

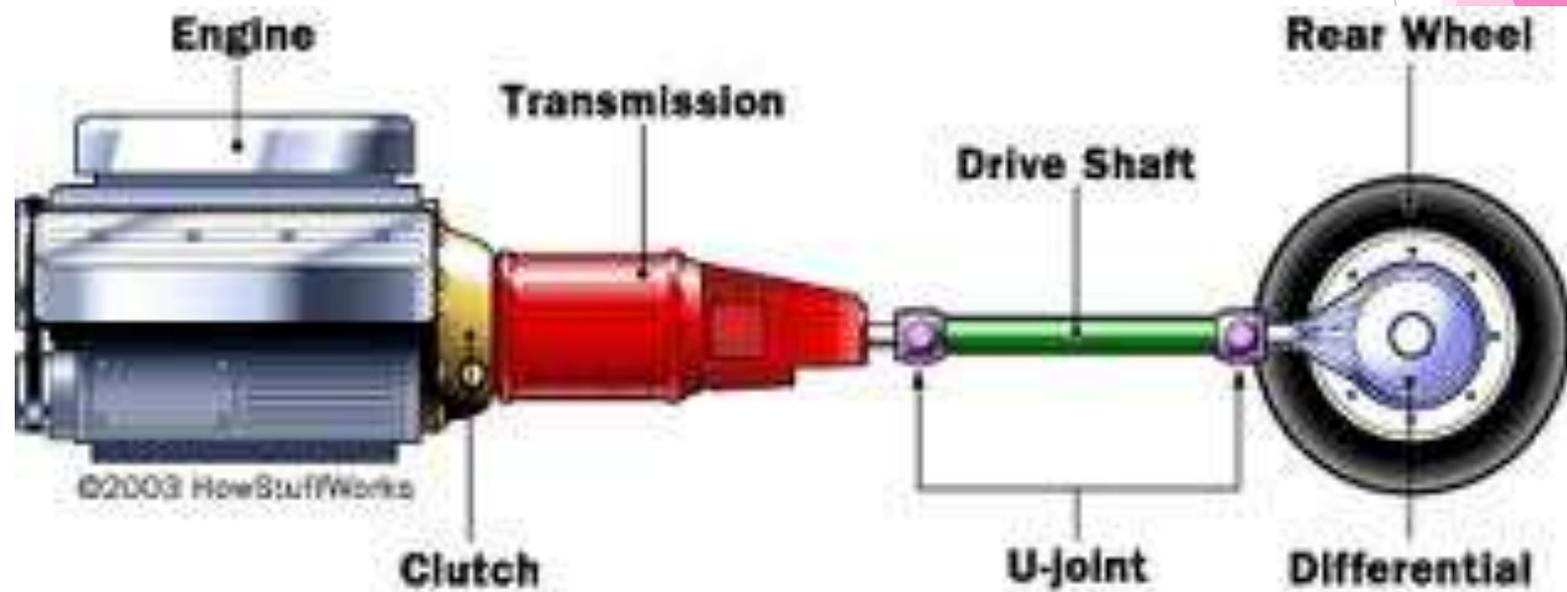
INTRODUCTION TO TRANSMISSION SYSTEM :-

- *TYPES OF TRANSMISSION SYSTEM*
- *CLUTCH*
- *GEAR BOX*
- *PROPELLER SHAFT*
- *UNIVERSAL JOINTS*
- *FINAL DRIVE AND DIFFERENTIAL*
- *REAR AXLE*

Definition Of Transmission System :-

The mechanism that transmits the power developed by the engine of automobile to the engine to the driving wheels is called the TRANSMISSION SYSTEM (or POWER TRAIN). It is composed of -

- Clutch
- The gear box
- Propeller shaft
- Universal joints
- Rear axle
- Wheel
- Tyres



