* Clutches :-

Clutch is a device which is used to engage and disengage the driven shaft from driving shaft. ~~withou~~ during the motion to change the gears meshing without stopping the driving shaft.

Its operation is based on the friction between two surfaces.

Clutches may be classified as follows -

1. Single plate clutch or disc clutch.
2. Multi-plate disc clutch.
3. Conical clutch.
4. Centrifugal clutch.

1 Single plate Clutch :-

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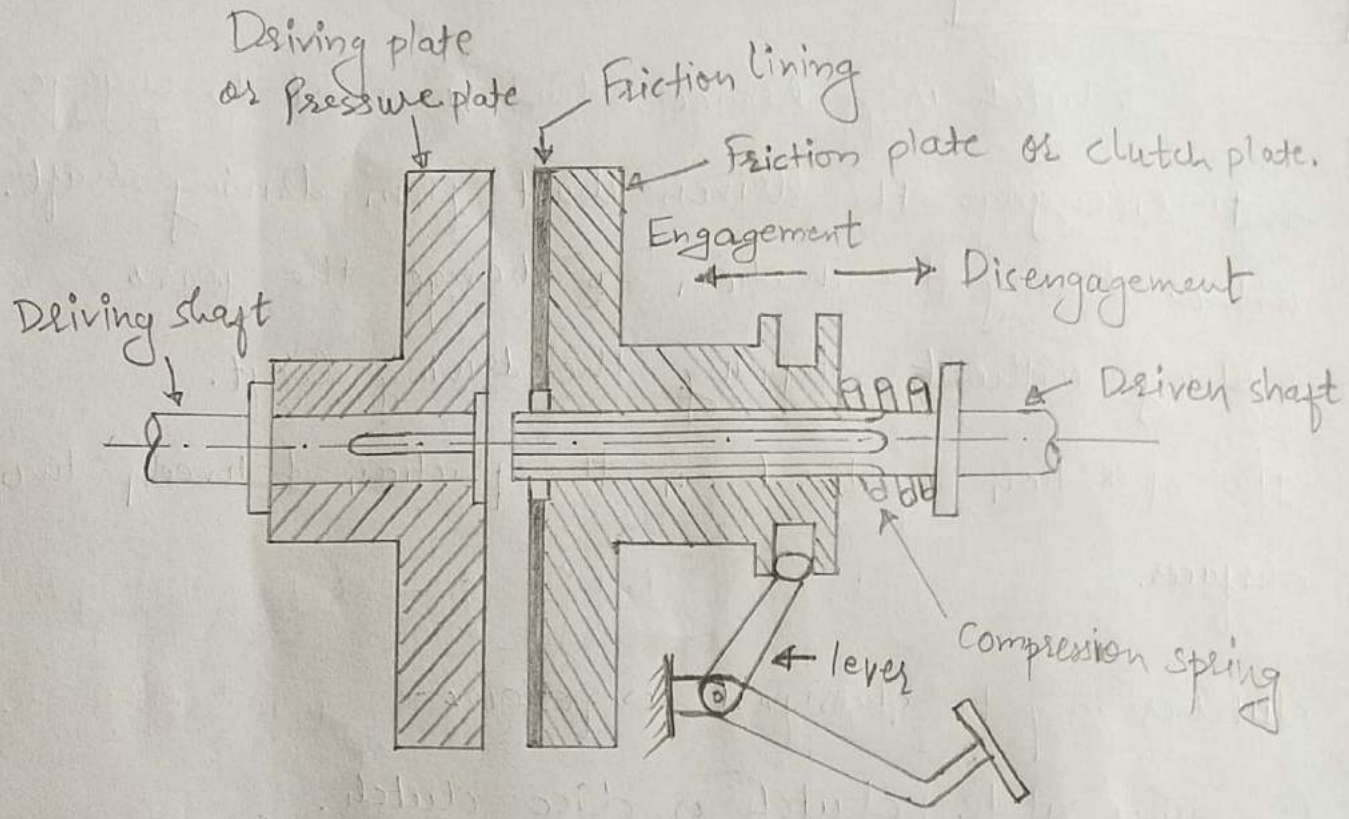

Fig. Single plate clutch.

> It operates on the principle of friction.

> When two surfaces are brought together and held against each other, due to friction between them, they can use to transmit power.
If one surface is rotated then other also rotates.

