

Power transmission is a process to transmit motion from one shaft to another by using some connections between them like belt, rope chain and gears.

There are various types of power transmission devices -

- ① Gear drive / Gear train.
- ② Belt drive.
- ③ Chain drive.

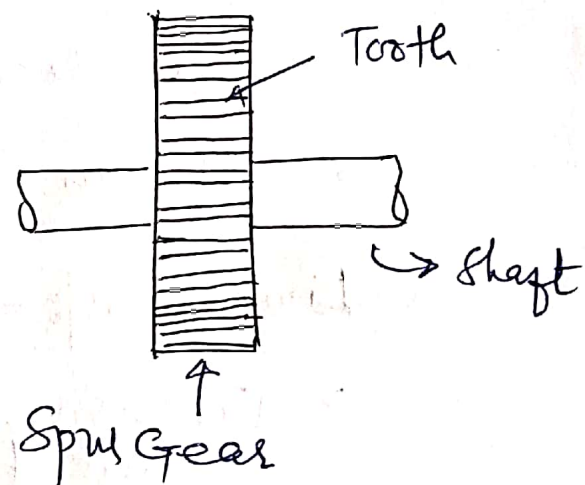
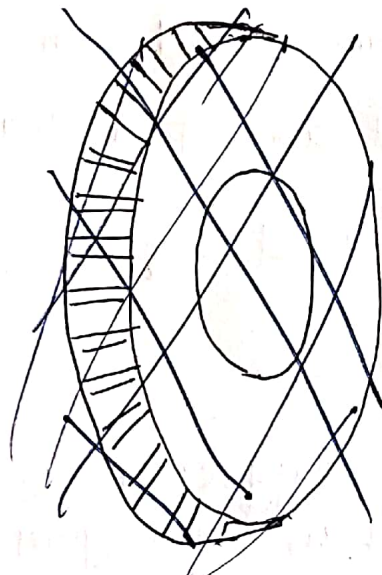
### \* Classification of gears :-

Gears are classified according to position of shafts -

#### ① Parallel shafts :-

##### ① Spur gear :-

- > Teeth on gear are parallel to the shaft.
- > These are most commonly used gears.



## \* Advantages of spur gears:-

- > Easy to find, inexpensive and efficient.

## Limitations:-

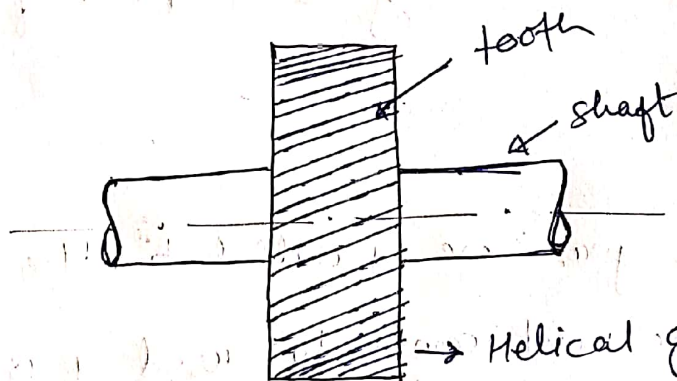
- > It is used for smaller speeds only.
- > Noise and vibration.

## ② Helical gears:-

- > Teeth of helical gear are inclined to the axis of shaft.
- > Teeth are longer than the teeth on a spur gear of equivalent pitch diameter.

## Advantages:-

- > Tooth strength is greater than spur gear.



- > Greater surface contact on the teeth which carry more load than spur gear.
- > It can be used for non-parallel shafts also.

## \* Limitations:-

- > Expensive, difficult to manufacture and less efficient than spur gear.

> Helical gears create axial thrust on the shaft.

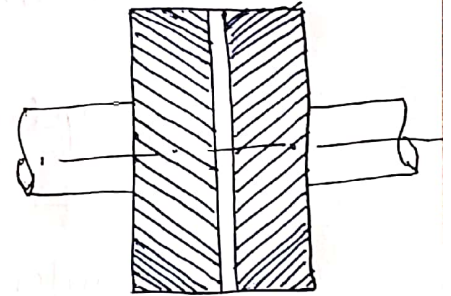
### ② Herringbone gears :- / Double helical gear :-

> To eliminate axial thrust herringbone or double helical gears are used.

