OPERATION AND FUNCTION OF THE TORQUE CONVERTOR

The Torque converter, provides a hydro-mechanical coupling that supplies rotational input from the engine to transmission gears. It multiples engine torque and provides a hydraulic cushion between the engine and the load. No disconnect clutch is needed.

TYPICAL TORQUE CONVERTER

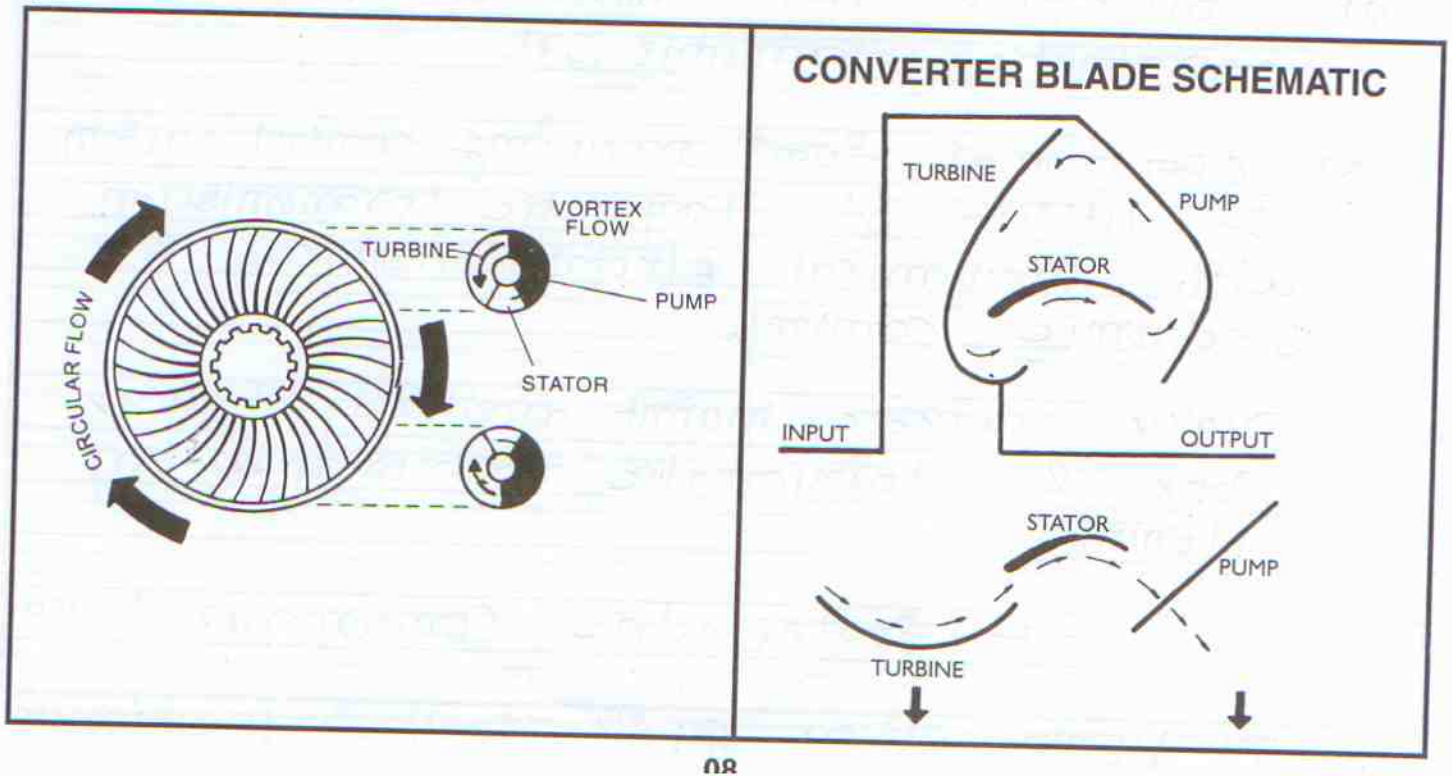
The torque convertors three main component. The pump, stator and turbine. The convertor pump driven by engine rotates at engine speed. The pump throws fluid over to the turbine. Once the force reaches a certain point. The fluid beings to spin the turbine. The convertor turbine is splined to the transmission turbine shaft. So the turbine shaft rotates and provides input to the transmission gearing.

THE STATOR

The Stator re-directs fluid back to the converter pump. When fluid strikes the front of the stator blades. The stator locks against its one-way clutch. Fluid leaving the locked stator is directed back to the pump at an accelerated rate, increasing torque. As the turbine gains speed, it directs oil to the back side of the stator blades, causing the stator to "free wheel". Fluid flowing through the free wheeling stator is no longer accelerated and doesn't increase torque, As turbine speed continues to increase, flow through the stator becomes smooth and eventully stops.

