

TRANSMISSION OF MOTION AND POWER

INTRODUCTION

- ✘ The mechanisms which are used to transmit the required motion and power from one shaft to another shaft are called mechanical drives.
- ✘ These drives are extensively used in automobiles, workshops, processing and transport industry.

TYPES OF MECHANICAL DRIVES

1. Belt and rope drives
2. Chain drives
3. Gear drives

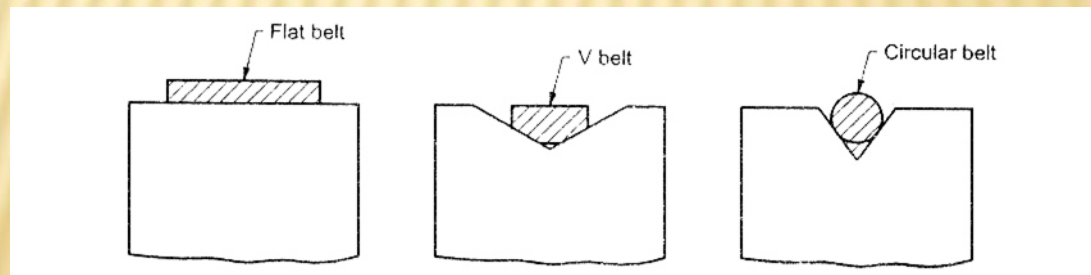
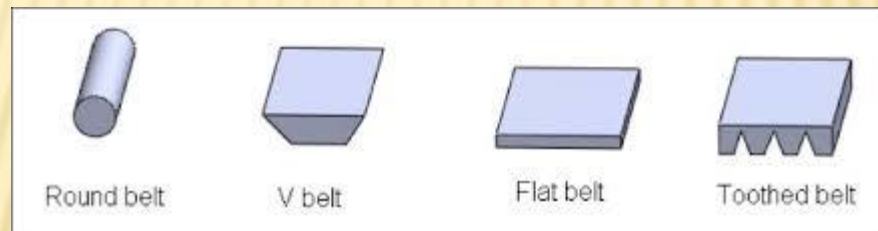
BELT DRIVES

- ✗ **Types of belts**
- ✗ **(a) Flat belt**
- ✗ It is mostly used in factories and workshops, where a moderate amount of power is to be transmitted. The distance between two pulleys is not more than 8 meters apart.
- ✗ **(b) V –belt**
- ✗ It is mostly used in factories and workshops, where a moderate amount of power is to be transmitted. The distances between two pulleys are very near to each other.

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(c) Circular belt or rope belt

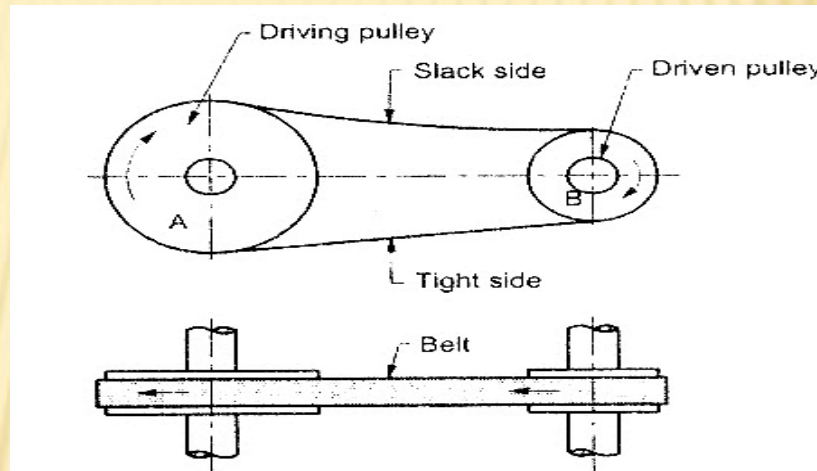
- ✗ It is mostly used in the factories and workshops, where a greater amount of power is to be transmitted. The distance between two pulleys is more than 8 meters.



OPEN BELT DRIVE

Use

- ✖ It is used when the driven pulley is to be rotated in the same direction as the driving pulley.