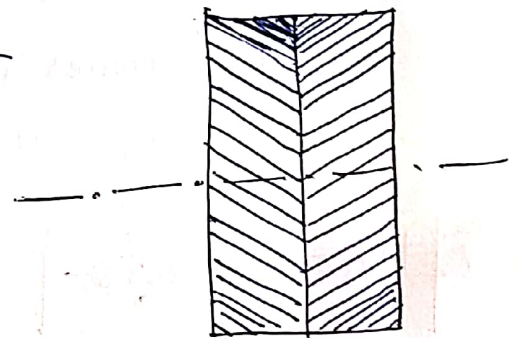
> ~~Herringbone~~ Double helical gears have one right-hand helix and the other a left-hand helix.

> The teeth of two rows <sup>of double helical</sup> are separated by a groove.

> Herringbone gears are joined in the middle of the gear circumference. This arrangement makes it compact.



② Double helical



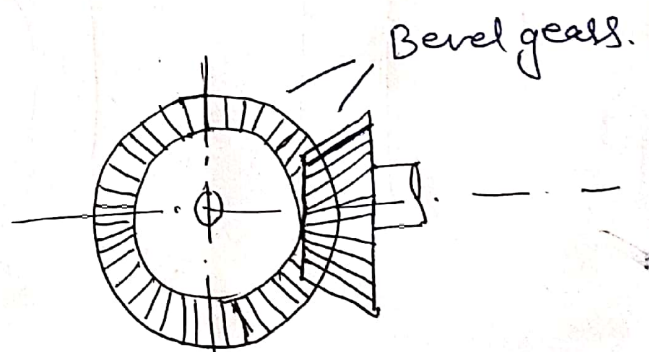
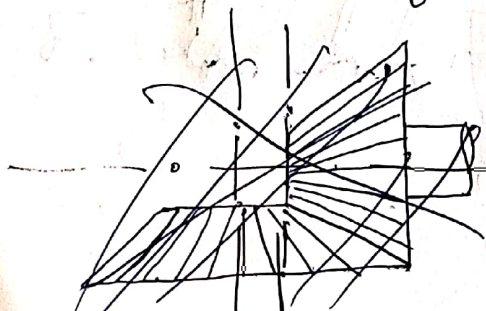
③ Herringbone gear

### ③ Intersecting shafts :-

#### ① Bevel gears :-

> It is used to transfer power between intersecting shafts. Mostly for the shafts which are perpendicular to each other.

> The teeth of these gears are formed on a conical surface.

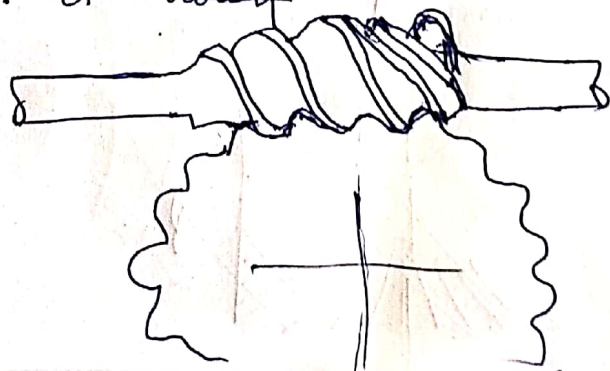


- > Standard bevel gears have teeth which are cut straight and parallel to the line pointing the apex of cone.
- > Spiral bevel gears are also available with teeth form arcs.
- > Used in differentials of automobiles.
- > Hypocycloid bevel gears are generally considered the best special type of spiral gear that allow non-intersecting, non-parallel shafts to mesh.
- > It can not be used for parallel shafts.
- > It becomes noisy at high speeds.

