In this article, we will study Definition, Construction, Working Principle, Functions, Advantages, Disadvantages, and Application of Clutches.

Notes: At the end of the article you can easily download whole document in PDF format.

Clutch is a device used in the transmission system for eg. in vehicles to engage and disengage the engine shaft according to our needs.

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Clutch Definition:
A clutch is a mechanical device that engages and disengages the power transmission means shaft especially from the driving shaft to driven shaft. When we have to change the gear in the transmission system then for that time we have to use the clutch.

- When the clutch is engaged the power will flow from the engine to the wheels through the transmission system and the vehicle will move.
- When the clutch is disengaged, the power is not transmitted to the wheels and the vehicles stop while the engine is still running.
- The clutch is kept engaged when the vehicle is moving.
- The clutch also helps to take the gradual load so that there will be no impact. When the clutch is properly operated it will prevent jerky motion or jerks on the vehicle.
- The clutch is disengaged when we want to start the engine.

Clutches are useful in devices with two rotating shafts one will act as driver and the other is driven shaft. One of the shafts is typically driven a motor or pulley and the other shaft is driving another device.

For example, in a drill one shaft is driven by a motor and the other driving a drill chuck. The clutch connects the two shaft so that they can either be locked together and rotate at the same speed and also at different speeds according to our needs.

_In a car, you need a clutch because the engine rotates all the time and the car wheels/tires don’t. If we want to stop the car without affecting the engine the wheel needs to be disconnected from the engine for that the clutch allows us to smoothly engage a rotating engine to a nonspinning of the engine by controlling the slipping between them. there should not be any slipping otherwise there will be power loss. Friction plays an important role in the principle of the clutch._
Clutch Construction or Main Parts:
Clutch consists of following Main Parts:

- Flywheel
- Friction Disc
- Pressure Plate
- Spring
- Release levers
- Clutch release bearing
- Clutch Linkage

**FIG: MULTI PLATE CLUTCH**
Following Main Parts of Multi Plate Clutch
Flywheel:
The flywheel is used to store energy when there is excess energy and give back to the system when we required it. The Flywheel mounted on the crankshaft keeps on running as long as the engine keeps running.

The Flywheel contains friction surface also known as friction disc which is bolted to the outer side of Flywheel.

Friction discs:
Single or multiple discs lined with friction material having a high coefficient of friction are Mounted on the driven shaft.

Friction provides the necessary ability to change the direction of driving and driven shaft.
they also consist of metal plates bonded

Pressure Plate:
The purposes that it will act as a link between engine and gearbox mainly it will transmit the torque obtained from the engine to the gearbox. Another friction disc is bolted to pressure plates. the pressure plate is mounted on the spline hub.
Spring and Release levers:
The spring used are diaphragm springs which move friction disc to a fro. the operation of spring is obtained with the help of levers.

The release lever will light the force which is held on the spring when the clutch is disengaged.

Clutch Release bearing:
Transmits the movement of the clutch linkage to the pressure plate is usually a ball or roller type bearing and Self-centering to compensate for variations clutch alignment.
Clutch Linkage:
A clutch linkage mechanism uses levers and rods to transfer motion from the Clutch pedal to the Clutch fork when the pedal is pressed, the pushrod will push the bell crank and it reverses the forward movement of the clutch pedal. The bell crank is connected to the release rod.

The release rod transfers the bell crank movement to the clutch fork. It also provides how the adjustment of the clutch takes place.

Clutch Working Principle:
Clutches are used to attach two moving shafts that are moving at different speeds. This enables us to disengage the power of the engine and drive off smoothly with the engine.

When we press the clutch pedal the friction disc which is movable slides on the shaft. This is the disengaged condition in which the friction doesn’t touch the Flywheel which means that the Axial load applied by the pressure plate is 0 and hence power/torque transmission is 0.
The engine is still running but the vehicle will not move.

When the clutch 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 an 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 disengaged.

When we completely Release the clutch pedal the movable friction disc slides forward on that shaft.

This is an Engaged condition in which the disc has completely touched the Flywheel that means that the Axial load applied by the pressure plate is maximum and the spring force and hence power transmitted is max.

The clutch plate is gripped between the pressure plate. Due to the friction between the Flywheel clutch plate and pressure plate, the clutch plate revolves with the Flywheel.

As the clutch plate revolves, the clutch shaft also revolves. the clutch shaft is connected to the transmission .thus the engine power is transmitted to the crankshaft to the clutch shaft.
One friction plate is bolted to Flywheel & the other is movable over the crankshaft.