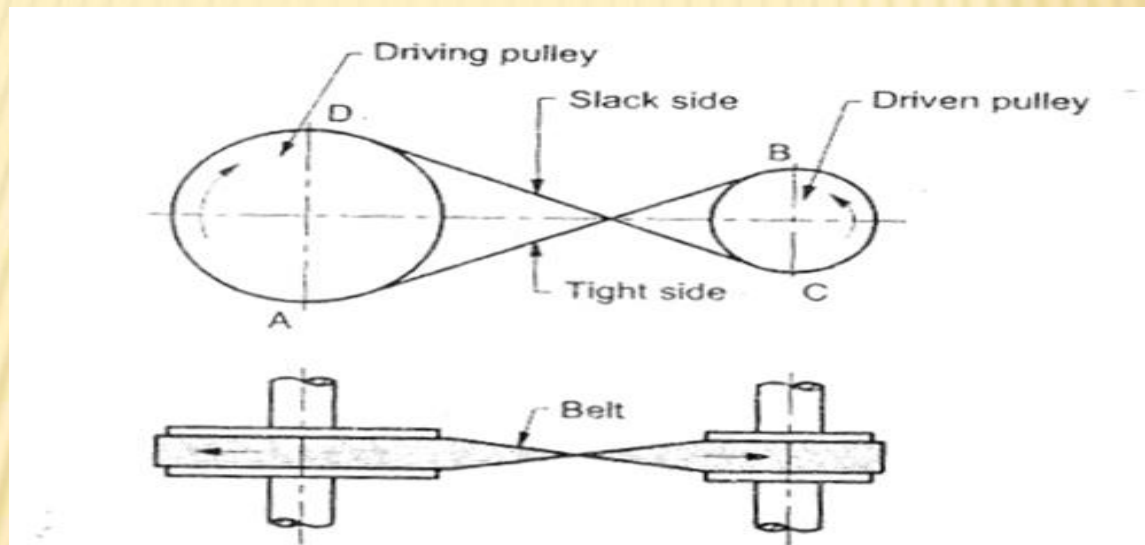
Construction

- ✖ In this driving pulley pulls the belt on one side and drives it to the other side. So the tension on pulled side will be more than other side. The tension on pulled side is known as tight side and other side is known as slack side.

CROSSED BELT DRIVE

Use

- ✗ It is used when the driven pulley is to be rotated in the opposite direction to that of driving pulley.



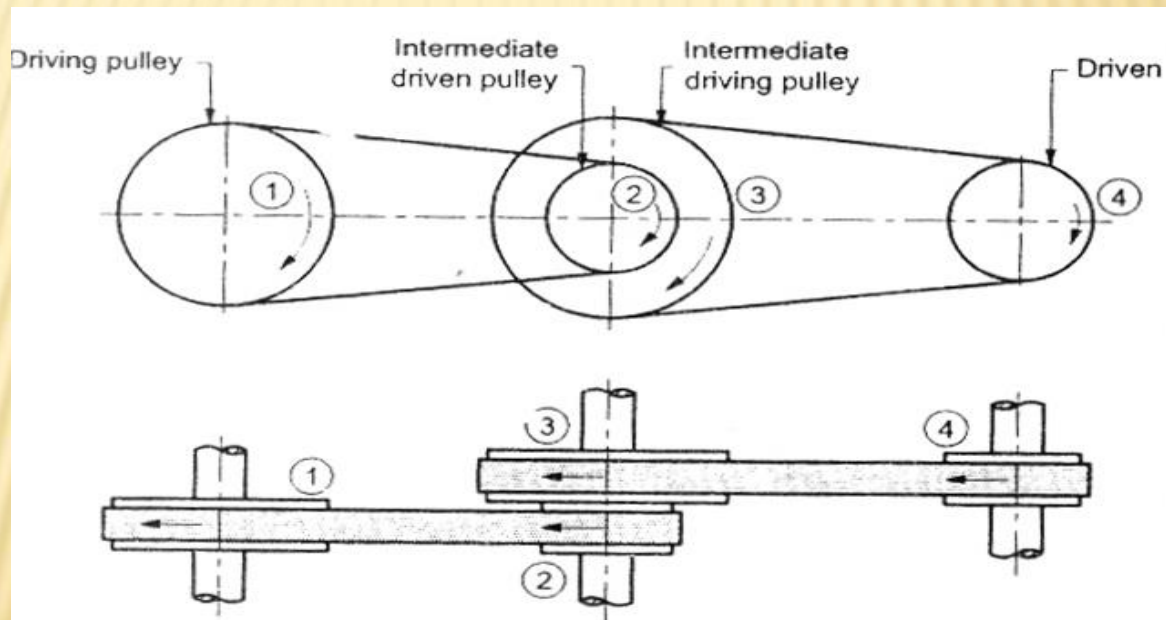
Construction

- ✗ In cross belt drive the belt bends in two different planes, it therefore wears more rapidly

COMPOUND BELT DRIVE

Use:

