

UNIT 2

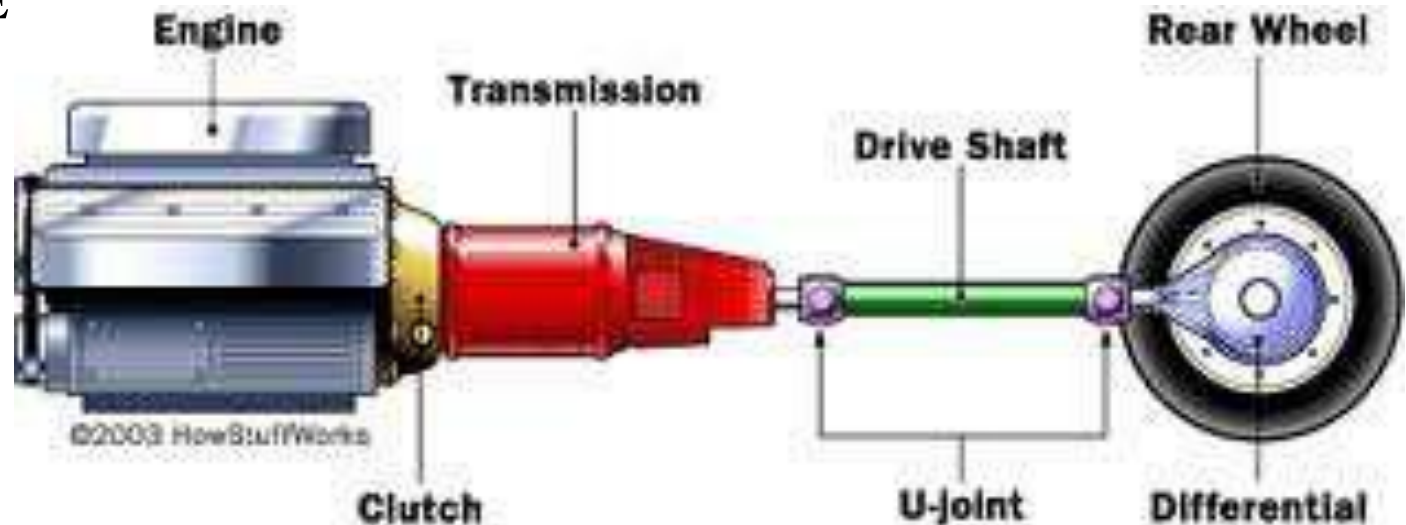
TRANSMISSION SYSTEM

➤ ***Transmission system :-***

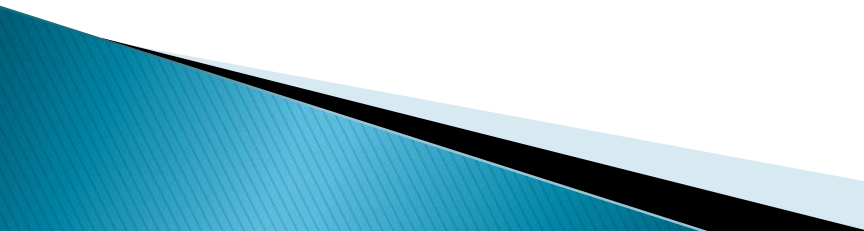
The mechanism that transmits the power from the engine crankshaft to the rear wheels.

➤ ***INTRODUCTION TO TRANSMISSION SYSTEM :-***

1. TYPES OF TRANSMISSION SYSTEM
2. CLUTCH
3. GEAR BOX
4. PROPELLER SHAFT
5. UNIVERSAL JOINTS
6. Final drive and differential
7. REAR AXLE



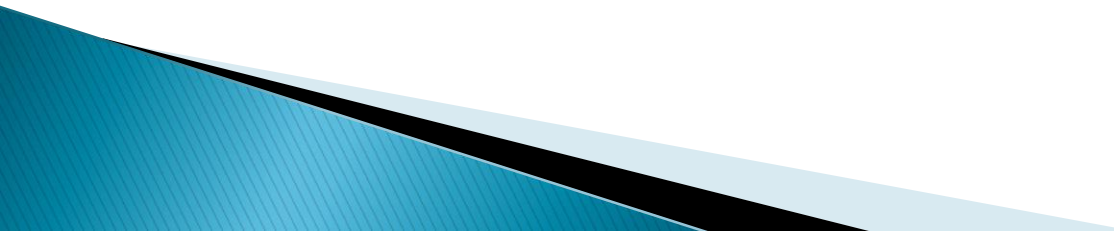
❖ *Requirements Of Transmission System :-*

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

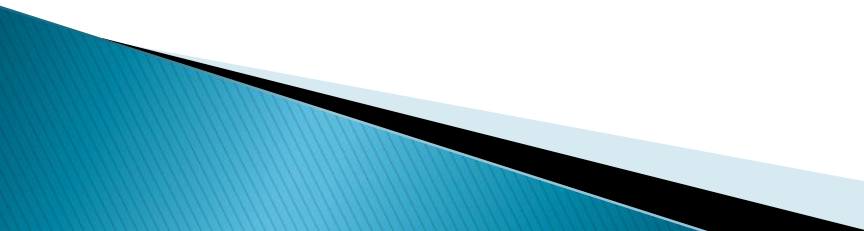
Clutches

- **Clutch** is a mechanism which enables the rotary motion of one shaft to be transmitted, when desired to a second shaft the axis of which is coincident.