Requirements Of Transmission System :-

- ***Provide means of connection and disconnection of engine with rest of power train without shock and smoothly.***
- ***Provide a varied leverage between the engine and the drive wheels***
- ***Provide means to transfer power in opposite direction.***
- ***Enable power transmission at varied angles and varied lengths.***
- ***Enable speed reduction between engine and the drive wheels in the ratio of 5:1.***
- ***Enable diversion of power flow at right angles.***
- ***Provide means to drive the driving wheels at different speeds when required.***
- ***Bear the effect of torque reaction , driving thrust and braking effort effectively.***

The above requirements are fulfilled by the following main units of transmission system :-

- ***Clutch***
- ***Gear Box***
- ***Transfer Case***
- ***Propeller Shaft and Universal Joints.***
- ***Final Drive***
- ***Differential***
- ***Torque Tube***
- ***Road Wheel***

Difference between tyre and wheel :-

Wheel

A wheel is a device that allows heavy objects to be moved easily through rotating on an axle through its centre, facilitating movement or transportation while supporting a load (mass), or performing labor in machine.



Tyre

While tyre is the outer part of the wheel made up with rubber and mostly use in vehicles for smooth movement



Types Of Transmission System -:

Transmission system

Hydraulic transmission system

Mechanical transmission system

Fluid coupling

Torque converter

Automatic transmission system

Manual transmission system

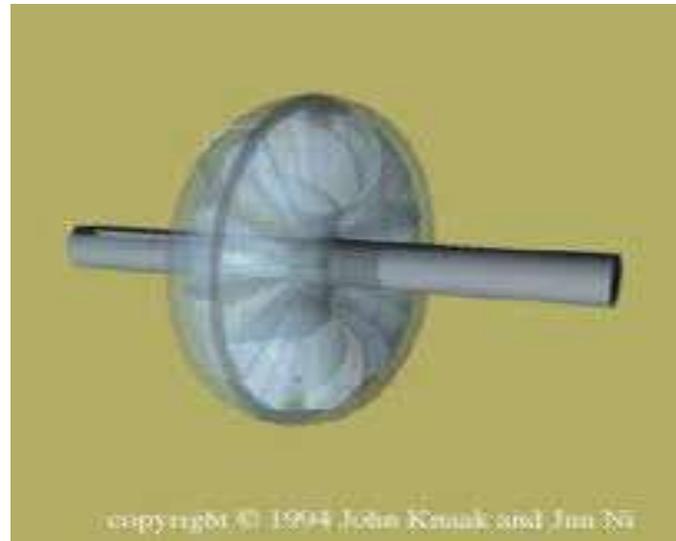
Clutch, gear box and line axle transmission .

Clutch, gear box and dead axle transmission.

Clutch, gear box and axleless transmission

Hydraulic transmission system:-

- Fluid coupling -: *A fluid coupling is a hydrodynamic device used to transmit rotating mechanical power. It has been used in automobile transmissions as an alternative to a mechanical clutch.*



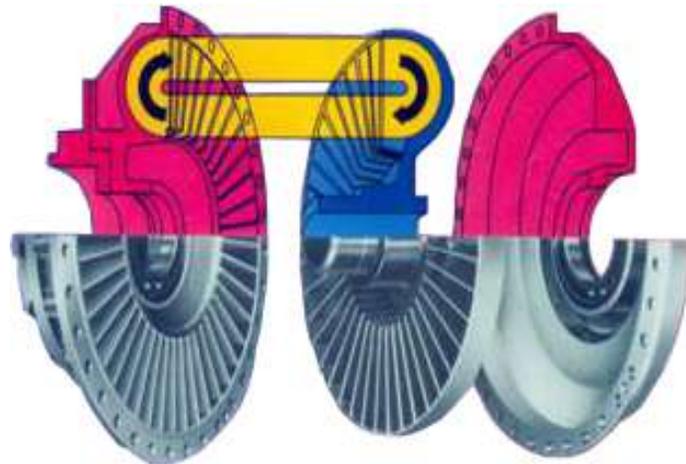
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How fluid coupling can be act as a mechanical clutch ?