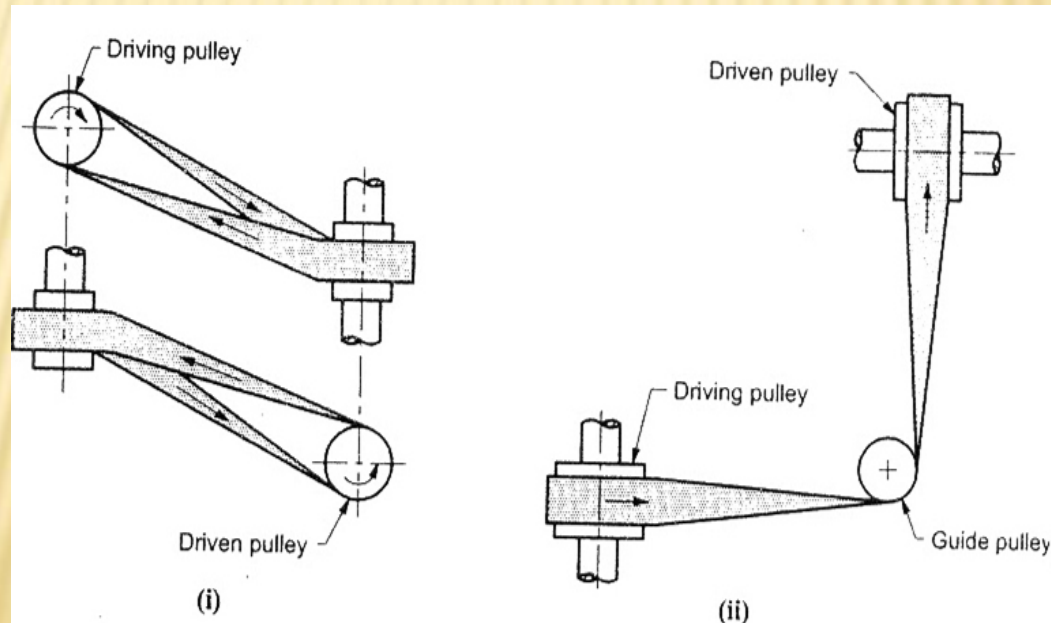
- ✗ It is used when the distance between input and output shaft is very large.



QUARTER TURN BELT DRIVE OR RIGHT ANGLE BELT DRIVE

Use:

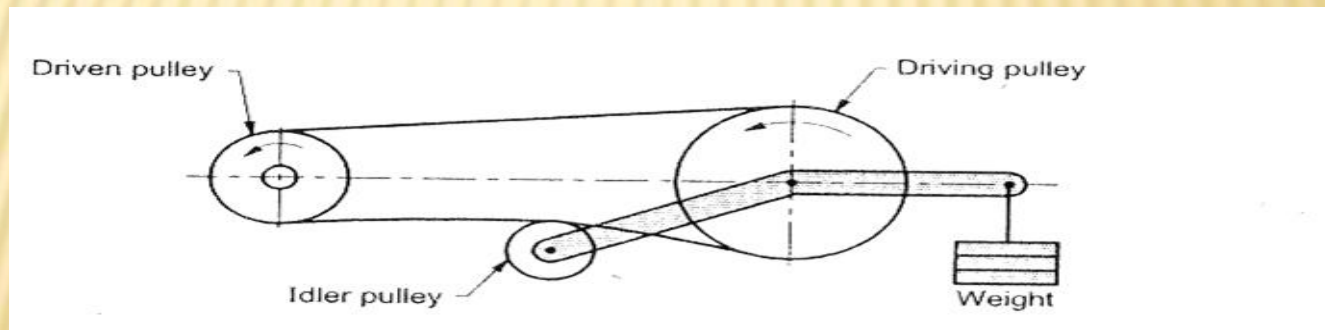
- ✗ This belt drive is used when two shafts are at right angles and rotating in one direction only.
- ✗ A guide pulley is used when motion is required in either direction.



BELT DRIVE WITH IDLER PULLEYS

Construction

Material of belt is elastic due to which after prolonged use the belt is permanently stretched in length. This reduces the tension in the belt which leads to lower power transmission capacity.

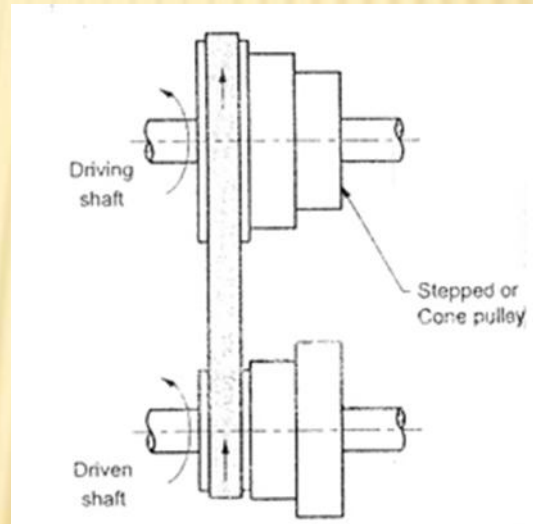


STEPPED OR CONE PULLEY DRIVE

Use:

- ✗ To run the driven shaft at different speed whereas the driving shaft runs at a constant speed through a motor.