- **Functions of Clutches:-**

1. To permit engagement or disengagement of a gear when the vehicle is stationary and the engine is running.
 2. To transmit the engine power to the road wheels smoothly without shock to the transmission system while the vehicle in motion.
 3. To permit the engaging of gears when the vehicle is in motion without damaging the gear wheels.
- 

• Requirement of Clutch:-

1. **Torque transmission:-** The clutch should be able to transmit the maximum torque of the engine under all conditions.
 2. **Gradual engagement:-** should positively take the drive gradually without the occurrence of sudden jerks.
 3. **Heat dissipation:-** The proper design of clutch should ensure proper ventilation or cooling for adequate dissipation of the heat.
 4. **Dynamic balancing:-** Necessary particularly in high speed clutches.
 5. **Vibration damping:-** To eliminate noise produced in the transmission.
 6. **Size:-** Must be as smallest as possible to occupy minimum amount of space.
 7. **Inertia:-** The clutch rotating parts should have minimum inertia.
 8. **Clutch free pedal play:-** To reduce effective camping load on bearing and wear, clutch free pedal play must be provided in the clutch.
 9. **Ease of operation**
- 

• Classification of Clutches:-

A) Friction Clutch:-

- | | | |
|----------------------------|------------------------|----------------------|
| 1) Cone Clutch | 2) Single Plate Clutch | 3) Multiplate Clutch |
| i) External ii) Internal | | i) Wet ii) Dry |