> In single plate clutch one surface is connected to engine and other to the transmission system.
It consist of (a) Driving member (b) Driven member (c) Operating member.

> The driving member has a flywheel which is mounted on the engine crankshaft.

> A disc is bolted to ~~flywheel~~ flywheel which is known as pressure plate.

> The driven member is a disc called clutch plate. This plate can slide freely to and fro on the clutch shaft.

> The operating member consists of a pedal or lever which can be pressed to disengage the driving and driven plate.

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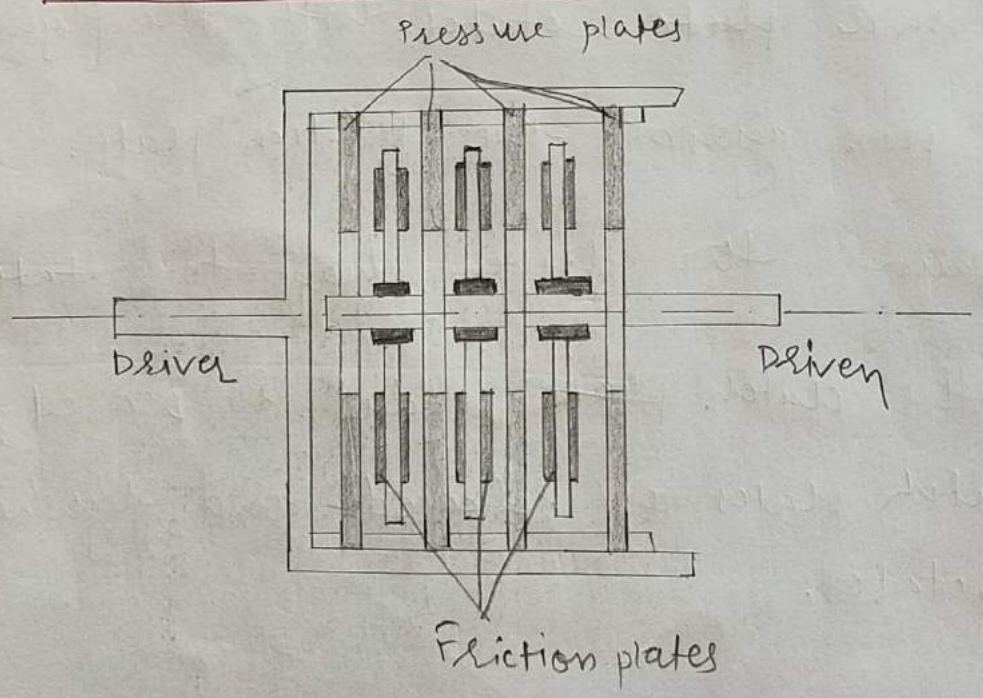
* **Multiplate clutch:-**



> A multiplate clutch consists of a number of clutch plates, instead of only one clutch plate

as in the case of single clutch plate.

> The increased number of friction surfaces increases the capacity of the clutch to transmit torque.

> The plates are alternately fitted to the engine shaft and gear box shaft. They are firmly pressed by springs.

> The working of multiplate clutch is the same as a single plate clutch by operating the clutch pedal.

> The pressure plate rotates with the flywheel and it press against the friction plate.

> This causes the driven shaft to rotate.

> When the clutch ~~plate~~ pedal is pressed, the clutch plates are released and flywheel still rotates.