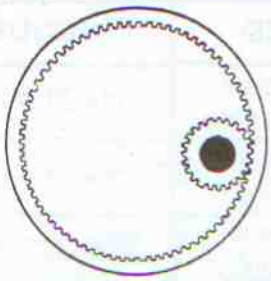
LOCK UP CLUTCH (Provided in some torque converters)

The torque converter fluid coupling will never allow turbine speed to equal engine speed. The lock up clutch provides a way to create a one-to-one coupling between the engine and transmission input. The Hydraulic fluid force between the drive cover / Flywheel and lockup clutch piston "sandwiches" the clutch plates between the piston and back plate. The clutch plate now rotates at engine speed and since the clutch plate is splined to the gear which is riveted to turbine. The input to the transmission matches the engine rpm.



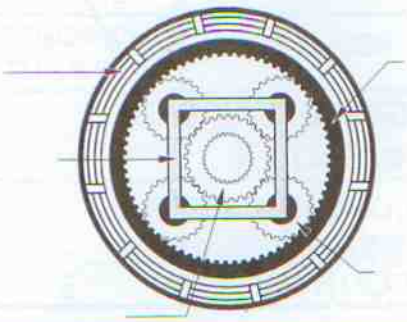
Principle of Gear Rotation

EXTERNAL TO INTERNAL



EXTERNAL TO EXTERNAL

Planetary Gears



Planetary gear sets consists of a sun gear, planetary pinion gears (Planet pinions) which are held by a carrier and a ring gear.

Gear Relationships

- When two gears with external teeth mesh, their rotation is opposite each other.
  - Example - the sun gear and pinion gears.
- When a gear with external teeth meshes with a gear with internal teeth, they rotate in the same direction.
  - Example - the pinion gears and the ring gear.
- These gear relationships provide the basis for planetary gear operation.

When one planetary component is held and another is rotated, or "input", the third member becomes an output mechanism. Depending on which components are held and input, the planetary gear set can develop various output rotations:

- Output speed decrease.
- Input Speed increases.
- Provide direct I to I drive.
- Create reverse.

To decrease speed :

- The ring gear is held and the sun gear is rotated, or "input"
  - The carrier becomes output, rotating at a slower speed than the sun gear.
- These gear relationships provide the basis for planetary gear operation.

To increass speed :

- The ring is held and the carrier is input.
  - The sun gear becomes output and rotates faster than the carrier.

In-direct drive:

- No components are held and two components are driven at the same speed and direction.
  - The third member becomes output, rotating the same speed and direction as input.

To create reverse :

- The carrier is held and either the sun or ring gear is input.
  - If the ring gear is input, the sun gear becomes output. The sun gear rotates the opposite direction, faster than the ring gear.
  - If the sun gear is input, the ring gear becomes output. The ring gear rotates the opposite direction, slower than the sun gear.

BASIC LAWS OF SIMPLE PLANETARY GEAR SETS

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 INCRAESE	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 DRIVEN TOGETHER, SPEED AND DIRECTION ARE 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.					

BASIC PLANETARY PRINCIPLES

The Planetary transmission is built around a center shaft with gear set clusters stacked end-to-end to distribute load and conserve space. In the simplest form, planetary transmissions consists of a planetary gear set for forward, reverse and each speed range. Each planetary set has a sun gear in the center of planetary gears that are mounted on a planet carrier which causes the gears to uniformly rotate around the sun gear and inside the ring gear. To transmit power, one element is held stationary by a clutch pack. Holding the planet carriers causes the sun gear to drive the planet gears about their axis thus driving the ring gear which becomes the input source hold the ring gear and the planet carrier becomes the output.

WHY A PLANETARY POWER SHIFT

While the planetary arrangement allows maximum reduction within minimum space... the main advantage in ease of shifting. The ability to change speed and direction with a single lever means the operator can work faster, with less effort, an especially critical factor on applications where load and speed requirements rapidly change. Your operator can upshift when the blade, bowl or bucket is full and travel at a faster speed to improve work cycle time. Effortless shifting and smooth travel also reduce operator fatigue resulting in a more efficient alert operator throughout the work shift.

5 REASONS WHY THE PLANETARY POWER SHIFT TRANSMISSION IS BETTER

1. Constantly in mesh, **2.** Concentric power flow; **3.** Divides gear forces equally, **4.** Divides gear tooth loading.

5. Versatile a) Single set planetary gears has 7 combinations of speed and direction.
b) Compounding planetary gears have additional variations of speed and direction.

6. Gear noise can be controlled without tightening tooth tolerance.

CLUTCHES: Clutches provide input and holding force for the planetary gear sets. They consists of two intertwind sets of clutch plates - Graphite ("friction") plates, and steel ("reaction") plates. Plates types are alternated in the clutch assembly so that they "sandwich" each other. In most case, one plate type is splined to an inner compoent, and the other plate type is splined to an outer component (usually a housing). Even though the plates are interwind, they rotate indepently - until hydraulic pressure is applied behind the piston. Then the plates compress together, locking the inner and outer components as one. The clutch is released when the pressure is removed from the back of the piston. Springs are typically incorporated to return the piston quickly and completely.

ROTATING CLUTCHES : Rotating clutches supply rotational input to other shafts or components.

STATIONERY CLUTCHES : Stationery clutches hold components when applied.