~~Hypoid gears:-~~

\* Worm gears:-

- > If a tooth of a helical gear makes complete revolutions on the pitch cylinder, the resulting gear is known as worm. The mating gear is called worm wheel. ~~as shown~~



## \* Gear trains :-

Sometimes, two or more gears are made to mesh with each other to transmit power from one shaft to another, such a combination is called as gear train.

### Types of gear trains :-

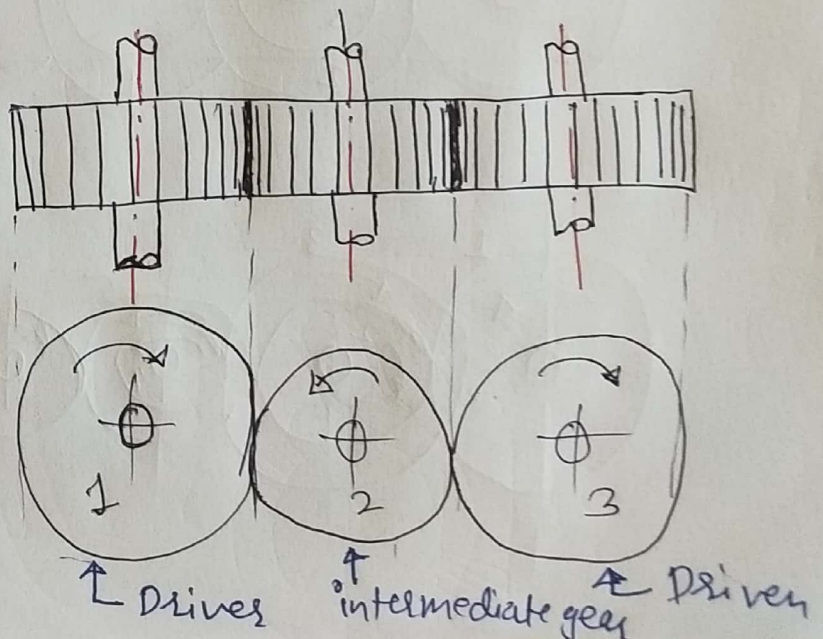
Depending upon arrangement of wheels

- ① Simple gear train.
- ② Compound gear train
- ③ Reverted gear train
- ④ Epicyclic gear train.

### ① Simple gear train :-

When there is only one gear on each shaft, the gear train is known as simple gear train.

> Motion is transferred from Gear 1 to gear 3. Gear 1 is known as driver and gear 3 is known as driven or follower.



> When number of intermediate gear are odd, the the motion of driver and driven gear is like and vice-versa.

$$\text{Speed ratio} = \frac{\text{Speed of driver}}{\text{Speed of driven}} = \frac{\text{Number of teeth of driven}}{\text{Number of teeth on driver}}$$

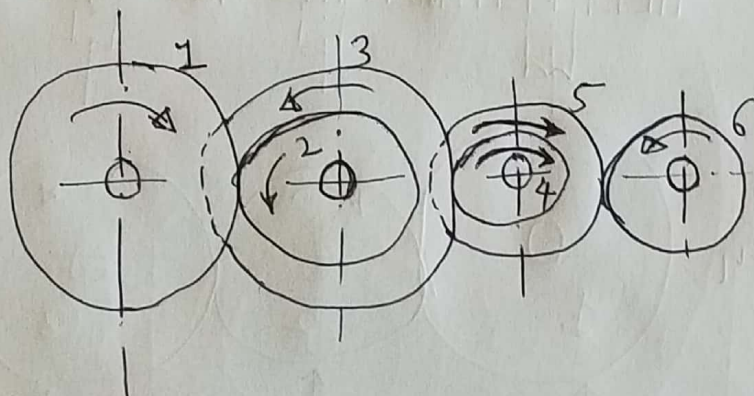
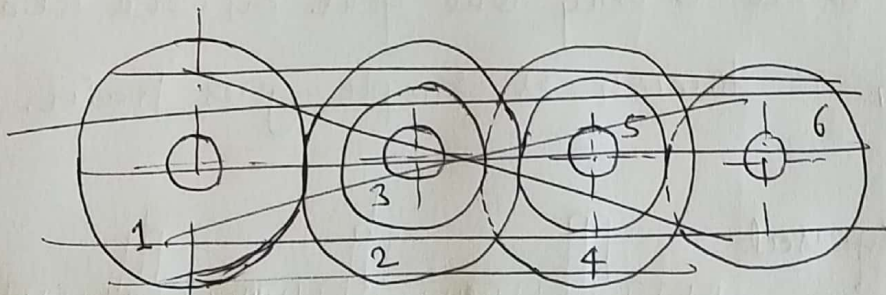
$$\text{Speed ratio} = \frac{\text{Speed of driver}}{\text{Speed of driven}} = \frac{\text{Product of number of teeth on drivers}}{\text{Product of number of teeth on driven}}$$