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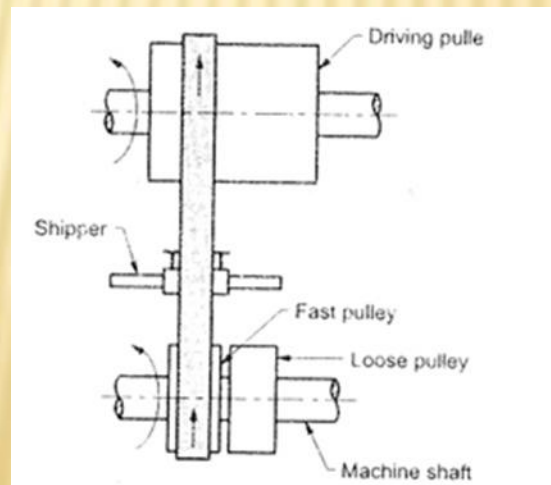


Construction:

- ✗ Both driving and driven pulleys has steps of equal radius so that the same belt can be used for varying the speed.

FAST AND LOOSE PULLEY DRIVE

- ✗ Use
- ✗ Many times it is required to drive many machines from one driving shaft or main shaft. It is used to start or stop one machine without interfering other machines.



ROPE DRIVE

- ✗ Rope drives are widely used where a large amount of power is to be transmitted from one shaft to another shaft over a considerable distance.

Types of Rope Drives

(a) Fiber ropes

- ✗ Made from fibrous material such as hemp, manila and cotton. Fiber ropes are used when shafts are about 60 meters apart.

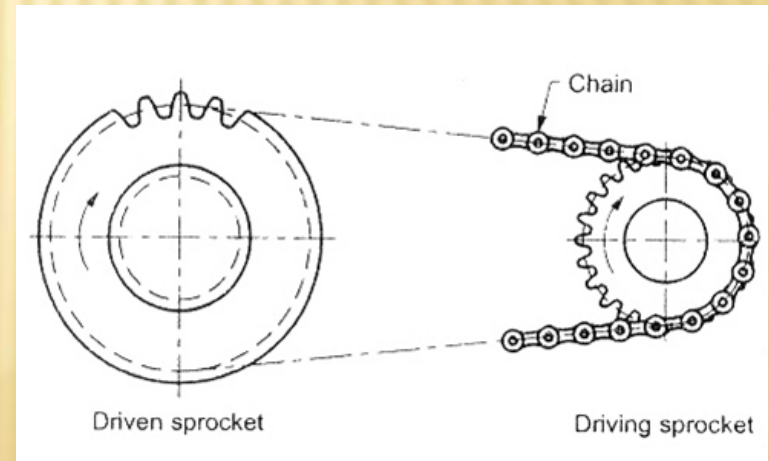
(b) Wire ropes

- ✗ Made from metallic wires. Wire ropes are used when shaft are about 150 meters apart. The wire ropes are used in elevators, mine hoists, cranes, conveyors etc.

CHAIN DRIVE

- ✗ Slipping occurs in belt and rope drives. In order to avoid this slipping phenomenon chain drives are used.
- ✗ **Construction**
- ✗ A chain drive consists of three elements driving sprocket, driven sprocket and an endless chain which is wrapped around two sprockets.
- ✗ A chain consists of a number of links connected by pin joints, while the sprockets are toothed wheels and fit into the corresponding recesses in the links of the chain.

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METHODS OF DRIVE

- ✕ There are basically two methods of drive.
 - + Individual drive
 - + Group drive

INDIVIDUAL DRIVE

- ✘ In this system, each machine tool has its own electric motor which drives the machine through belt, chain, gearing or by direct coupling. The system is also called as self contained drive.

Advantages

- ✘ Individual machines can be run and stopped at operator will.
- ✘ System is simple and compact.
- ✘ Failure of motor affects the working of a particular machine only without affecting the working of other machines in the workshop.
- ✘ Overhead cranes can be installed.
- ✘ Lighting of the workshop is not affected by belts and overhead shafts.

(B) GROUP DRIVE

- ✗ The main shaft runs across the workshop from one end to other end. The main shaft drives another shaft called counter shaft. Finally the countershaft drives the group of machines through belting. The countershaft also carries cone pulleys to give wide range of speeds.

