

Unit-2 clutch

Clutch is defined as the device which is used in automobiles to transmit power from one rotating shaft to another shaft. In cars it transmits power from the flywheel connected to the engine shaft to the clutch shaft, and from clutch shaft it is transmitted to the rear wheels through gear shaft, propeller shaft and differential.



Mainly clutches are divided into 2 parts:

1. Friction clutches and
2. Fluid flywheel

Friction clutches:

These clutches work on the principle of friction exist in between two rotating shaft when they come in contact with each other.

Fluid flywheel:

Fluid flywheel clutches work on transfer of energy from one rotor to the other by means of some fluid. For Example: Fluid coupling and torque converter.

Types of friction clutches:

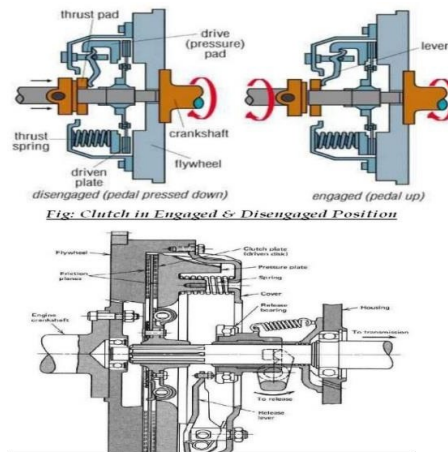
- Cone clutch
- Single plate clutch
- Multi-plate clutch
- Semi-centrifugal clutch
- Centrifugal clutch

1. Single Clutch Plate:

It is the most common type of clutch plate used in motor vehicles. Basically it consists of only one clutch plate, mounted on the splines of the clutch shaft. The flywheel is mounted on engine crankshaft and rotates with it. The pressure plate is bolted to the flywheel through clutch springs, and is free to slide on the clutch shaft when the clutch pedal is operated. When the clutch is engaged the clutch plate is gripped between the flywheel and pressure plate. The friction linings are on both the sides of the clutch plate. Due to the friction between the flywheel, clutch plate and the pressure plate the clutch plate revolves with the flywheel. As the clutch plate revolves the clutch shaft also revolves. Clutch shaft is connected to the

transmission gear box. Thus the engine power is transmitted to the crankshaft and then to the clutch shaft.

When the clutch pedal is pressed, the pressure plate moves back against the force of the springs, and the clutch plate becomes free between the flywheel and the pressure plate. Thus the flywheel remains rotating as long as the engine is running and the clutch shaft speed reduces slowly and finally it stops rotating. As soon as the clutch pedal is pressed, the clutch is said to be engaged, otherwise it remains engaged due to the spring forces.



2. Multi-plate Clutch:

Multi-plate clutch consists of a number of clutch plates instead of only one clutch plate as in case of single plate clutch. As The number of clutch plates are increased, the friction surfaces also increases. The increased number of friction surfaces obviously increases the capacity of the clutch to transmit torque.

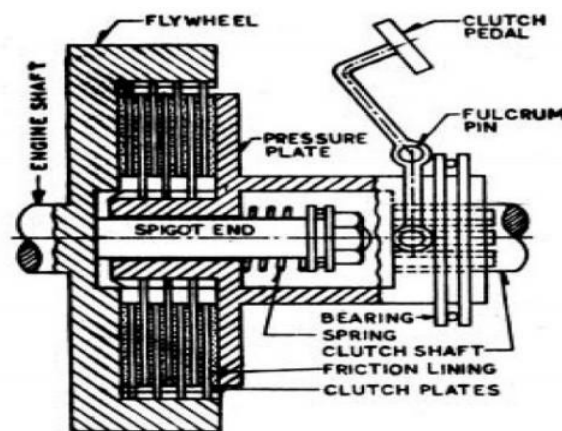


Fig: Multi-Plate Clutch



Fig: Cutaway Model Of Multi-Plate Clutch



Fig: Exploded View Of Multi-Plate Clutch

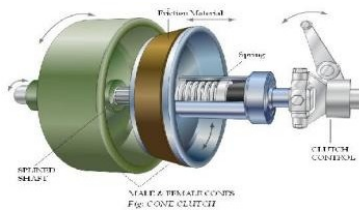
Fig: Multi-Plate Clutch

The plates are alternately fitted to engine and gear box shaft. They are firmly pressed by strong coil springs and assembled in a drum. Each of the alternate plate slides on the grooves on the flywheel and the other slides on splines on the pressure plate. Thus, each alternate plate has inner and outer splines. The multi-plate clutch works in the same way as a single plate clutch by operating the clutch pedal. The multi-plate clutches are used in heavy commercial vehicles, racing cars and motor cycles for transmitting high torque. The multi-plate clutch may be dry or wet. When the clutch is operated in an oil bath, it is called a wet clutch. When the clutch is operated dry it is called dry clutch. The wet clutch is used in conjunction with or part of the automatic transmission.

3. Cone Clutch:

Cone clutch consists of friction surfaces in the form of cone. The engine shaft consists of female cone. The male cone is mounted on the splined clutch shaft. It has friction surfaces on the conical portion. The male cone can slide on the clutch shaft. When the clutch is engaged the friction surfaces of the male cone are in contact with that of the female cone due to force of the spring. When the clutch pedal is pressed, the male cone slides against the spring force and the clutch is disengaged.