- ***In automotive applications, the pump typically is connected to the flywheel of the engine The turbine is connected to the input shaft of the transmission. While the transmission is in gear, as engine speed increases torque is transferred from the engine to the input shaft by the motion of the fluid, propelling the vehicle . So, the behavior of the fluid coupling strongly resembles that of a mechanical clutch driving a manual transmission.***

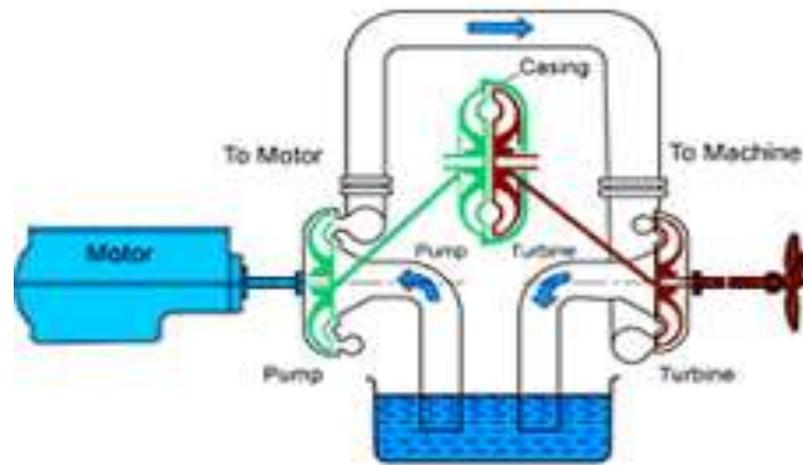
Construction Of a Fluid Coupling :-

- ❑ *It consists of a pump-generally known as impeller and a turbine generally known as rotor, both enclosed suitably in a casing . They face each other with an air gap. The impeller is suitably connected to the prime mover while the rotor has a shaft bolted to it. This shaft is further connected to the driven machine through a suitable arrangement. Oil is filled in the fluid coupling from the filling plug provided on its body.*



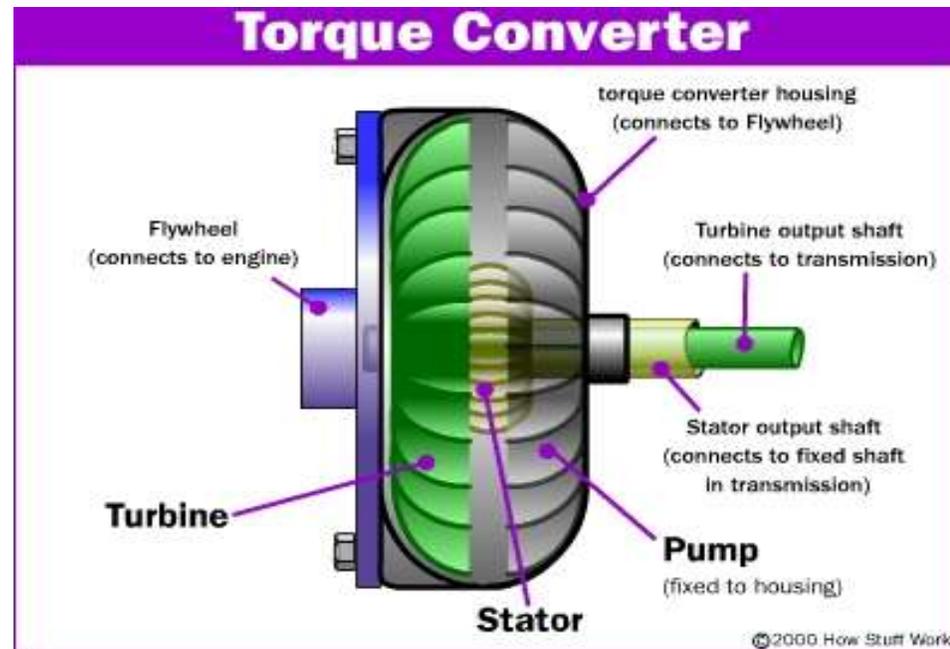
Operating principle of fluid coupling :-