B) Centrifugally assisted clutch

C) Semi-centrifugally Clutch

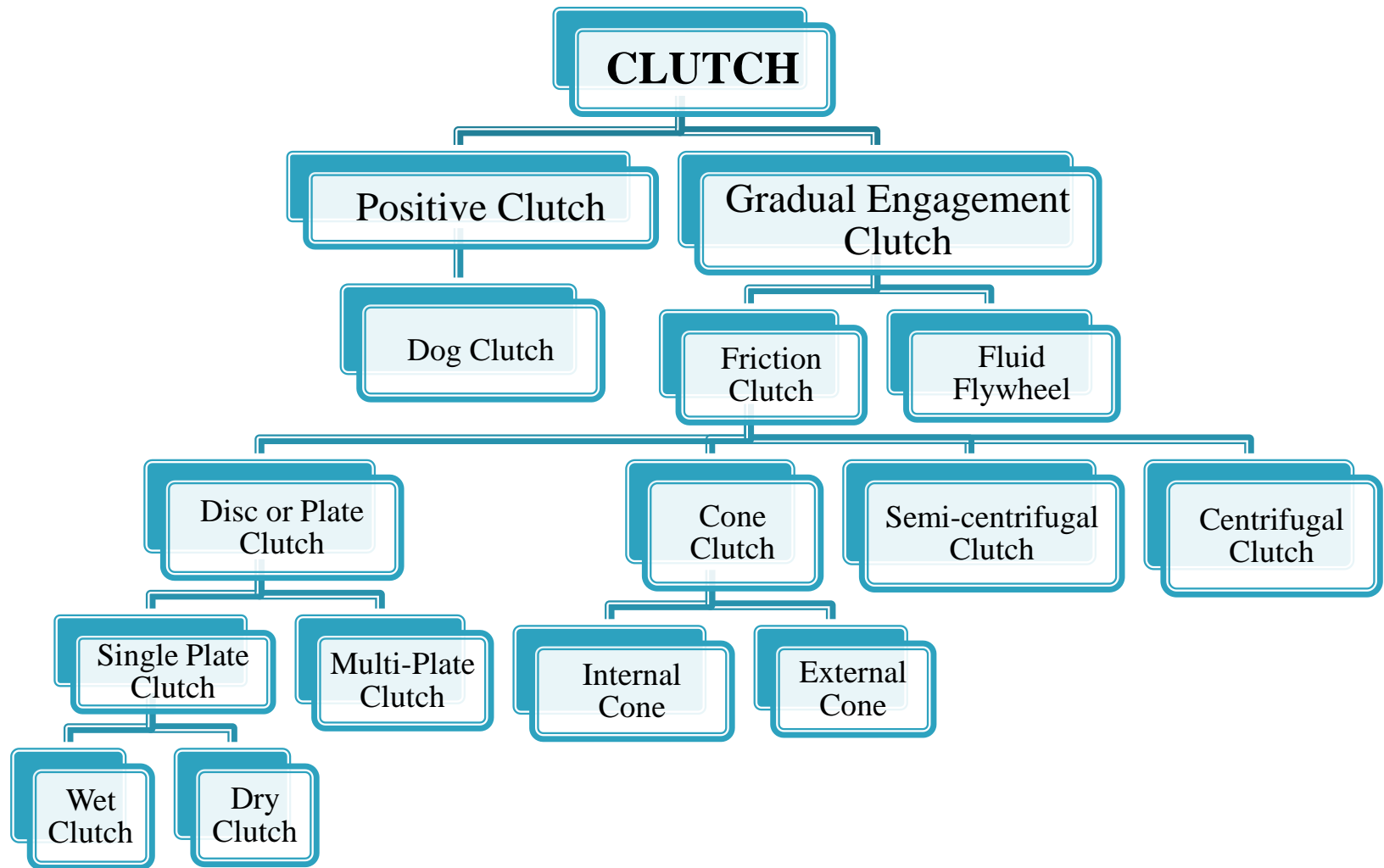
D) Coil pressure spring clutch

E) Diaphragm Clutch or Conical Spring Clutch

- 1) Tapered finger type 2) Crown spring type

F) Positive clutch





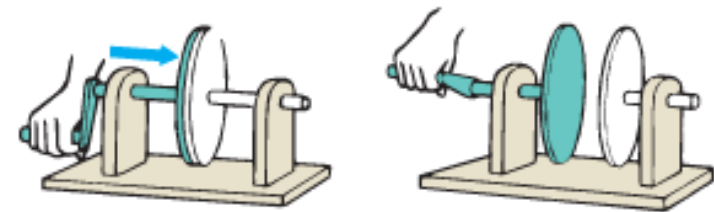
• Classification of Clutches:-

A) Friction Clutch:-

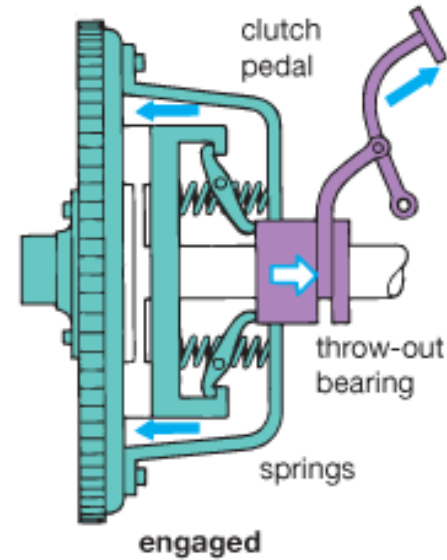
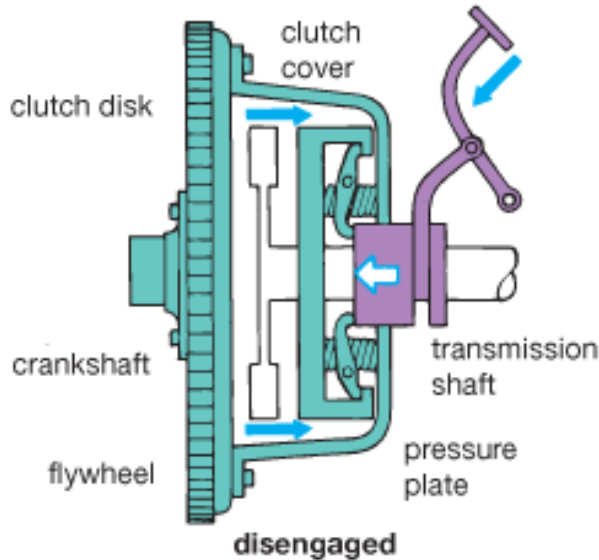
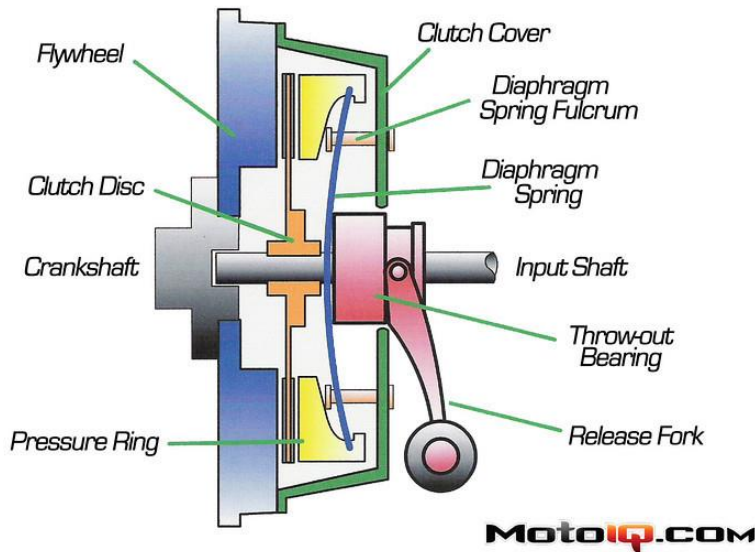
- 1) Cone Clutch 2) Single Plate Clutch 3) Multiplate Clutch
- i) External ii) Internal i) Wet ii) Dry

Friction clutch

principle of operation



Disengaged



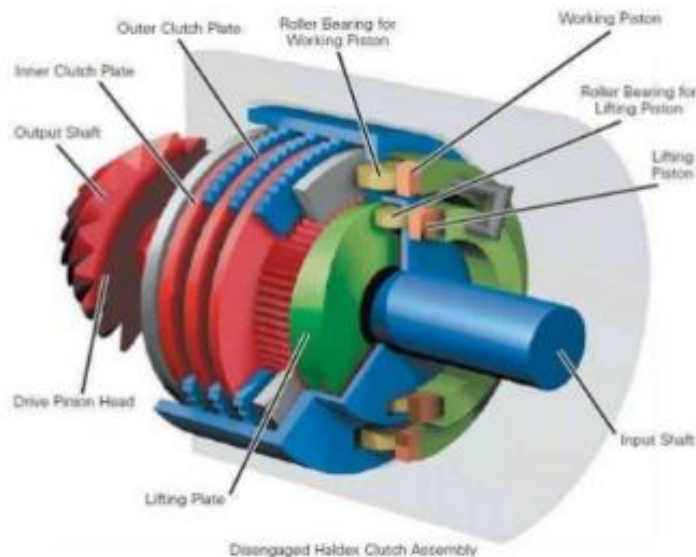
 driving member  driven member

• Classification of Clutches:-

A) Friction Clutch:-

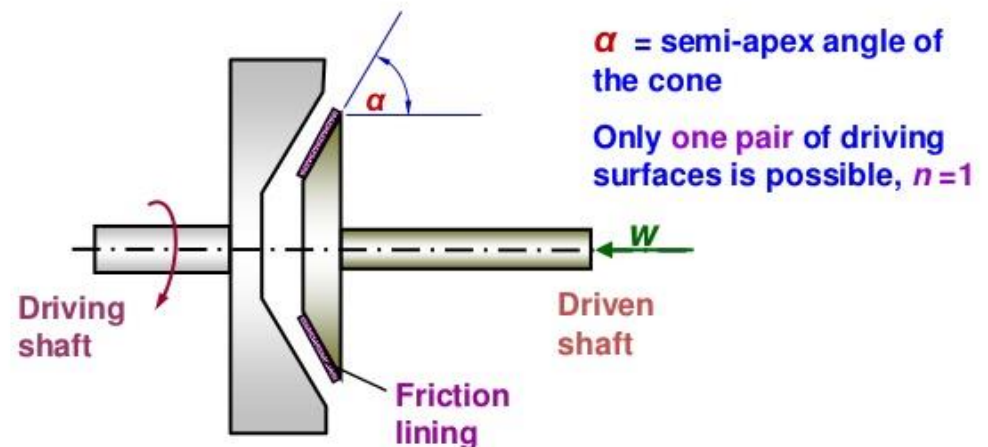
- | | | |
|----------------------------|------------------------|----------------------|
| 1) Cone Clutch | 2) Single Plate Clutch | 3) Multiplate Clutch |
| i) External ii) Internal | | i) Wet ii) Dry |

Multiplate clutch



Cone Clutch

- NOT used in automobiles



$$\text{Maximum torque transmitted (T)} = \mu W r_m \operatorname{cosec} \alpha$$

