Gear Train - Combination of gears, to transmit power from one shaft to another..

Why gear train ??

1. Gear train is used to transmit power large centre distance b/w two shaft.
2. Reduce low or high velocity ratio.

A gear train may consist of spur, bevel or spiral gears.

Types of Gear Trains.

1. Simple gear train
2. Compound gear train
3. Revested gear train
4. Epicyclic gear train

- Each gear train follows law of gearing $\frac{\omega_1}{\omega_2} = \frac{D_2}{D_1} = \frac{T_2}{T_1}$

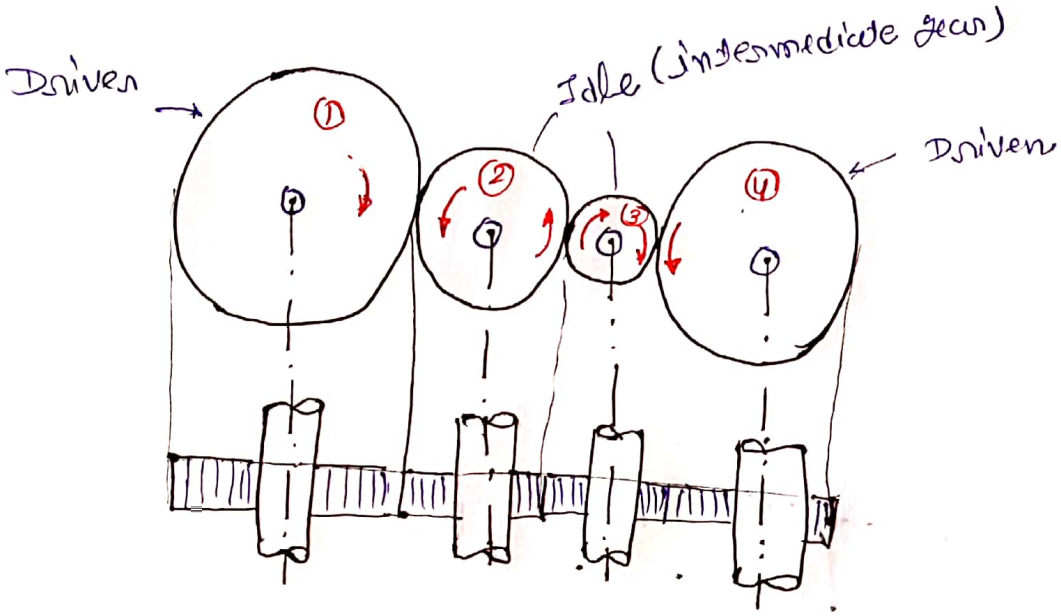
Two important term

- Speed ratio = The ratio of speed of driven to speed of driven. (follower) $SR = \frac{N_1}{N_2} = \frac{T_2}{T_1}$
- Train value = Reciprocal of speed ratio.

$$= \frac{1}{SR} \quad i.e \quad \frac{N_2}{N_1} = \frac{T_1}{T_2}..$$

1. Simple Gear Train

- There is only one gear on each shaft
- The distance b/w the two shaft is small



Let N_1, N_2, N_3, N_4 = Corresponding Speeds on ①, ②, ③ & ④ respectively

T_1, T_2, T_3, T_4 = Corresponding No. of teeth on gear ①, ②, ③ & ④

Now, apply law of gearing

①, ②

$$\frac{\omega_1}{\omega_2} \text{ or } \frac{N_1}{N_2} = \frac{T_2}{T_1} \quad -①$$

b/w ② & ③

$$\frac{\omega_2}{\omega_3} \text{ or } \frac{N_2}{N_3} = \frac{T_3}{T_2} \quad -②$$

b/w ③ & ④

$$\frac{\omega_3}{\omega_4} \text{ or } \frac{N_3}{N_4} = \frac{T_4}{T_3} \quad -③$$

eqn ① × ② × ③

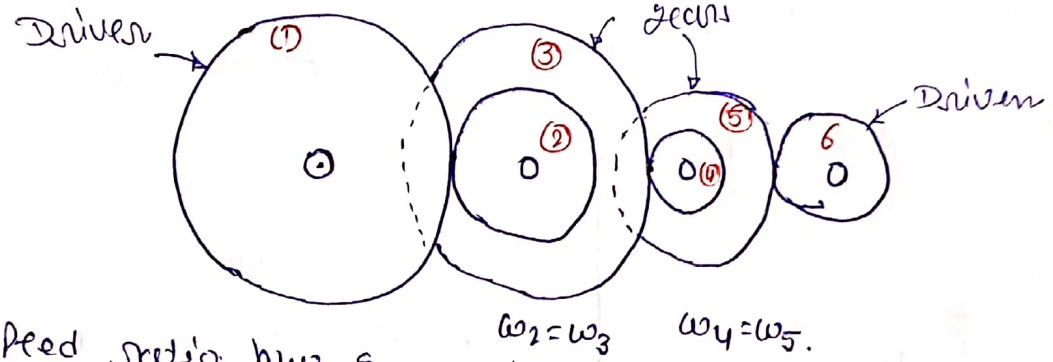
$$\frac{\omega_1}{\omega_4} = \frac{N_1}{N_4} = \frac{T_4}{T_1} = \text{Speed ratio}$$

From the above eqn, the Speed ratio is independent of size & number of intermediate gear. The intermediate gear are called **Idle** gears.

- If No. of gears (intermediate gears)
  - odd – dirn is same
  - even – dirn opposite

Compound Gear Train

- When there are more than one gear on a shaft, it is called compound train of gear.
- In simple gear train, idle gear are used only for bridging over the space b/w driver & driven. Idle gear do not effect the speed ratio.
- Whenever, the distance b/w the driver & driven or follower is bridged over by intermediate gear & at the same time a great (or much less) speed ratio is required, then advantage of intermediate gears is intensified by providing compound gears.



Modules

$m_1 = m_2$

$m_3 = m_4$

$m_5 = m_6$

$\omega_2 = \omega_3$ $\omega_4 = \omega_5$.

Speed ratio b/w gear 1 & 2

$$\frac{\omega_1}{\omega_2} = \frac{T_2}{T_1} \quad \text{---(1)}$$

b/w gear (3) & (4)

$$\frac{\omega_3}{\omega_4} = \frac{T_4}{T_3}$$

b/w gear (5) & (6)

$$\frac{\omega_5}{\omega_6} = \frac{T_6}{T_5}.$$

(1) × (2) × (5)

$$\frac{\omega_1}{\omega_2} \times \frac{\omega_3}{\omega_4} \times \frac{\omega_5}{\omega_5} = \frac{T_2}{T_1} \times \frac{T_4}{T_3} \times \frac{T_6}{T_5}.$$

$$SR = \frac{\omega_1}{\omega_6} = \frac{T_2 \times T_4 \times T_6}{T_1 \times T_3 \times T_5}$$

$$= \frac{\text{Product of No. of teeth on (followers) Driven}}{\text{Product of No of teeth on Drivers}}$$