



SNS COLLEGE OF TECHNOLOGY

(AN AUTONOMOUS INSTITUTION)



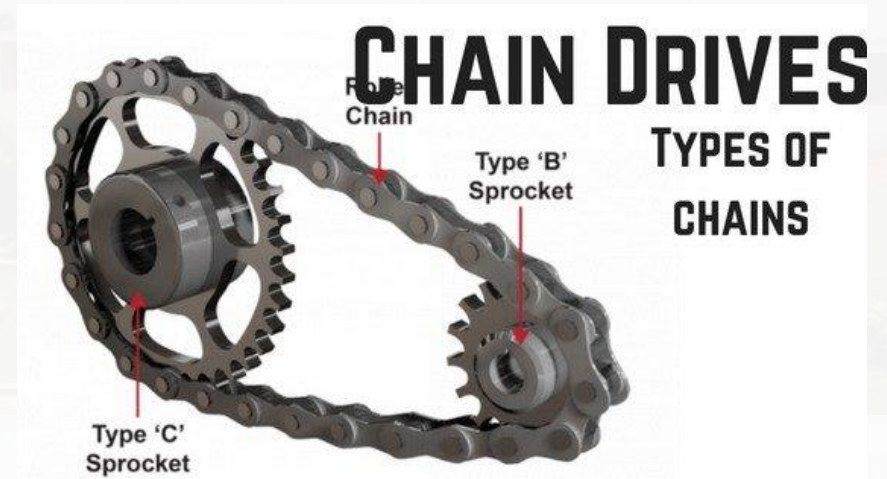
Department of Mechanical Engineering

Kinematics of Machinery

Unit – IV

Friction in Machine Elements

Belt, Rope and Chain Drives



Prepared by

Dr.V.S.Kashik

Source: theengineerspost.com

Assistant Professor / Mechanical Engineering

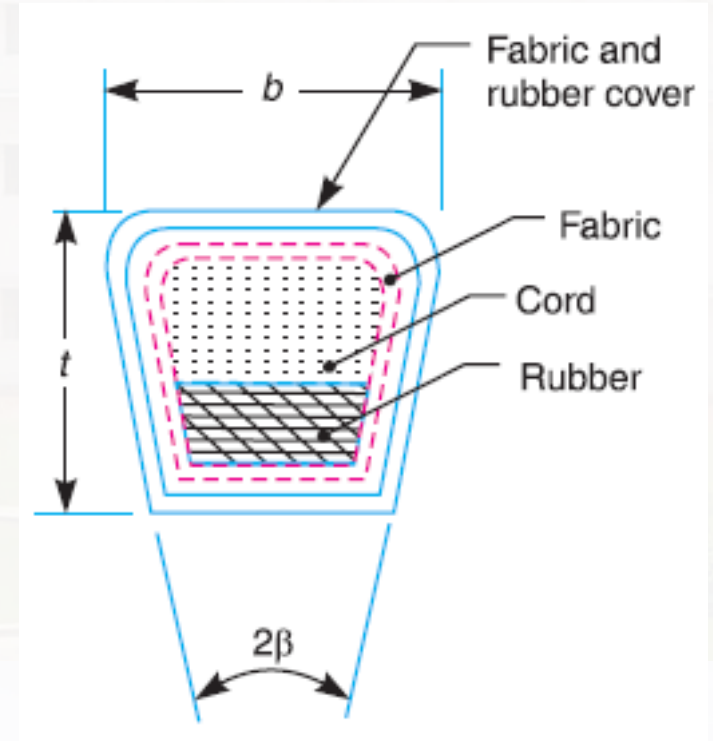
SNS College of Technology, Coimbatore



V-belt drive



- The V-belts are made of fabric and cords moulded in rubber and covered with fabric and rubber. These belts are moulded to a trapezoidal shape and are made endless. These are particularly suitable for short drives *i.e.* when the shafts are at a short distance apart.
- The included angle for the V-belt is usually from $30^\circ - 40^\circ$. In case of flat belt drive, the belt runs over the pulleys whereas in case of V-belt drive, the rim of the pulley is grooved in which the V-belt runs.
- The effect of the groove is to increase the frictional grip of the V-belt on the pulley and thus to reduce the tendency of slipping.
- The power is transmitted by the wedging action between the belt and the V-groove in the pulley.