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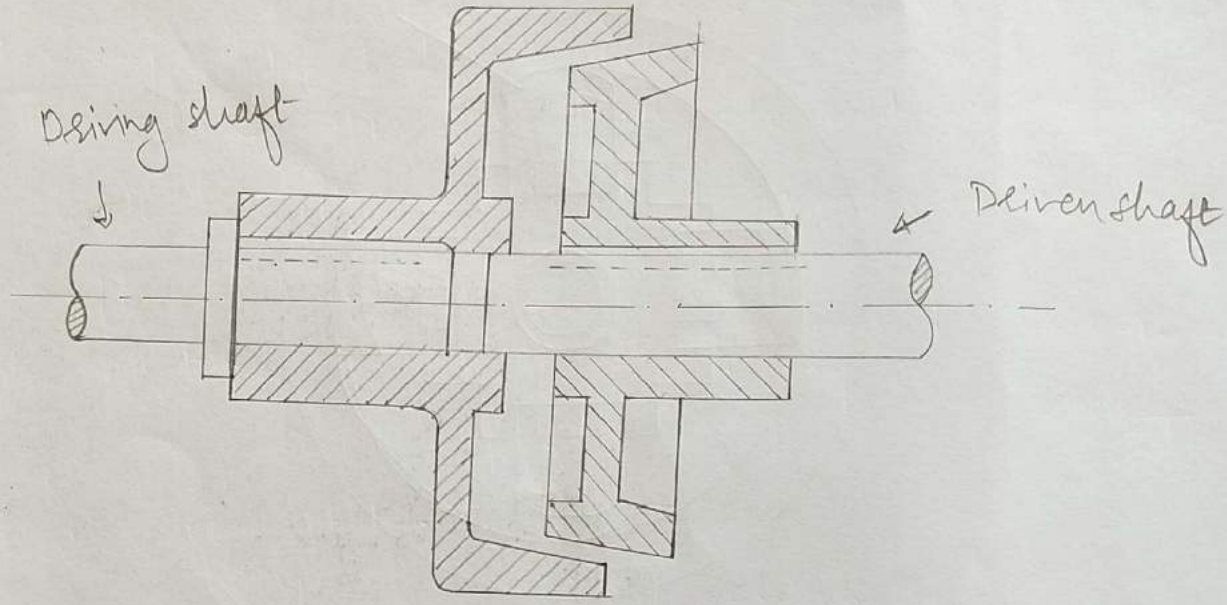
* Cone clutch :-



> A cone clutch serves the same purpose as a disc or plate clutch.

> Instead of mating two spinning disks, the clutch uses two conical surfaces to transmit torque by friction.

> The cone clutch transfers a higher torque than plate or disc clutches of same size due to increased surface area of contact.

> They are used in racing or extreme off-road vehicles.

* Centrifugal clutch :-

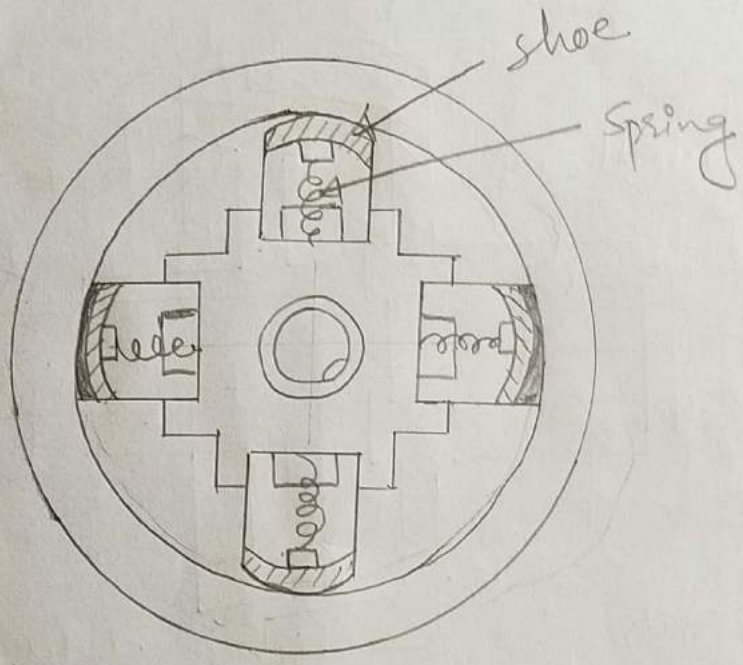


Fig. Centrifugal clutch.

- Centrifugal clutch works on the principle of centrifugal force.
- When driving shaft rotates at high speed, the shoes move radially outward.
- The outer surfaces of the shoes are covered with friction material which engages the pulley. Thus pulley rotates with driving shaft.
- This type of clutch is generally used in motor pulley.
- The spring force resists the centrifugal force, thus prevents the engagement at lower speed.