- *There is no mechanical interconnection between the impeller and the rotor and the power is transmitted by virtue of the fluid filled in the coupling. The impeller when rotated by the prime mover imparts velocity and energy to the fluid, which is converted into mechanical energy in the rotor thus rotating it. The fluid follows a closed circuit of flow from impeller to rotor through the air gap at the outer periphery and from rotor to impeller again through the air gap at the inner periphery. To enable the fluid to flow from impeller to rotor it is essential that there is difference in the "heat" between the two and thus it is essential that there is difference in R.P.M., known as slip between the two. As the slip increases more and more fluid can be transferred from the impeller to the rotor and more torque is transmitted.*



Torque converter:-

- **Torque Converter** :- *Torque converter is a hydraulic transmission which increases the torque of the vehicle reducing its speed . It provides a continuous variation of ratio from low to high. The key characteristic of a torque converter is its ability to multiply torque when there is a substantial difference between input and output rotational speed, thus providing the equivalent of a reduction gear. cars with an automatic transmission have no clutch that disconnects the transmission from the engine. So, they use an amazing device called a torque converter.*



What's Inside The Torque Converter?

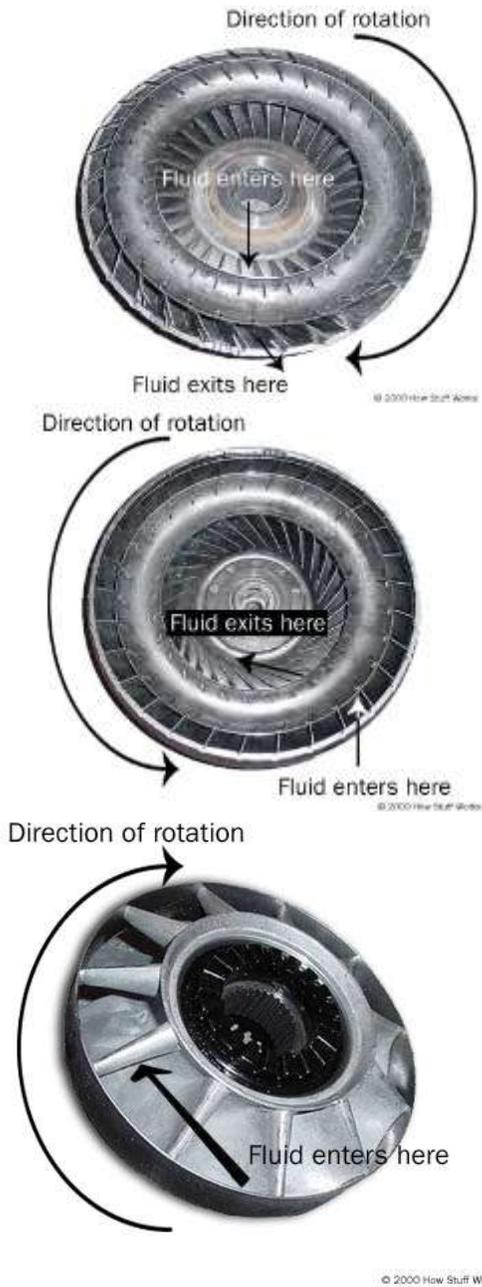
There are four components inside the very strong housing of the torque converter:

- Pump
- Turbine
- Stator
- Transmission fluid

These are the parts in the figure turbine, stator, pump (left to right).



The housing of the torque converter is bolted to the flywheel of the engine, so it turns at whatever speed the engine is running at. The pump inside a torque converter is a type of centrifugal pump. As it spins, fluid is flung to the outside. As fluid is flung to the outside, a vacuum is created that draws more fluid in at the center. The fluid then enters the blades of the turbine, which is connected to the transmission. The turbine causes the transmission to spin, which basically moves your car. The blades of the turbine are curved. This means that the fluid, which enters the turbine from the outside, has to change direction before it exits the center of the turbine. It is this **directional change** that causes the turbine to spin.



