AT Basics, Planetary Gears

Transmission Gear Trains

Most automatic transmissions use planetary gear sets to provide the different gear ranges. Power flow through these gear sets is controlled by the control devices: clutches, bands, and one-way clutches.



Planetary Gear set

A simple planetary gear set is composed of:

- •A sun gear at the center
- •A ring gear at the outside
- •A carrier that supports the planet pinions
- •A set of planet pinion gears



4-Speed Gear Set

The 4T60-E uses a compound gear set. This is two simple gear sets with the ring gear of each set combined with the carrier of the other set. This gear set can produce four forward speeds plus a reverse.



Control

Different gear ranges are obtained by either driving (input) or holding (reaction) parts of the gear set. Note that the Input ring and reaction carrier are connected to the output shaft.



Clutches and bands are the control devices and allow the driving and reaction member to be changed.

Power Flow, Rules

In order for power to flow through a planetary gear set: **1.** One member must be driven; in this example it is the sun gear.

2. One member must be the output; in this example, it is the ring gear.

3. One member must be held in reaction; here it is the carrier.



4. Direct drive will result if two members are driven

Power Flow, Reverse

The sun gear is driving the planet pinion gears. They are rotating on their axis, acting as idler gears and driving the ring gear. The result is a reverse with a reduction.



Power Flow, Overdrive

In this example, the carrier is driven, and the sun gear is held stationary in reaction. The planet pinions must rotate on their axis as they "walk" around the stationary sun gear. This will drive the ring gear at an overdrive ratio, faster than the carrier.



Power Flow, Reduction

In this example, the ring gear is driven and the sun gear is held in reaction. The planet pinion gears are forced to walk around the sun gear, and this drives the carrier at a reduction ratio, slower than the ring gear.



Power Flow, Direct Drive

If two gear set members are driven (the sun and carrier), the gear set will lock up and be in direct drive. The planet pinions will not rotate on their axis.



Changing Power Flow



This transmission uses three driving clutches with two oneway sprags, one holding clutch, a one-way holding clutch, and three bands to control the power flows. These devices are applied or releases as needed for that gear range.