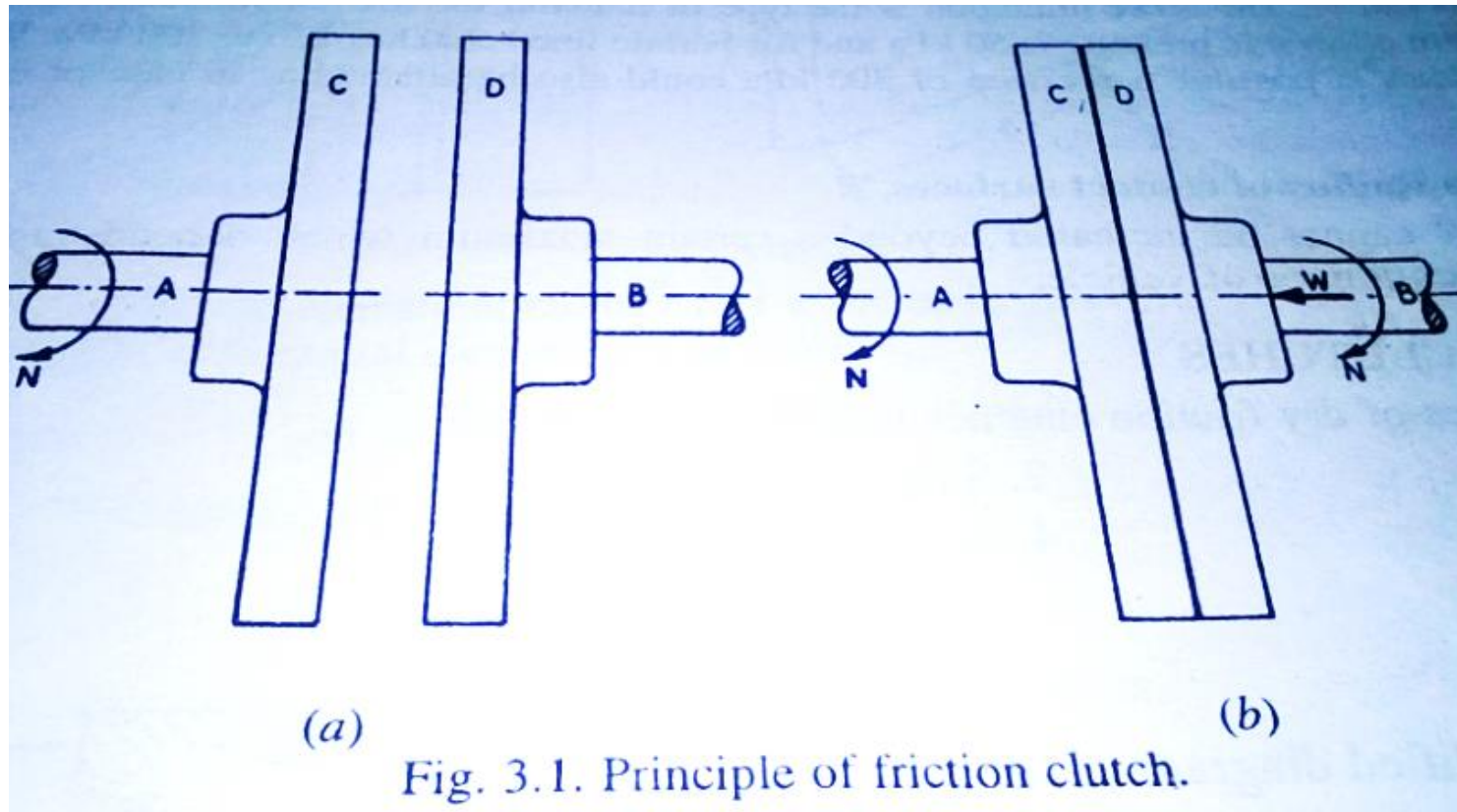
Clutch terms

- Clutch **disengaged** (Clutch pedal pressed)

The clutch is **disengaged** when

- Starting the engine
 - Shifting the gear
 - Stopping the vehicle and
 - Idling the engine
- Clutch **engaged**
 - Clutch pedal is released

Friction Clutches



The speed of shaft D is depends upon friction force present, which in turn, is proportional to the force W applied

- Max speed of D= speed of C

Cone Clutch

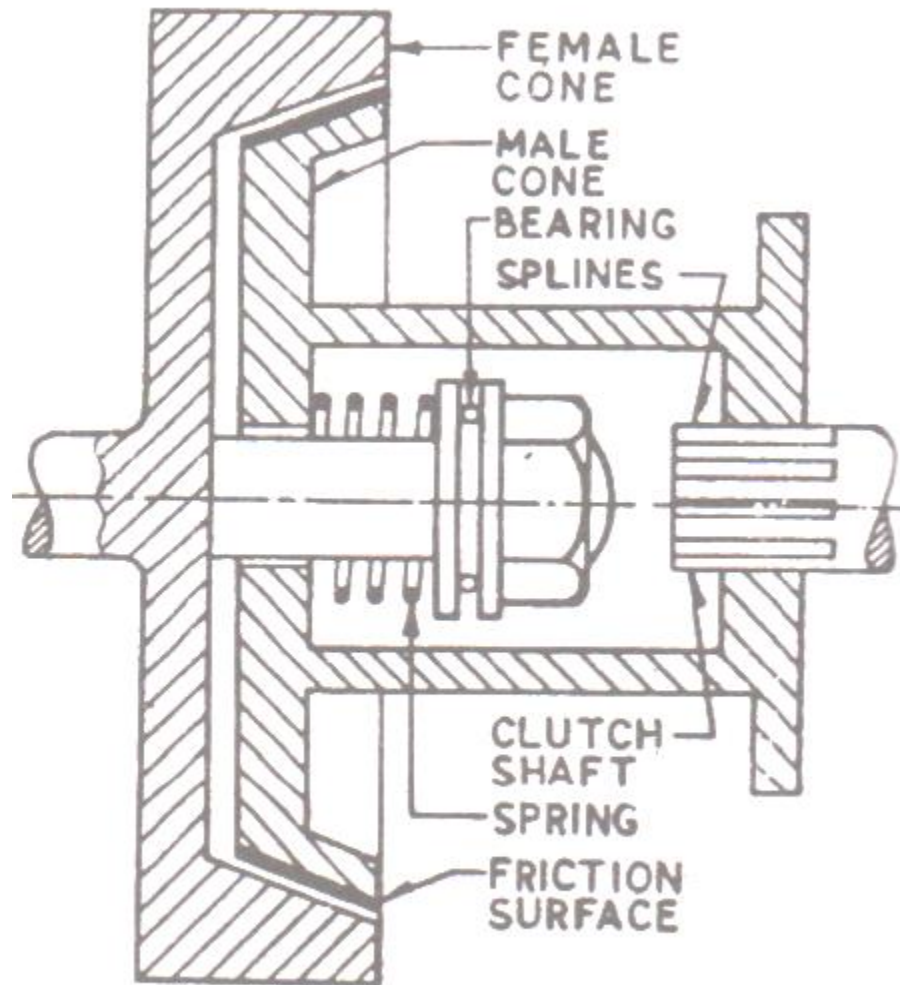


Fig. 3.2. Cone Clutch.