Source: R.S.Khurmi



Advantages and Disadvantages of V-belt Drive Over Flat Belt Drive



Following are the advantages and disadvantages of the V-belt drive over flat belt drive.

Advantages

1. The V-belt drive gives compactness due to the small distance between the centres of pulleys.
2. The drive is positive, because the slip between the belt and the pulley groove is negligible.
3. Since the V-belts are made endless and there is no joint trouble, therefore the drive is smooth.
4. It provides longer life, 3 to 5 years.
5. It can be easily installed and removed.
6. The operation of the belt and pulley is quiet.
7. The belts have the ability to cushion the shock when machines are started.
8. The high velocity ratio (maximum 10) may be obtained.



Advantages and Disadvantages of V-belt Drive Over Flat Belt Drive



9. The wedging action of the belt in the groove gives high value of limiting ratio of tensions.
10. The V-belt may be operated in either direction with tight side of the belt at the top or bottom. The centre line may be horizontal, vertical or inclined.

Disadvantages

1. The V-belt drive cannot be used with large centre distances.
2. The V-belts are not so durable as flat belts.
3. The construction of pulleys for V-belts is more complicated than pulleys for flat belts.
4. Since the V-belts are subjected to certain amount of creep, therefore these are not suitable for constant speed application such as synchronous machines, and timing devices.
5. The belt life is greatly influenced with temperature changes, improper belt tension and mismatching of belt lengths.
6. The centrifugal tension prevents the use of V-belts at speeds below 5 m/s and above 50m/s.



Rope Drive



- The rope drives are widely used where a large amount of power is to be transmitted, from one pulley to another, over a considerable distance.
- It may be noted that the use of flat belts is limited for the transmission of moderate power from one pulley to another when the two pulleys are not more than 8 metres apart.
- It may be noted that frictional grip in case of rope drives is more than that in V-drive. One of the main advantage of rope drives is that a number of separate drives may be taken from the one driving pulley. For example, in many spinning mills, the line shaft on each floor is driven by ropes passing directly from the main engine pulley on the ground floor.

The rope drives use the following two types of ropes :

1. Fibre ropes, and **2.** Wire ropes.

The fibre ropes operate successfully when the pulleys are about 60 metres apart, while the wire ropes are used when the pulleys are upto 150 metres apart.



Fibre Ropes



- The ropes for transmitting power are usually made from fibrous materials such as hemp, manila and cotton.
- Since the hemp and manila fibres are rough, therefore the ropes made from these fibres are not very flexible and possesses poor mechanical properties. The hemp ropes have less strength as compared to manila ropes.
- When the hemp and manila ropes are bent over the sheave (or pulley), there is some sliding of fibres, causing the rope to wear and chafe internally.
- In order to minimise this defect, the rope fibres are lubricated with a tar, tallow or graphite.
- The lubrication also makes the rope moisture proof. The hemp ropes are suitable only for hand operated hoisting machinery and as tie ropes for lifting tackle, hooks etc.



Advantages of Fibre Rope Drives



The fibre rope drives have the following advantages :

1. They give smooth, steady and quiet service.
2. They are little affected by out door conditions.
3. The shafts may be out of strict alignment.
4. The power may be taken off in any direction and in fractional parts of the whole amount.
5. They give high mechanical efficiency.



Wire Ropes



- When a large amount of power is to be transmitted over long distances from one pulley to another (*i.e.* when the pulleys are upto 150 metres apart), then wire ropes are used.
- The wire ropes are widely used in elevators, mine hoists, cranes, conveyors, hauling devices and suspension bridges.
- The wire ropes run on grooved pulleys but they rest on the bottom of the grooves and are not wedged between the sides of the grooves.



Source: R.S.Khurmi



Advantages of Wire Rope Drives



The wire ropes have the following advantage over cotton ropes.

1. These are lighter in weight,
2. These offer silent operation,
3. These can withstand shock loads,
4. These are more reliable,
5. They do not fail suddenly,
6. These are more durable,
7. The efficiency is high, and
8. The cost is low.



