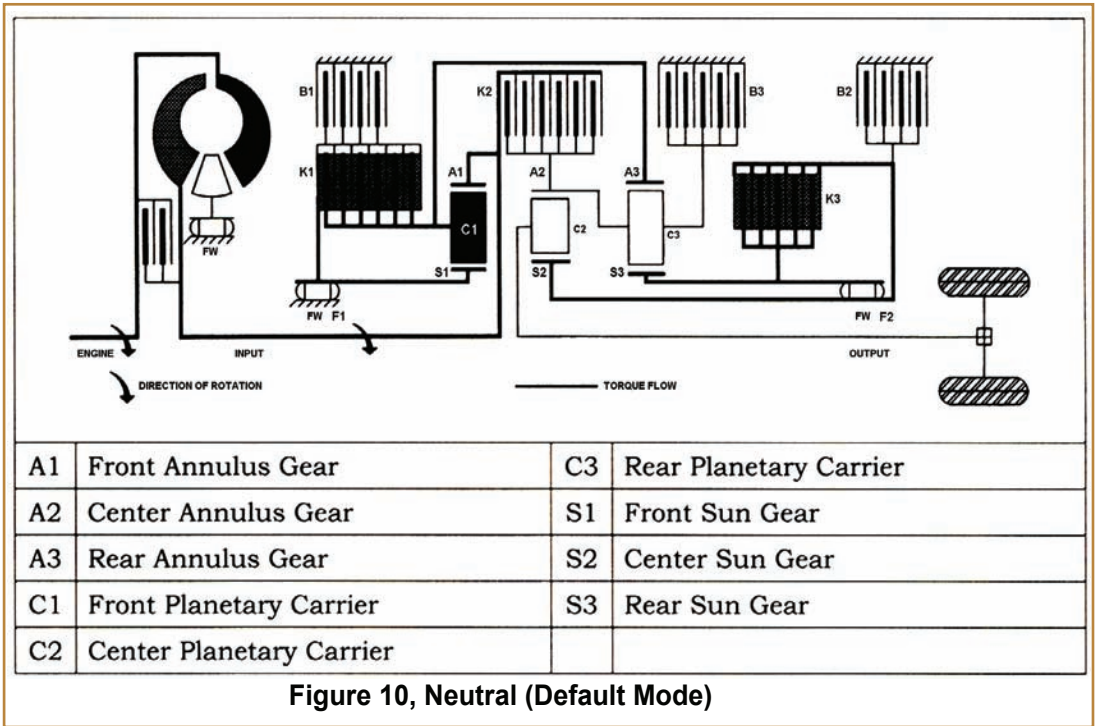


Figure 10, Neutral (Default Mode)

ond or standard reverse, and aren't held to the case by the B2 brake. To achieve 2nd gear in Limp-in Mode, the B2 brake is applied by fluid directly from the manual valve.

Thanks to DaimlerChrysler for providing information and illustrations, and Randall Schroeder for his special assistance.



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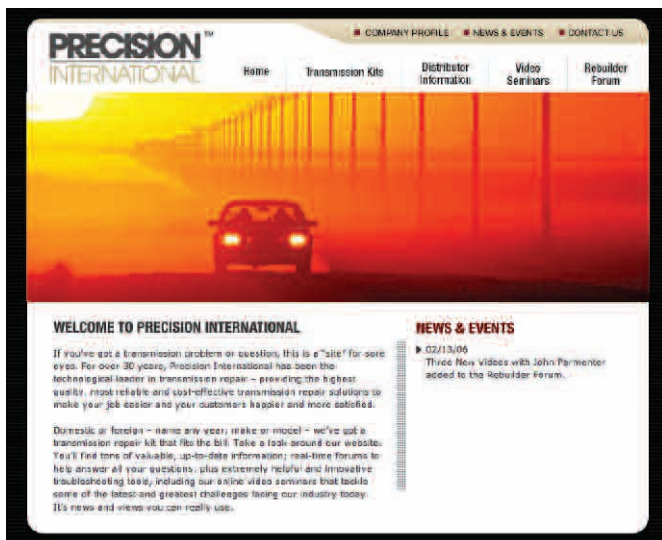
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