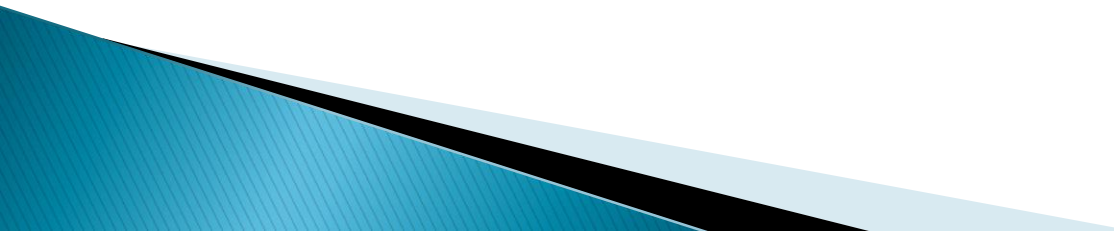
Cone Clutch

It consists of a flywheel and a cone mounted on driving and driven shafts respectively.

The shape of the side of the flywheel facing the cone is as to accommodate the cone readily when the clutch is engaged.

The surfaces of contact are lined with the friction lining (Asbestos, leather etc.).

The cone can be disengaged from flywheel by mechanism which operates in the groove of the cone.

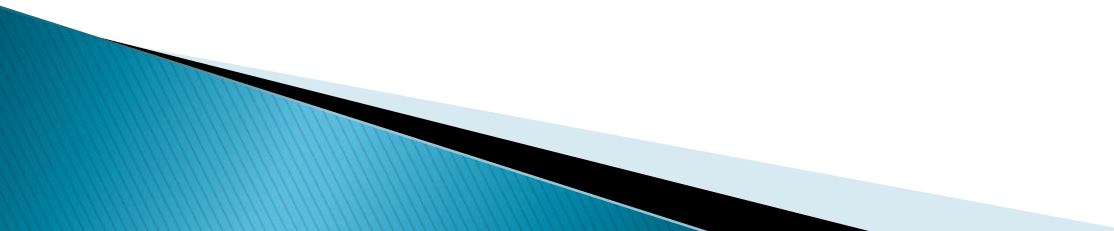


Cone Clutch

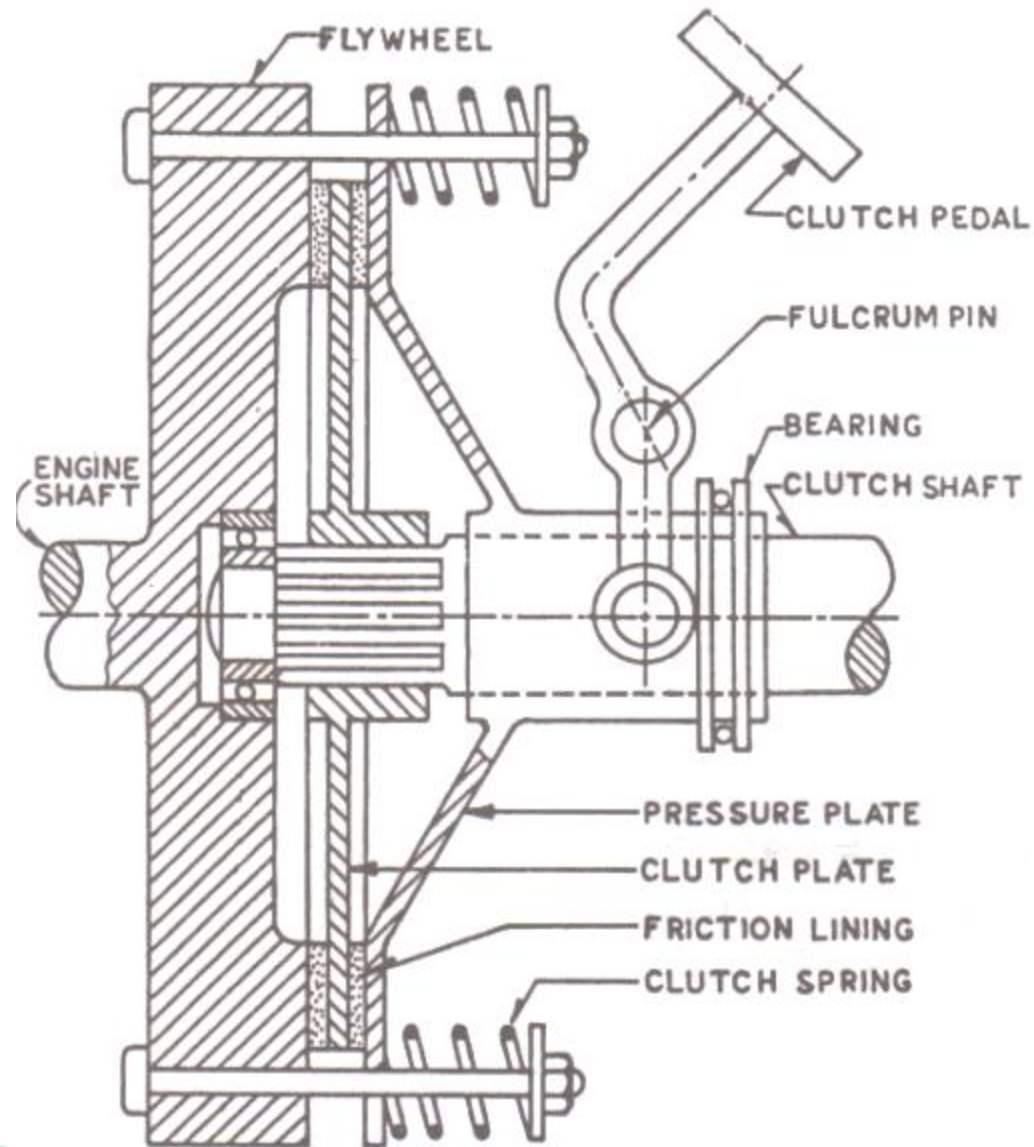
Advantage:

- Normal force acting on the contact surfaces in this case is larger than the axial force as compared to single plate clutch.