Advantages

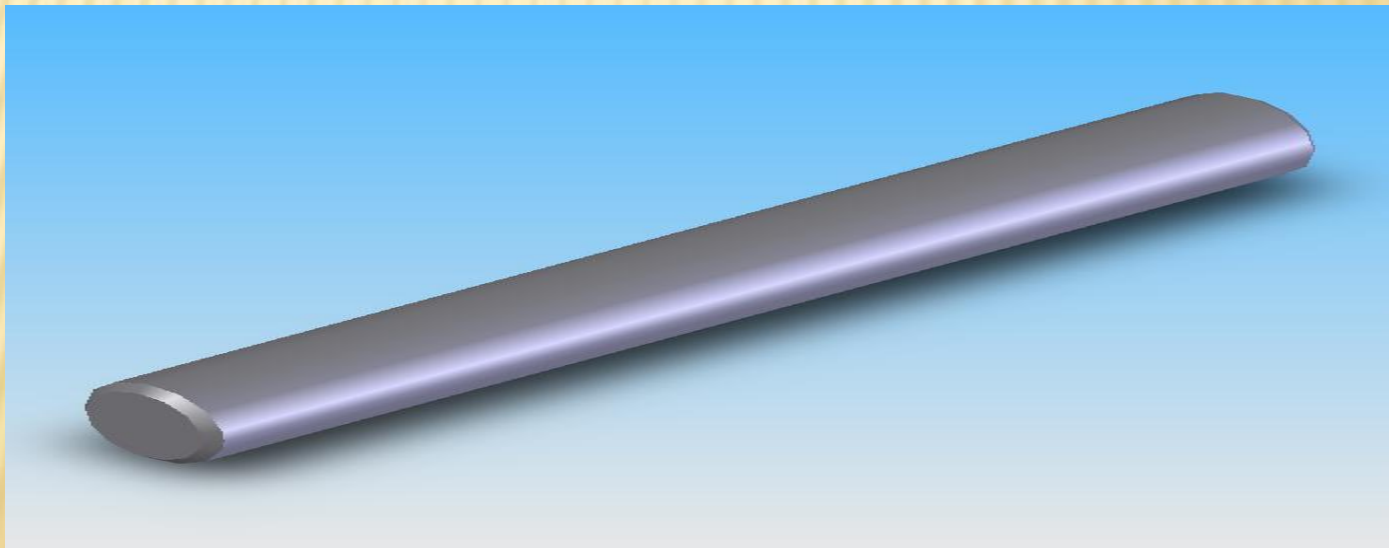
- ✗ It is suitable when all machines are required to run simultaneously. It reduces the size of the motor required.
- ✗ The initial capital investment is low.
- ✗ A set of cone pulleys give wide range of speed.
- ✗ It will be more economical when utilization factor is high.
- ✗ Maintenance is easy.

ELEMENTS OF POWER TRANSMISSION

- ✗ The main elements of power transmission system are,
- ✗ The nuts, bolts, pins, keys and couplings, etc. are provided to hold the two components of machine elements together.
- ✗ Driving and driven shafts.
- ✗ Belts, chains, gears are as connectors for transmission of motion and power from driving to driven shaft.
- ✗ Axles, bearings, brackets etc. to provide support to other elements of a machine.

SHAFT

- ✗ A shaft is a rotating machine element which transmits power.
- ✗ The power is delivered to the shaft by the application of tangential force and the resulting turning moment set up in the shaft allows the power to be transmitted from one point to another point.



Spindle

- ✖ A spindle is a short revolving shaft that transmits motion either to a cutting tool or a work piece.

Axle

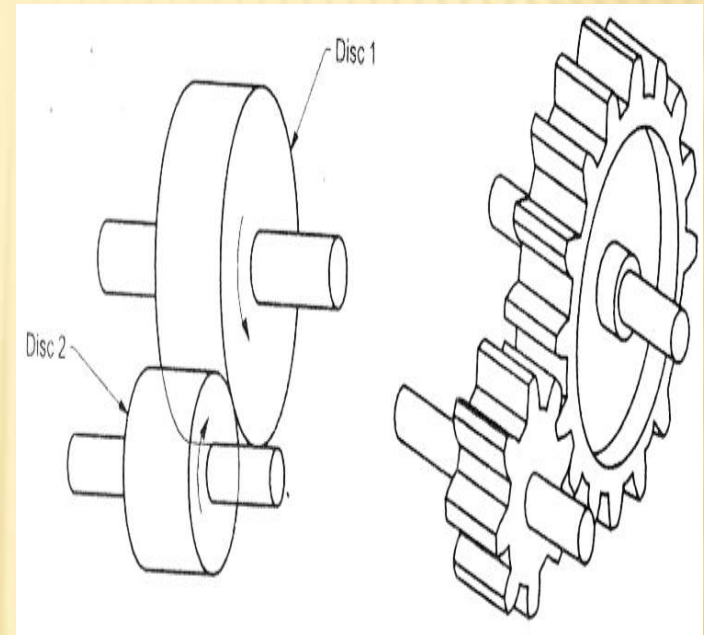
- ✖ An axle is machine element which is used for transmitting bending moment and carries such rotating parts as wheels and gears. An axle may be stationary or it may be rotating.