Chain Drives

- As in belt and rope drives that slipping may occur.
- In order to avoid slipping, steel chains are used.
- The chains are made up of rigid links which are hinged together in order to provide the necessary flexibility for warping around the driving and driven wheels.
- The wheels have projecting teeth and fit into the corresponding recesses, in the links of the chain.
- The wheels and the chain are thus constrained to move together without slipping and ensures perfect velocity ratio.
- The toothed wheels are known as *sprocket wheels* or simply *sprockets*. These wheels resemble to spur gears.



Source: R.S.Khurmi



Advantages and Disadvantages of Chain Drive Over Belt or Rope Drive



- The chains are mostly used to transmit motion and power from one shaft to another,
- when the distance between the centres of the shafts is short such as in bicycles, motor cycles, agricultural machinery, road rollers, etc.

Following are the advantages and disadvantages of chain drive over belt or rope drive :

Advantages

1. As no slip takes place during chain drive, hence perfect velocity ratio is obtained.
2. Since the chains are made of metal, therefore they occupy less space in width than a belt or rope drive.
3. The chain drives may be used when the distance between the shafts is less.
4. The chain drive gives a high transmission efficiency (upto 98 per cent).
5. The chain drive gives less load on the shafts.
6. The chain drive has the ability of transmitting motion to several shafts by one chain only.

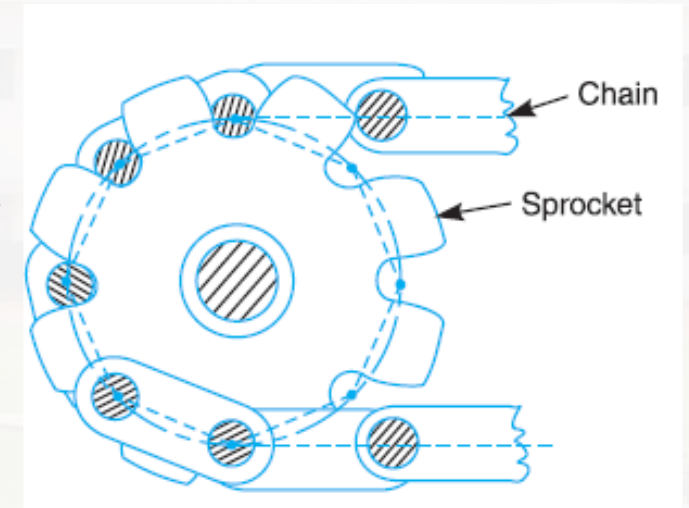


Advantages and Disadvantages of Chain Drive Over Belt or Rope Drive



Disadvantages

1. The production cost of chains is relatively high.
2. The chain drive needs accurate mounting and careful maintenance.
3. The chain drive has velocity fluctuations especially when unduly stretched.



Source: R.S.Khurmi



Classification of Chains

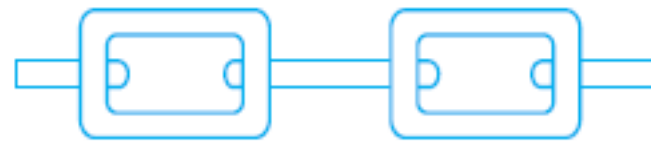


The chains, on the basis of their use, are classified into the following three groups :

1. Hoisting and hauling (or crane) chains,
2. Conveyor (or tractive) chains, and
3. Power transmitting (or driving) chains.



(a) Chain with oval links.



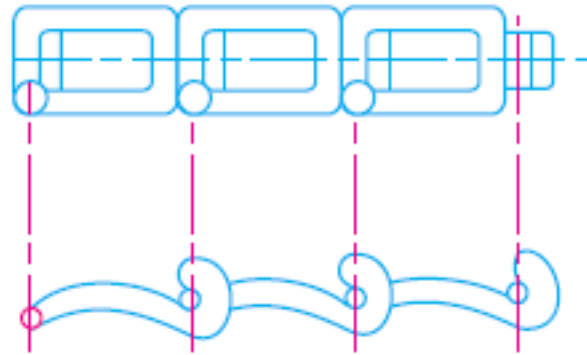
(b) Chain with square links.