* Brakes :-

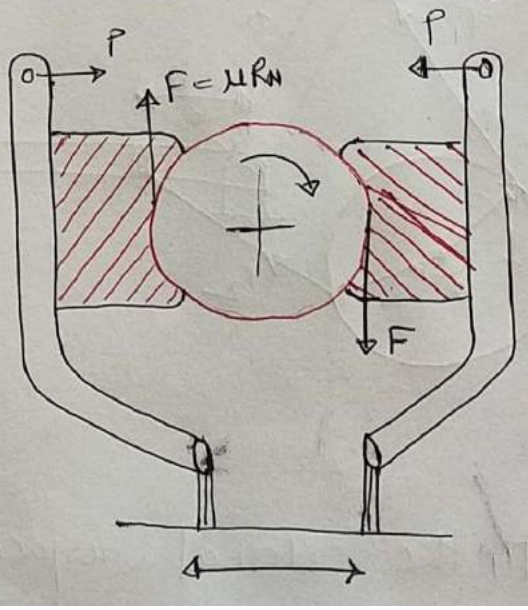
Brake is a device which is used to bring the body into rest while it is in motion.

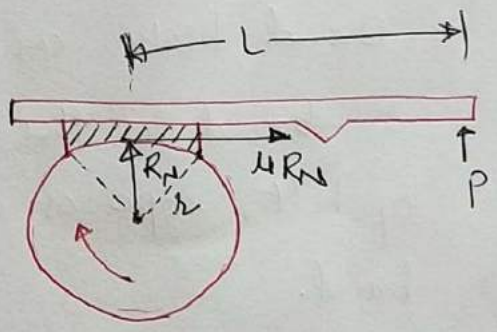
There are four types of brakes –

1. Block brake or shoe brake
2. Band brake.
3. Band and block brake.
4. Internal expanding shoe brake.

* Block or shoe brake :-

- In this brake, a shoe or block is pressed against the drum.
- The force can be increased by using a lever as shown in figure.





r = Radius of drum

μ = Coefficient of friction.

R_N = Normal reaction ~~is~~ on the shoes

P = Force applied on lever.

F = Frictional force.

> Due to pressure applied by single shoe, there is a side thrust on the shaft of drum.

> To counter balance the side thrust, two shoes may be used opposite to each other.

> In this case, braking torque becomes double.

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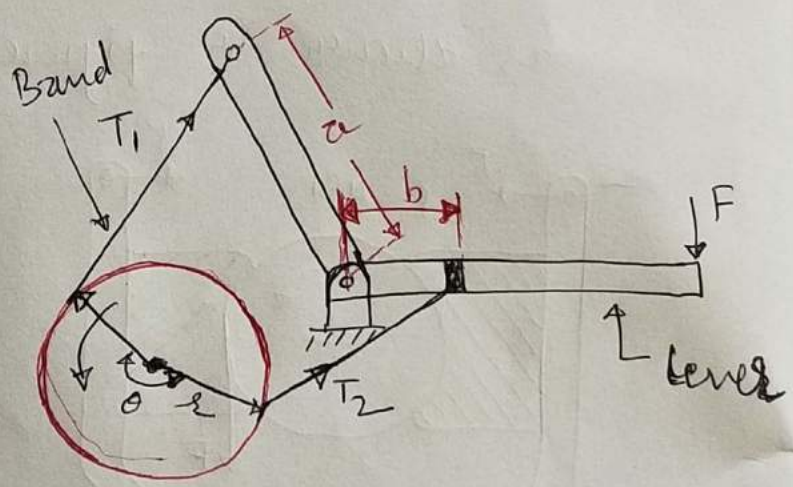
* Band brake :-



> Band brake consists of a band in the form of belt, rope or steel band.

> When force is applied at the free end of lever, the band is pressed against the external surface of drum

Braking torque,

$$T = (T_1 - T_2) \times r$$

$$\& \quad \frac{T_1}{T_2} = e^{\mu\theta}$$

Where, T_1 is tension in tight side.
T_2 is tension in slack side.

> The effectiveness of braking force varies according to the direction of rotation of drum, ratio of length a and b, and the direction of force applied at the end of lever.