Disadvantage:

- If the angle of cone is made smaller than 20 degree, the male cone tends to bind or join the female cone and it becomes difficult to disengage the clutch.
 - A small amount of wear on the cone surface results in a considerable amount of the axial movement of the male cone for which it is difficult to allow.
- 

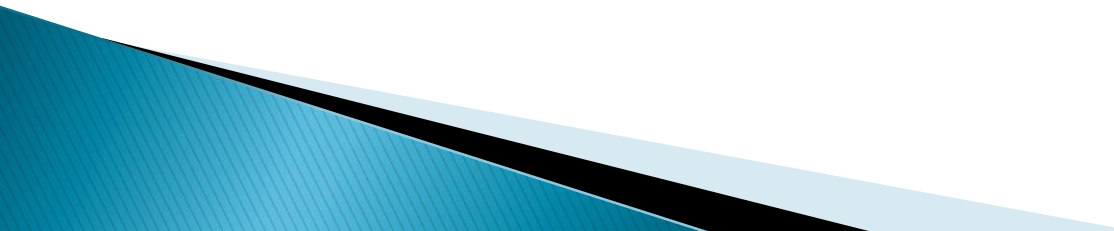
Single Plate Clutch



Single Plate Clutch

- A single plate clutch is commonly used in cars and light vehicles.
 - It has only one clutch plate which is mounted on the splines of the clutch shaft.
 - When clutch is in engaged position, the clutch plate remains gripped between flywheel and friction plate.
 - Friction linings are provided on both sides of clutch plate. On one side clutch plate is in touch with flywheel and other side with pressure plate.
 - Due to friction on both sides clutch plate revolves with engine flywheel.
 - Therefore clutch transmits engine power to clutch shaft and finally through transmission it is to the wheels.
- 

Single Plate Clutch

- When clutch plate is to be disengaged, the clutch pedal is pressed.
 - Because of this pressure plate moves back and clutch plate is disengaged from flywheel.
 - Thus, clutch shaft stops rotating even if engine flywheel is rotating.
 - In this position, power does not reach the wheels and vehicle also stops rotating.
- 

Single Plate Clutch

Advantage:

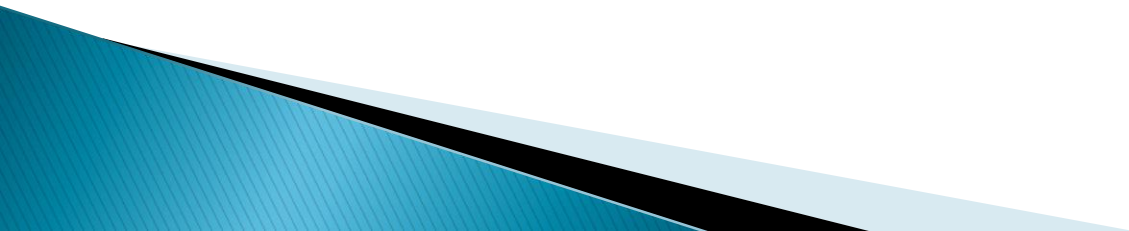
- Gear changing is easier than the cone clutch because the pedal movement is less.
- It is more reliable because it does not suffer from disadvantage of binding of cone.

Disadvantage:

- The springs have to be more stiff hence greater force required to be applied by the driver while disengaging.

Application:

- This clutch is used in four wheelers like **Truck, Jeep, Fiat-1100, Ashok Leyland, Tata sierra** etc.



Multi Plate Clutch

- Multi plate clutch is used when
 - large torque is to be transmitted e.g. Heavy vehicles and machine tools
 - compact construction is required e.g. scooters and motor cycles