> In simple gear train, speed ratio is independent of number of intermediate gears.

> ~~Train value is recipe~~

\*2) Compound gear train:-

When there is more than one gear on a shaft, it is known as compound gear train.



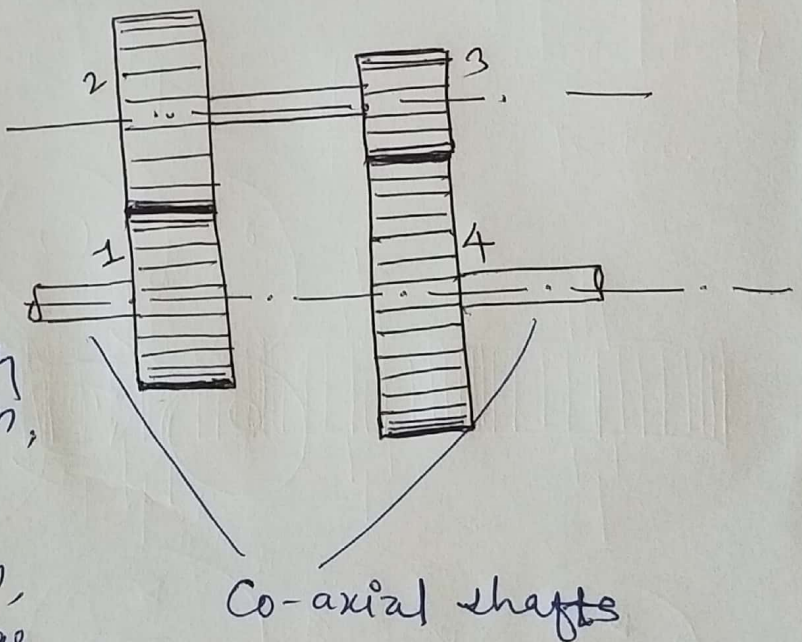
> Whenever, the distance between driver and driven shaft has to be bridged and at the same time great (or much less) speed ratio is required, then the ~~advantage~~ of compound gear train is used.

∴ Speed ratio of compound gear train is -

$$\frac{N_1}{N_6} = \frac{T_2 \times T_4 \times T_6}{T_1 \times T_3 \times T_5}$$

### ③ Reverted gear train:

> When the axes of the first gear (driver) and the last gear are co-axial, then the gear train is known as reverted gear train, as shown in figure.



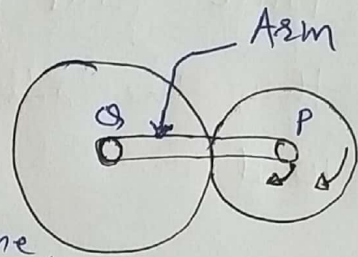
> In reverted gear train, the motion of first gear and last gear is like.

~~Speed ratio~~ 1

> Reverted gear train is used in clocks, automotive transmitters

### ④ Epicyclic gear train:-

> If the axis of at least one gear in gear train moves relative to fixed axis or frame, such type of gear train is known as epicyclic gear train.



> In this one gear rotate upon and around other gear.

> If gear Q is fixed, then arm can rotate about the axis of Q & gear P would also ~~move~~ rotate around Q.