GEAR DRIVE AND FRICTION DRIVE

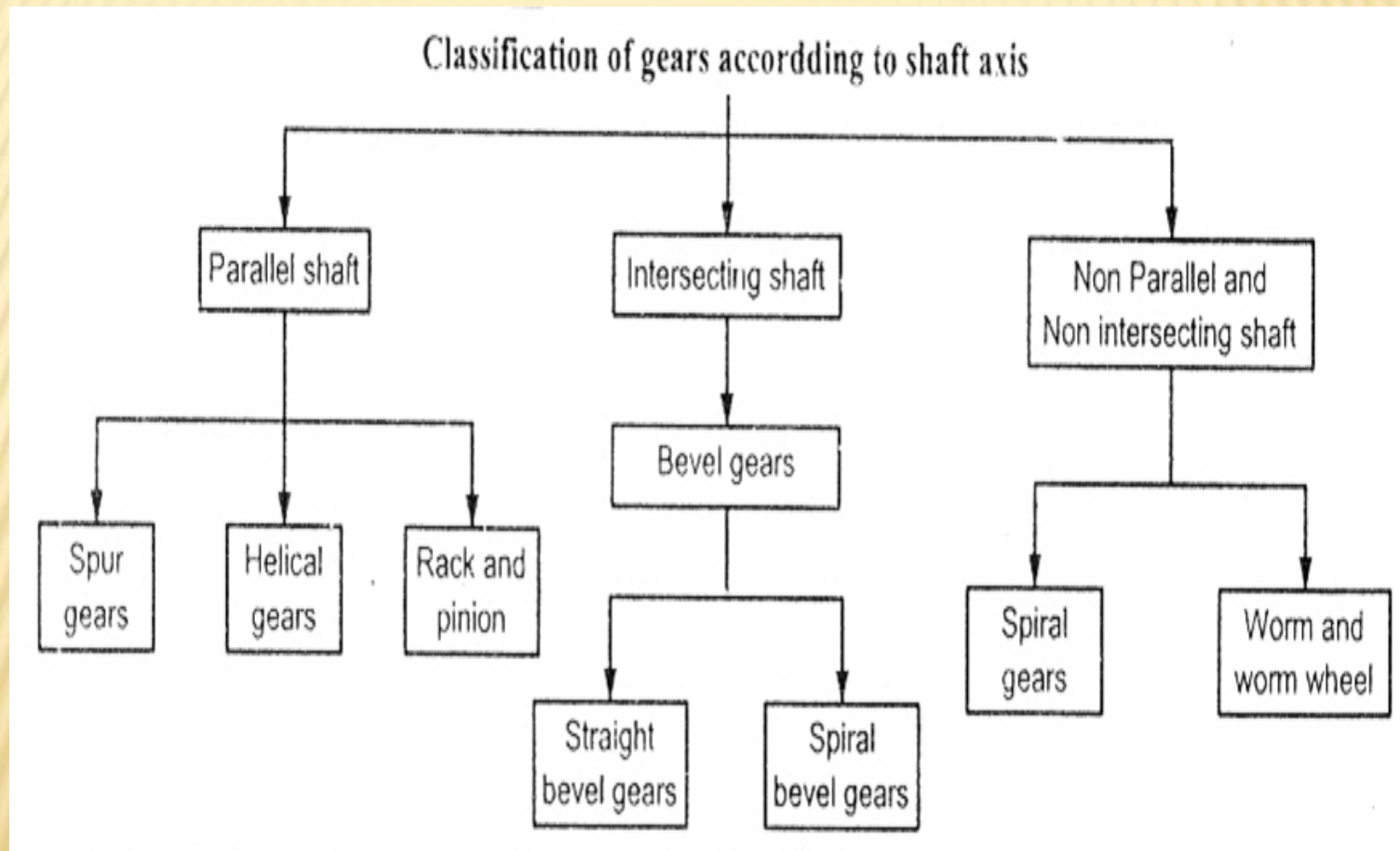
✗ Advantages

- ✗ It is a positive drive (no slip) i.e. it transmits exact velocity ratio from one shaft to another shaft.
- ✗ It can transmit very large power.
- ✗ High transmission efficiency.
- ✗ Requires less space.
- ✗ Reliable.