*In order to change the direction of a moving object, you must apply a **force** to that object -- it doesn't matter if the object is a car or a drop of fluid. And whatever applies the force that causes the object to turn must also feel that force, but in the opposite direction. So as the turbine causes the fluid to change direction, the fluid causes the turbine to spin.*

*The fluid exits the turbine at the center, moving in a different direction than when it entered. The fluid exits the turbine moving opposite the direction that the pump (and engine) are turning. If the fluid were allowed to hit the pump, it would slow the engine down, wasting power. This is why a torque converter has a **stator**. The stator resides in the very center of the torque converter. Its job is to redirect the fluid returning from the turbine before it hits the pump again. This dramatically increases the efficiency of the torque converter. The stator has a very aggressive blade design that almost completely reverses the direction of the fluid. A one-way clutch (inside the stator) connects the stator to a fixed shaft in the transmission (the direction that the clutch allows the stator to spin is noted in the figure above). Because of this arrangement, the stator cannot spin with the fluid -- it can spin only in the opposite direction, forcing the fluid to change direction as it hits the stator blades.*

The figure (top to bottom) shows the pump, turbine and the stator, sending the fluid in their respective direction.

Intersting facts about stator !!!

- ▶ *Something a little bit tricky happens when the car gets moving. There is a point, around 40 mph (64 kph), at which both the pump and the turbine are spinning at almost the same speed (the pump always spins slightly faster). At this point, the fluid returns from the turbine, entering the pump already moving in the same direction as the pump, so the stator is not needed.*
- ▶ *Even though the turbine changes the direction of the fluid and flings it out the back, the fluid still ends up moving in the direction that the turbine is spinning because the turbine is spinning faster in one direction than the fluid is being pumped in the other direction. If you were standing in the back of a pickup moving at 60 mph, and you threw a ball out the back of that pickup at 40 mph, the ball would still be going forward at 20 mph. This is similar to what happens in the turbine: The fluid is being flung out the back in one direction, but not as fast as it was going to start with in the other direction.*

Manual transmission system :-

- ▶ In this type of transmission system , the driver has to manually select and engage the gear ratios -:

Stages of Manual transmission

➤ Clutch fully depressed

The clutch is fully disengaged when the pedal is fully depressed. There will be no torque being transferred from the engine to the transmission and wheels. Fully depressing the clutch allows the driver to change gears or stop the vehicle.

➤ Clutch slips

The clutch slips is the point that vary between being fully depressed and released. The clutch slip is used to start the vehicle from a stand still. It then allows the engine rotation to adjust to the newly selected gear ratio gradually . It is recommended not to slip the clutch for a long time because a lot of heat is generated resulting in energy wastage.

➤ Clutch fully released

The clutch is fully engaged when the pedal is fully released. All the engine torque will be transmitted to the transmission. This results in the power being transmitted to the wheels with minimum loss.

Automatic transmission :-

➤ *Automatic transmission system is the most advanced system in which drives mechanical efforts are reduced very much and different speeds are obtained automatically. This system is generally also called hydramatic transmission. It contain epicyclic gear arrangement, fluid coupling and torque converter. In this planetary gears sets are placed in series to provide transmission. This type of transmission are used by Skoda ,Toyota , Lexus , etc*

➤ **Epicyclic gearing (planetry gearing)** :- *it is a gear system consisting of one or more outer gears, or planet gears, revolving about a central gear .By using epicyclic gear , different torque speed ratio can be obtained . It also compact the size of gear box.*