The only advantage of the cone clutch is that the normal force acting on the friction surfaces is greater than the axial force, as compare to the single plate clutch in which the normal force acting on the friction surfaces is equal to the axial force. The disadvantage in cone clutch is that if the angle of the cone is made smaller than 200 the male cone tends to bind in the female cone and it becomes difficult to disengage the clutch. Cone clutches are generally now only used in low peripheral speed applications although they were once common in automobiles and other combustion engine transmissions. They are usually now confined to very specialist transmissions in racing, rallying, or in extreme off-road vehicles, although they are common in power boats. Small cone clutches are used in synchronizer mechanisms in manual transmissions



Unit 3- gear box

The word “transmission” is used for a device that is located between the clutch and the propeller shaft. It may be a gearbox, a torque converter, overdrive, fluid drive or hydraulic drive. In this post, we will describe the types of gearbox in details.

Types of Gearbox

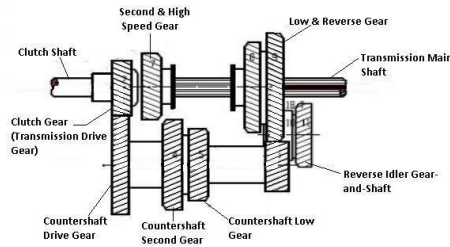
The following are four different **types of gearbox** and how they are commonly used.

- Sliding mesh type gearbox
- Constant mesh type gearbox

- Synchronmesh gearbox
- Epicyclic gearbox

Sliding Mesh Type Gearbox

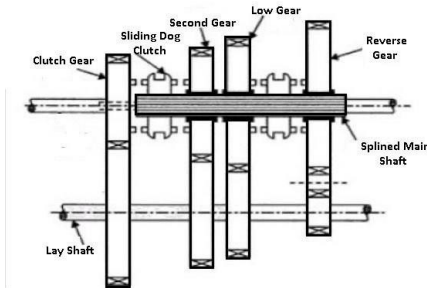
It is the simplest type of gearbox. The arrangement of gears is in a neutral position. The gear housing and bearing are not shown. The clutch gear is fixed to the clutch shaft. It remains always connected to the drive gear of the counter-shaft.



Sliding Mesh Gear Box

Constant Mesh Gear Box

In this type of gearbox, all the gears of the main shaft are in constant mesh with the corresponding gears of the countershaft (layshaft). As the figure shows sliding two dog clutches are provided on the main shaft. The one sliding dog clutch is placed in between the clutch gear and the second gear, and the other is placed in between the first gear and reverse gear. All gears are free on the splined main shaft.

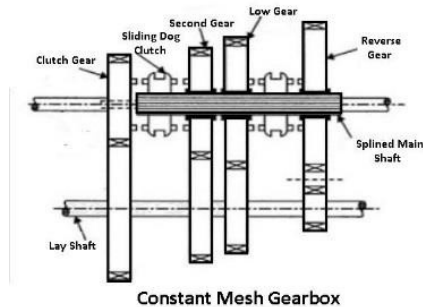


Constant Mesh Gearbox

Synchromesh Gear Box

The modern cars use helical gears and synchromesh devices in the gearboxes, that synchronize the rotation of gears that are about to mesh. This eliminates clashing of the gears and makes gear shifting easier.

The synchromesh gearbox is similar to the constant mesh gearbox. The synchromesh gearbox is provided with a synchromesh device by which the two gears to be engaged are first taken into frictional contact which adjusts their speed after which they are engaged easily.



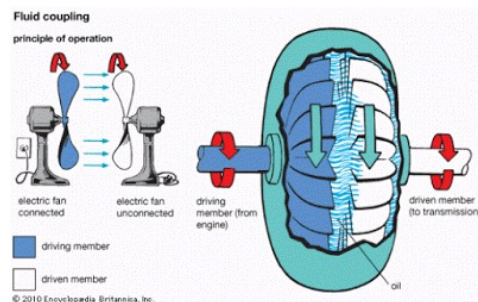
Torque Converter Working, Principle, Main Parts and Application

A **torque converter** is a type of fluid coupling which is used to transfer rotating power from the engine of a vehicle to the transmission. It takes place of mechanical clutch in an automatic transmission. The main function of it is to allow the load to be isolated from the main power source. It sits in between the engine and transmission. It has the same function as the clutch in manual transmission. As the clutch separates the engine from the load when it stops, in the same way it also isolates the engine from load and keep engine running when vehicle stops. Its main functions are:

It transfers the power from engine to the transmission input shaft. It drives the front pump of the transmission. It isolates the engine from the load when the vehicle is stationary. It multiplies the torque of the engine and transmits it to the transmission. It almost doubles the output torque.

Working Principle

For understanding the working principle of torque converter, let's take two fans. One fan is connected to the power source and other is not connected with power source. When first fan connected to the power source starts moving, the air from it flows to the second fan which is stationary. The air from the first fan strikes on the blades of the second fan and it also starts rotating almost at the same speed to the first one. When the second fan is stopped, it does not stop the first one. The first fan keeps rotating



Application

- The torque converter is used in the vehicle that is equipped with the automatic transmission. It is also used in industrial power transmission such as conveyer drives, winches, drilling rigs, almost all modern forklifts, construction equipment, and railway locomotives.
- It is used in marine propulsion systems.