In order to transmit a definite power from one shaft to another shaft to the projection on one disc and recesses on another disc can be made which can mesh with each other. This leads to the formation of teeth on both discs and the discs with teeth on their periphery are known as "Gears".

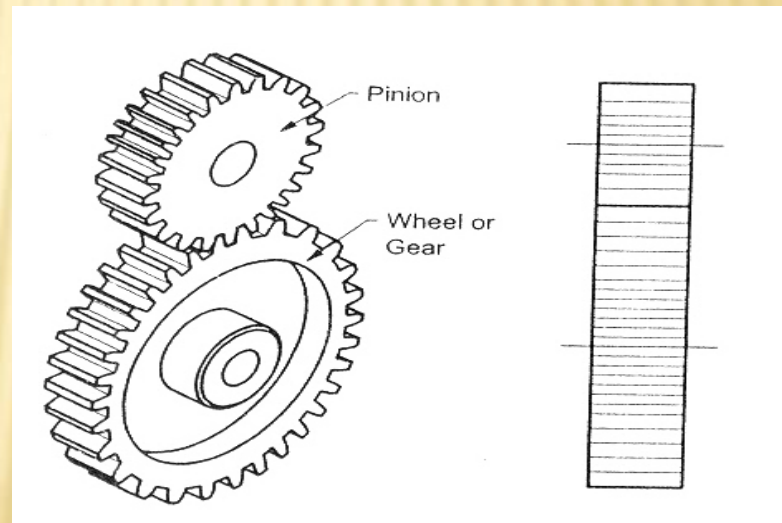
CLASSIFICATION OF GEARS



SPUR GEAR

Use:

- ✗ When the axis of two shafts are parallel to each other. These gears have teeth parallel to the axis of the shaft.



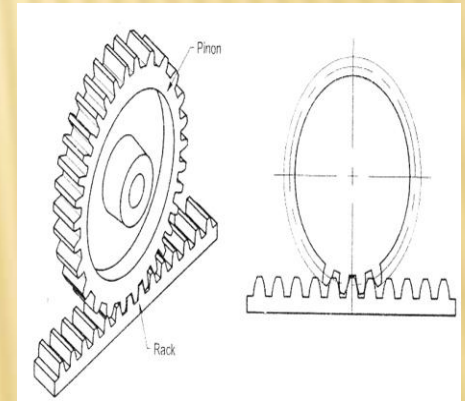
HELICAL GEAR

- ✗ In helical gears the teeth are at some angle called helix angle with respect to axis of the shaft.



RACK AND PINION

- ✖ It is a special case of spur gear in which one gear is having infinite diameter called "Rack".
- ✖ **Use**
- ✖ To transmit the rotary motion into reciprocating motion or vice-versa.



Application

- ✖ Lathe machine, drilling machine and measuring instrument.

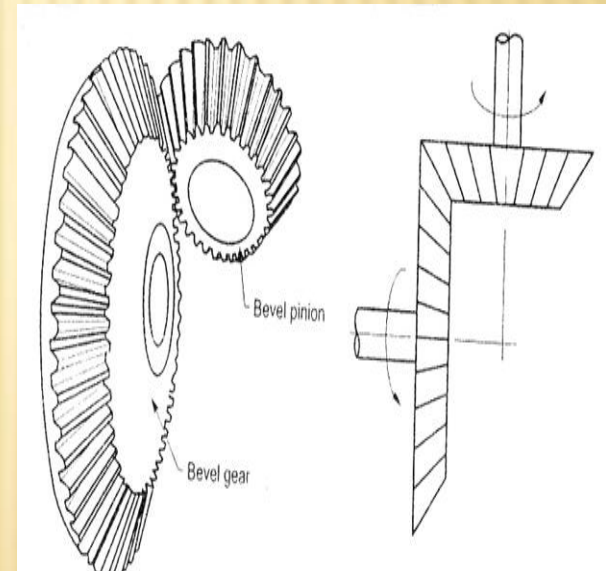
BEVEL GEAR

Use

- ✗ When power is required to be transmitted from one shaft to another shaft which are intersecting to each other then bevel gears are used. Generally, the angle between two shafts is 90^0 .
- ✗ The bevel gears are of two types,
 - ✗ Straight bevel gear
 - ✗ Spiral bevel gear