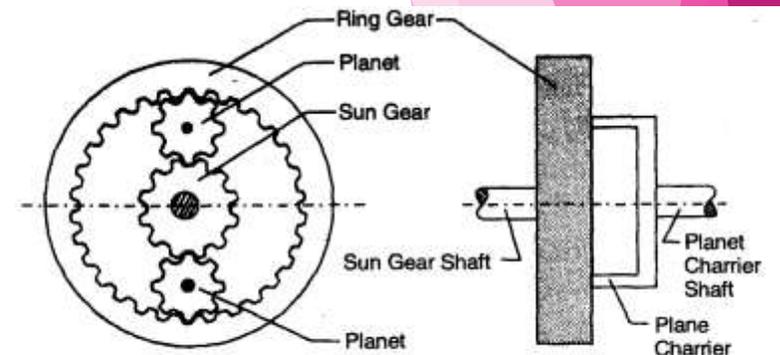


Fig. 4.4 Automatic Transmission System (Simple epicyclic gear set)

Stages of automatic transmission :-

- **Park(P)** :- selecting the park mode will lock the transmission, thus restricting the vehicle from moving.
- **Reverse(R)** :- selecting the reverse mode puts the car into reverse gear, allowing the vehicle to move backward.
- **Neutral (N)** :- selecting neutral mode disconnects the transmission from the wheel.
- **Low (L)** :- selecting the low mode will allow you to lower the speed to move on hilly and middy areas.
- **Drive (D)** :- selecting drive mode allows the vehicle to move and accelerate through a range of gears.



Comparison between manual transmission and automatic transmission :-

<u>Manual transmission</u>	<u>Automatic transmission</u>
<i>Vehicles with manual transmission are usually cheaper .</i>	<i>Vehicles with automatic transmission are costlier than those of manual transmission.</i>
<i>Manual transmission has better fuel economy . This is because manual transmission has better mechanical and gear train efficiency.</i>	<i>Automatic transmission has not better fuel economy . This is because automatic transmission has not better mechanical and gear train efficiency as compare to those of automatic transmission.</i>
<i>Manual transmission offers the driver more control of the vehicle.</i>	<i>Automatic transmission does not offer the driver more control of the vehicle as compare to that of automatic transmission system.</i>

CLUTCH

- *A clutch is a mechanism which enables the rotary motion of one shaft to be transmitted at will to second shaft ,whose axis is coincident with that of first.*
- *Clutch is located between engine and gear box. When the clutch is engaged, the power flows from the engine to the rear wheels through the transmission system and the vehicle moves . when the clutch is disengaged ,the power is not transmitted to the rear wheels and the vehicle stops, while the engine is still running*
- *Clutch is disengaged when-*
 - a) Starting the engine,*
 - b) Shifting the gears,*
 - c) Idling the engine*
- *clutch is engaged only when the vehicle is to move and is kept engaged when the vehicle is moving.*



Function Of a Clutch :-

- a) *To permit engagement or disengagement of a gear when the vehicle is stationary and the engine is running*
- b) *To transmit the engine power to the road wheels smoothly without shock to the transmission system while setting the wheel in motion.*
- c) *To permit the engaging of gears when the vehicle is in motion without damaging the gear wheels.*

Principle Of Operation Of a Clutch :-

- *The clutch principle is based on friction . when two friction surface are brought in contact with each other and pressed they are united due to friction between them. If one is revolved the other will also revolve . The friction between the two surfaces depends upon-*
- i. *Area of the surface,*
 - ii. *Pressure applied upon them,*
 - iii. *Coefficient of friction of the surface materials*

Here , One surface is considered as driving member and the other as driven member.

The driving member of a clutch is the flywheel mounted on the crankshaft, the driven member is the pressure plate mounted on the transmission shaft . Friction surfaces (clutch plates) are between the two members (driving and driven). On the engagement of the clutch, the engine is connected to the transmission (gear box) and the power flows from the engine to the rear wheels through the transmission system . when the clutch is disengaged by pressing a clutch pedal, the engine is disconnected from the transmission and consequently the power does not flow to the rear wheels while the engine is still running.