Multi-Plate Clutch

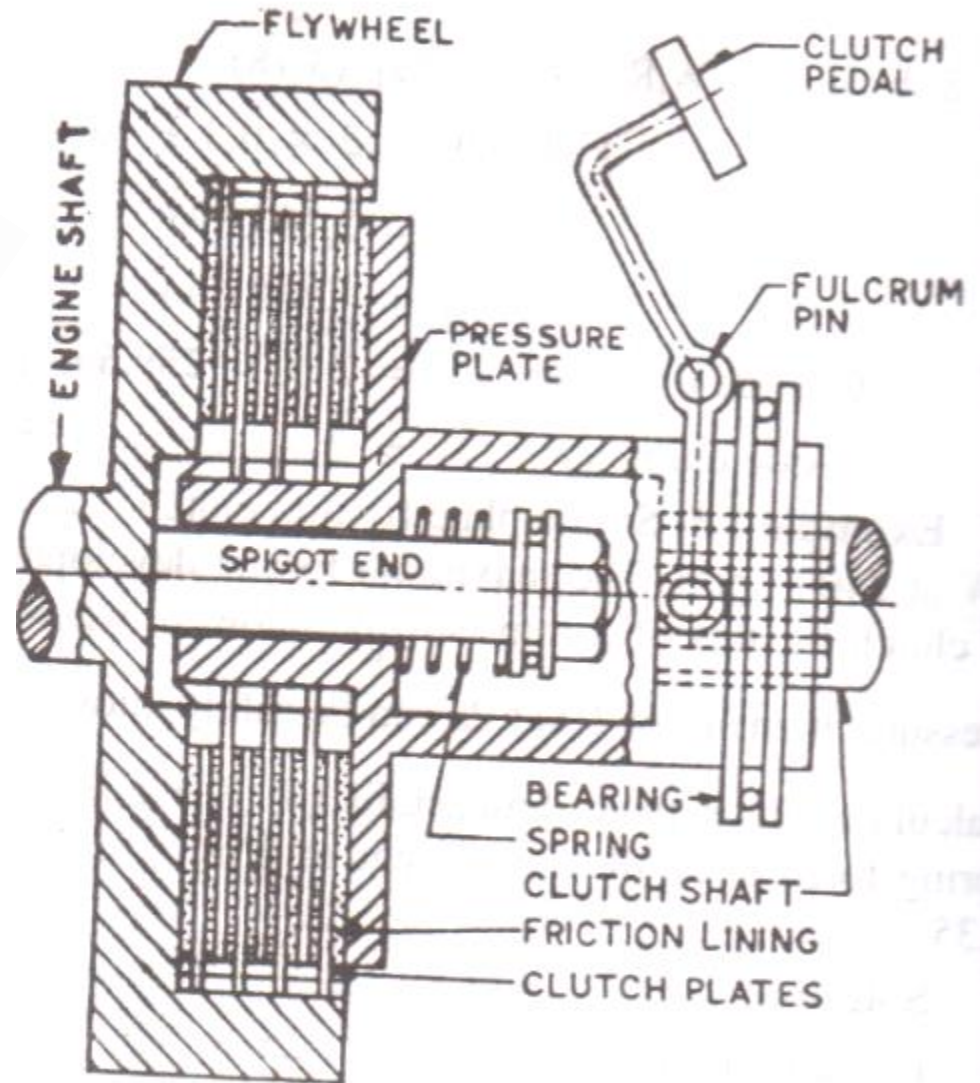
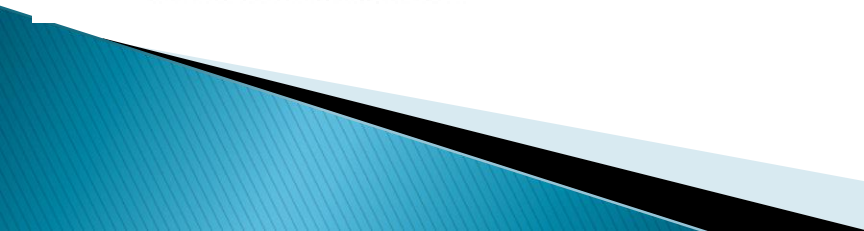


Fig. 3.21. Multiplate Clutch.

Multi-Plate Clutch

- When a great amount of torque is to be transmitted, instead of single plate a number of friction plates are employed. This increases the number of mating friction surfaces, hence it is called multiplate clutch.
 - These clutches are used in heavy commercial vehicles, racing cars and motor cycles for transmitting high torque.
 - In this friction rings are splined on their outer circumferences to mate with corresponding splines on the bore of the housing and are free to slide on the splines. The friction material therefore rotates with the housing and engine shafts.
 - Discs or plates are free to slide on the splines on the driven shaft and rotate with it.
 - The disc on the right can be moved to the right against a powerful spring which, when the actuating force is removed, presses the disc into contact with friction rings.
 - Torque is therefore transmitted between the engine shaft and the driven shaft.
- 

Multi-Plate Clutch

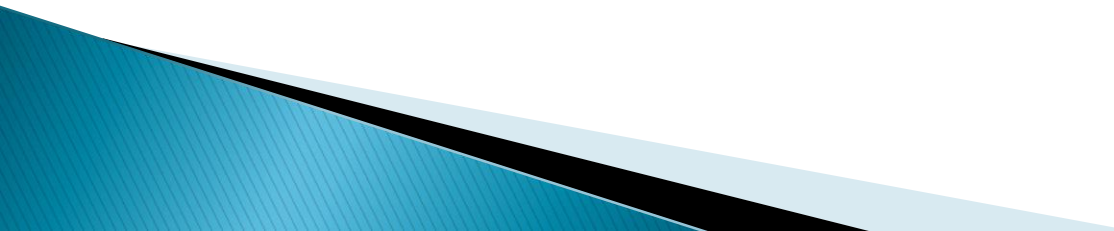
Advantage:

- Increase the amount of torque to be transmitted.
- Decrease the pedal effort to operate the clutch.
- Decrease the weight of clutch.
- Decrease the MI of the clutch.
- Increase in better acceleration.