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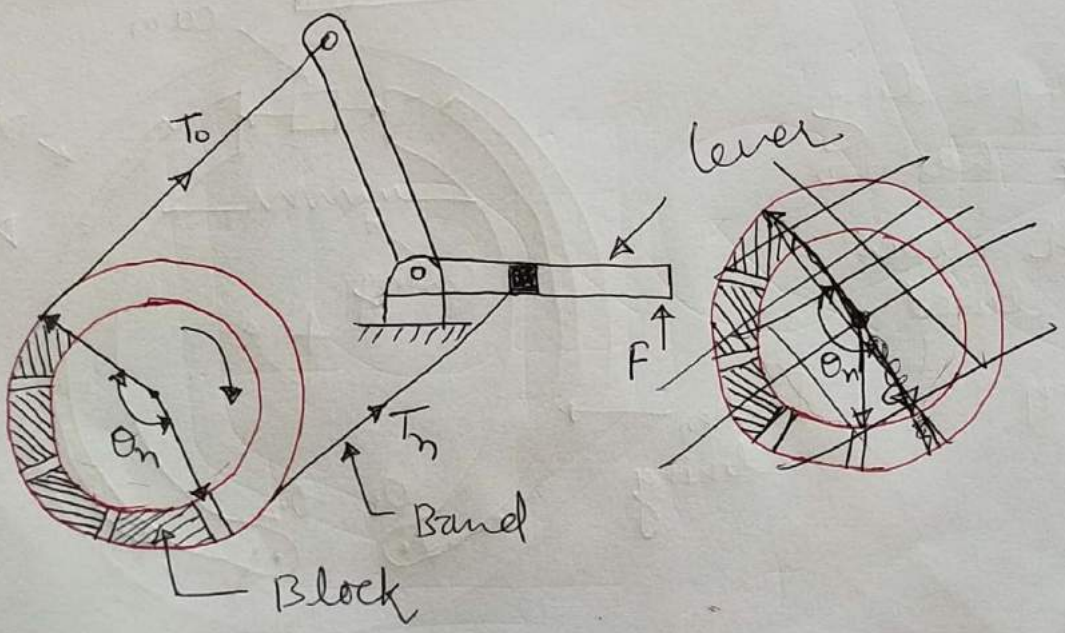
* **Band and Block Brake :-**



> This brake is combination of band and block brake.

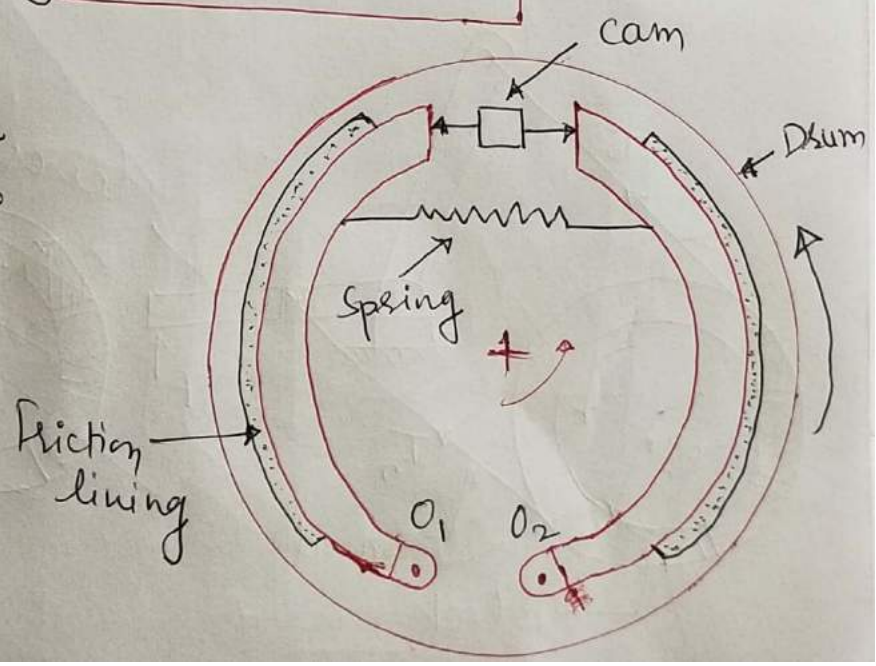
> A number of blocks are mounted on the drum and inside the band.

> Brake is applied by pressing the blocks against the drum with the help of band.

> Blocks are used under the band since blocks have higher coefficient of friction. This ~~incre~~ arrangement increases the effectiveness of brake.

* Internal expanding shoe brake :-

> Internal expanding shoe brake has two semicircular shoes which are lined with friction material.



- The outer diameter of shoe is less than inner diameter of drum, so that the drum can rotate freely.
- When brake is applied, the shoes expand and press the inner surface of the drum and resist the motion.
- It is used in automobile.
- It is self-energizing and good heat dissipative.

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