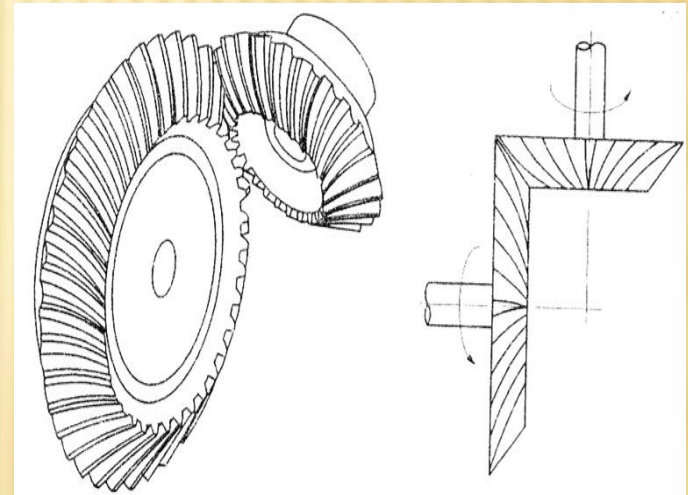
STRAIGHT BEVEL GEARS

- ✗ In straight bevel gears the teeth are formed straight on the cones, and they are parallel to the axis of the gear



SPIRAL BEVEL GEARS

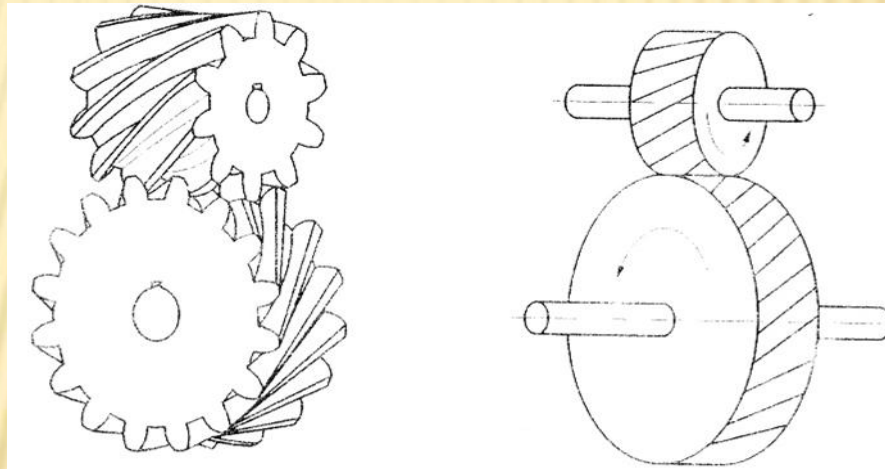
- ✗ In a spiral bevel gear, the teeth are formed at an angle with respect to its axis. The contact between two meshing teeth is gradual and smooth from start to end, as in case of helical gears.



SPIRAL GEARS (SKEW GEARS OR CROSSED HELICAL GEARS)

Use

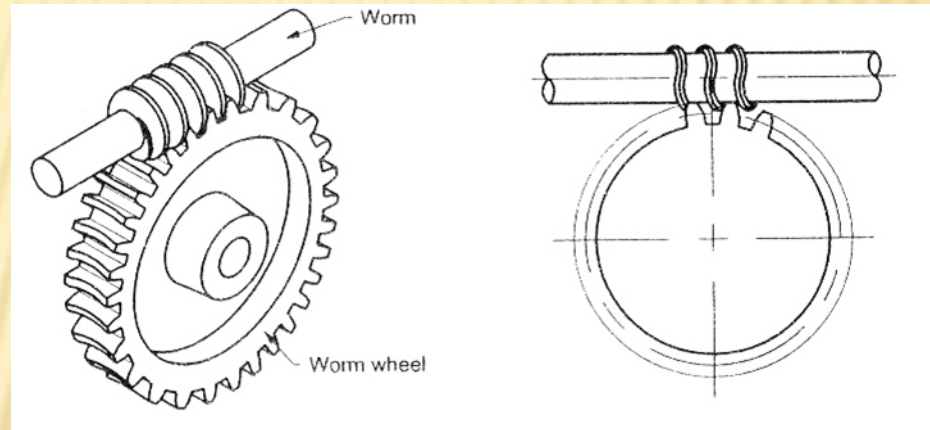
- ✗ To transmit power from one shaft to another shaft which are non parallel and non intersecting.



- ✗ For low load transmission only since they have point contact between mating teeth.

WORM AND WORM WHEEL

- ✗ Use
- ✗ To transmit power from one shaft to another shaft which are non intersecting and their axes are normally at right angles to each other.



- ✗ Application
- ✗ Lathe machine to get large speed reduction.

Thank you....