Hoisting and hauling (or crane) chains

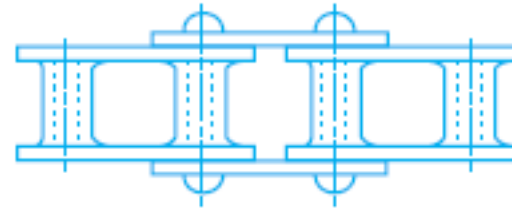
Source: R.S.Khurmi



Conveyor (or tractive) chains



(a) Detachable or hook joint type chain.



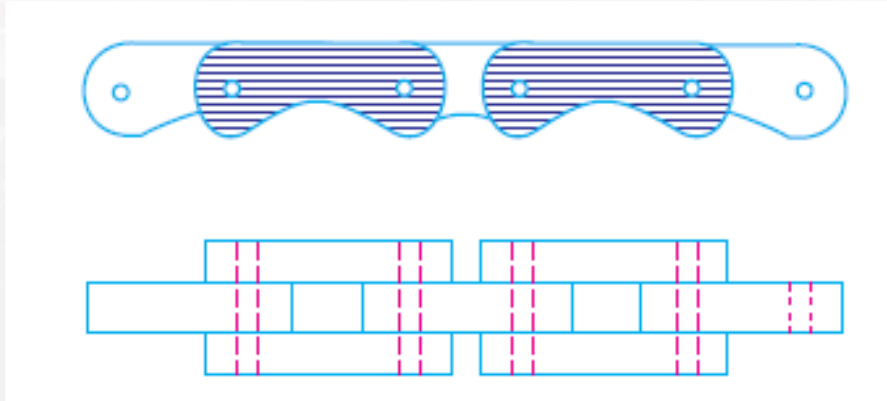
(b) Closed joint type chain.

Source: R.S.Khurmi

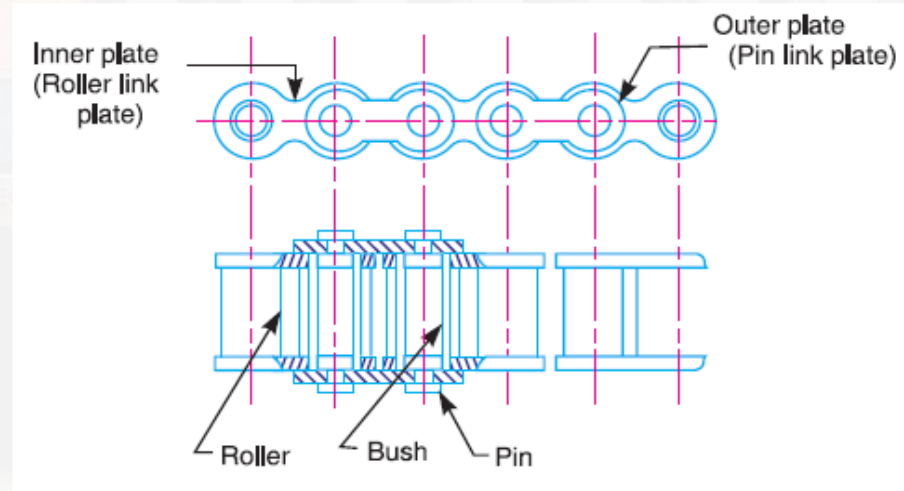
BOARD USAGE ALSO



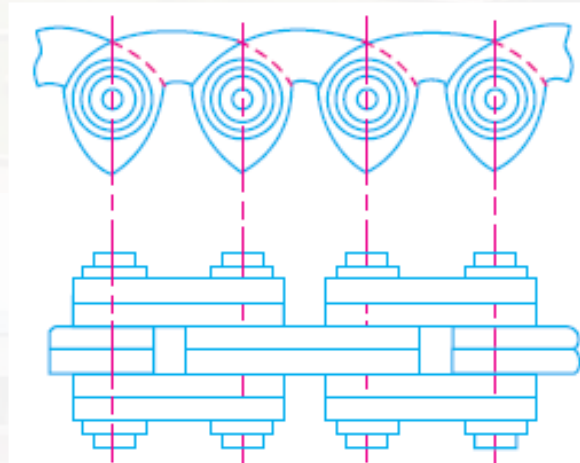
Power Transmitting Chains



Block chain



Bush roller chain.



Inverted tooth or silent chain

Source: R.S.Khurmi

BOARD USAGE ALSO