The amount of torque delivery depends on how much the Axial load is applied on the friction.

The movable disc is splined on crankshaft & is able to move back and forth with help of Clutch pedal.

More the Axial load more the power transmission less the Axial load lesser power transmission which also means.

If the load is zero, power transmitted will be zero and when the load will be max spring force power transmitted will be maximum.

- The load is applied by the pressure plate since the pressure plates are connected to springs which can multiple disc spring or a diaphragm spring.
- The main reason why we need a clutch is that it permits the engine to run even when the vehicle is not moving.
- Clutches have the ability to enable the driver and to change gears. This is important since
changing gears without disengaging the clutch would apply sudden loads & shocks on gears which may ultimately result in failure of gears & transmission systems.

- To obtain smoothness while gaining or losing speed & to avoid engine shutdown.
- The clutch plays a very important role to allow you to shift gears while moving in cars.

Now while changing gears it is very necessary to break the transmission from the Flywheel to the gearbox for the proper shift of the gears to the gears to take place.

If this isn’t done the gears will be damaged and will need to be replaced by a new set of gearboxes. The role of the clutch takes place.

When we press the clutch it will get Engaged then it means the clutch breaks the contact with the Flywheel and hence, no drive obtained from the engine. The gearbox can easily change gears with the help of synchronizers. Once the shift of gears is complete, we release the clutch lever.

At this point, the clutch gets disengaged i.e., the clutch plate gets in contact with the Flywheel again. The drive is transmitted again to the gearbox.

When we pressed clutch padel then the pressure plate is pressed which is bolted with Flywheel we applied force to clutch cover inward then the clutch disc will move upward and then the clutch disc is separated from between Flywheel and clutch disc.

A clutch as a verb is to hold or grasp something firmly it is a device that grasps one shaft to another shaft.

Internal combustion engines do not start from 0 rpm with some value of torque they need to run at least at an idle speed and will create more torque as the speed increases from idling when the load is at rest, and the engine is idling or faster, the clutch enables the spinning shaft to gradually transfer speed to the stationary shaft.

A Clutch transmits power from one element to another and it is a mechanical device. In an
automobile, the engine is the prime mover.

A Flywheel is connected to the engine the clutch is connected to the transmission. driver press the clutch pedal, then the clutch plate is pressing the Flywheel.

Flywheel motion is transmitted to the transmission system. When the driver presses the clutch pedal the clutch is disengaged from the Flywheel so even is the engine gives rotation to Flywheel and it will not be transmitted to the transmission system that is why the driver presses the clutch pedal and changes the gear.

Video Link: Working of Clutch By Learn Engineering

Clutch Function:
The main function of clutches are:
• It transmits power from the engine to the driving mechanism.
• Smooth transmission.
• Silent operation by reducing vibration due to driver operation.
• Protect drive train from engine jerks and vibrations
• The speed difference between an engine and a driven shaft by slip action will be removed
• The factor which must be taken into consideration in deciding what type of clutch is to be used are:

  Torque (normal force, type of friction, surface, and a number of the surface),
  Rotation speed (light, compact, fast, slow, etc),
  Available space (diameter, height),
  Frequency of operation (small travel, large travel, type of load, a simple engaging mechanism, large cooling area).
Clutch Application:
The simple application of clutches connect and disconnect two rotating shafts, one shaft is typically attached to a motor while the other shaft provides output power for example automobiles work while typically the motions involved are rotary but there can be linear clutches are also possible.

A Clutch is used to engage or disengage the engine in the gearbox. When the clutch is in an Engaged position, the engine power or rotary motion of engine crankshaft is transmitted to the gearbox and then to wheels.

When the clutch is disengaged the engine power doesn’t reach to gearbox although the engine is running Clutch is also used to allow shifting or changing of gears when the vehicle is running for shifting gears clutch is first disengaged then gears are shifted and then clutch is Engaged clutch has to be disengaged to stop the vehicle and also at the time when we want to idle the engine or in an easy language neutral.
Clutch Advantages:
The following advantages of clutches are:

- The Engagement is smooth, No heat generation unless the operation requires frequent starts and stops.
- Once engaged there is no slip.
- In some cases, it works as safety devices because it gets disengage when torque crosses the safety limits.
- Easy to operate.
- They are capable of transmitting partial power.
- Frequent engagement and disengagement are possible.

Clutch Disadvantages:
The following disadvantages of clutches are:
• The slip of the clutch can cause wear and tear.

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- **Single Plate Clutch**
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I hope you liked the articles of clutch. Do share with your friend and Family. Till then Thank you for reading. We will meet in another article.