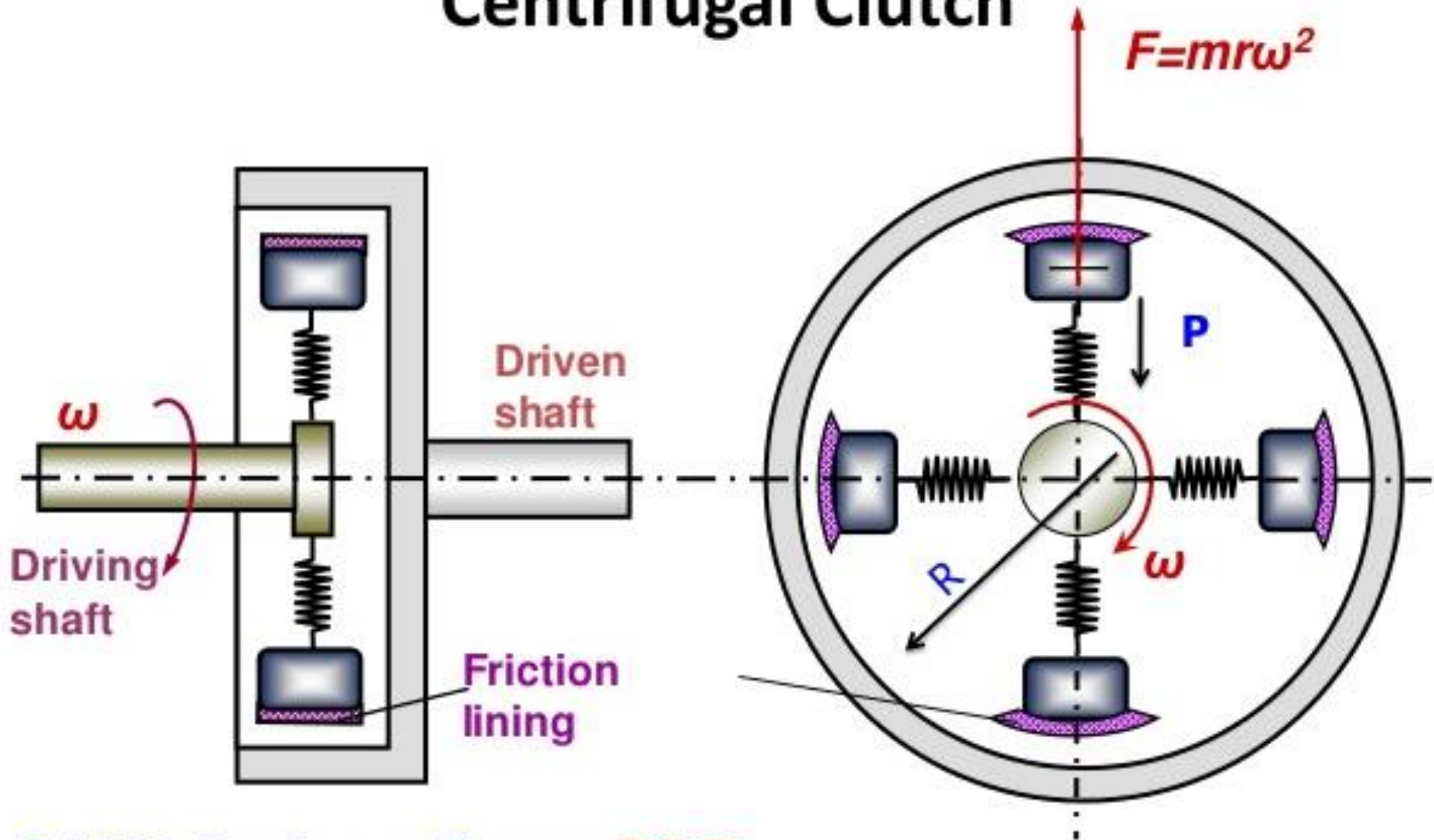
Disadvantage:

- It is too expensive.

Application:

- Sport car, Motor cycle.
 - Heavy vehicle.
 - Locomotives.
- 

Centrifugal Clutch



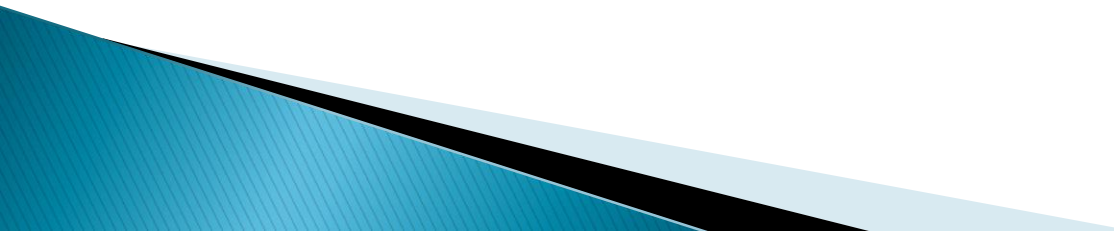
Total friction torque (T) = $n\mu R(F-P)$

Centrifugal Clutch

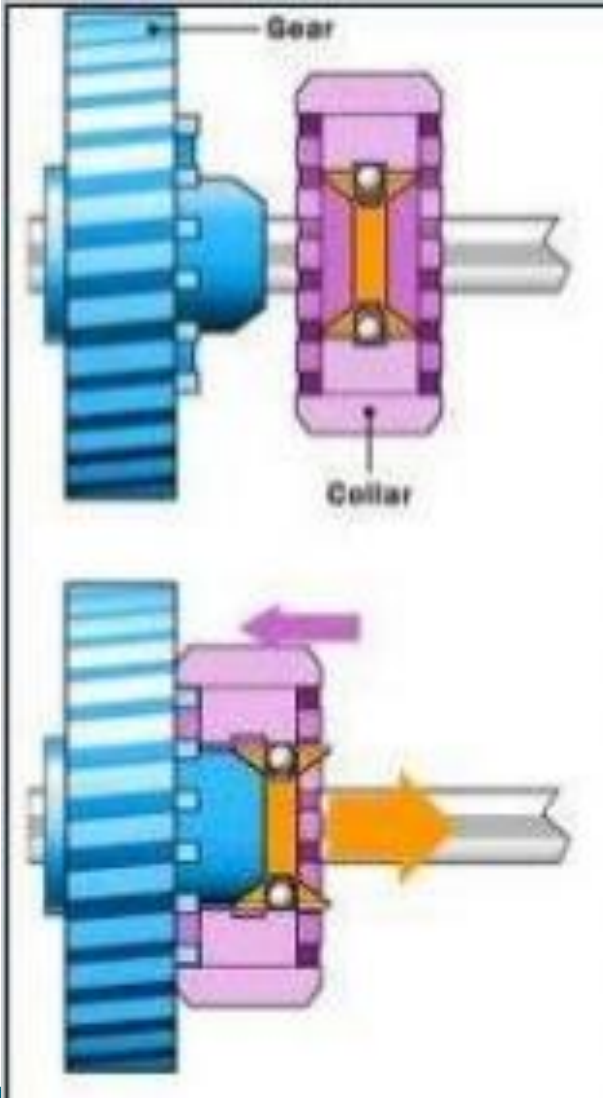
- The faster the RPM, more is the force on clutch disk



Centrifugal Clutch

- ✓ A Dog Clutch is a type of clutch that couples two rotating shafts or other rotating components not by friction but by interference.
 - ✓ The two parts of the clutch are designed such that one will push the other, causing both to rotate at the same speed and will never slip.
 - ✓ Utilized in automobile manual transmission system.
- 

Dog Clutch



- ✓ A Dog Clutch is a type of clutch that couples two rotating shafts or other rotating components not by friction but by interference.
- ✓ The two parts of the clutch are designed such that one will push the other, causing both to rotate at the same speed and will never slip.
- ✓ Utilized in automobile manual transmission system.

Materials used to make Clutch

- Organic materials
 - Kevlar materials
 - Semi metallic materials
 - Sintered metal
 - Carbon materials
- 