



SNS COLLEGE OF TECHNOLOGY
COIMBATORE-35
DEPARTMENT OF MECHATRONICS ENGINEERING
19MCT203 MECHANICS OF MACHINES



UNIT – III
GEARS AND GEAR TRAINS

Classification of Toothed Wheels

The gears or toothed wheels may be classified as follows:

1. According to the position of axes of the shafts. The axes of the two shafts between which the motion is to be transmitted, may be

(a) Parallel, **(b)** Intersecting, and **(c)** Non-intersecting and non-parallel.

The two parallel and co-planar shafts connected by the gears is shown in Fig. These gears are called **spur gears** and the arrangement is known as **spur gearing**. These gears have teeth parallel to the axis of the wheel. Another name given to the spur gearing is **helical gearing**, in which the teeth are inclined to the axis. The single and double helical gears connecting parallel shafts are shown in Fig. 1 (a) and (b) respectively. The double helical gears are known as **herringbone gears**. A pair of spur gears are kinematically equivalent to a pair of cylindrical discs, keyed to parallel shafts and having a line contact.

The two non-parallel or intersecting, but coplanar shafts connected by gears is shown in Fig. 1 (c). These gears are called **bevel gears** and the arrangement is known as **bevel gearing**. The bevel gears, like spur gears, may also have their teeth inclined to the face of the bevel, in which case they are known as **helical bevel gears**.

The two non-intersecting and non-parallel *i.e.* non-coplanar shaft connected by gears is shown in Fig. 1(d). These gears are called **skew bevel gears** or **spiral gears** and the arrangement is known as **skew bevel gearing** or **spiral gearing**. This type of gearing also have a line contact, the rotation of which about the axes generates the two pitch surfaces known as **hyperboloids**.

Notes: **(a)** When equal bevel gears (having equal teeth) connect two shafts whose axes are mutually perpendicular, then the bevel gears are known as **mitres**.

(b) A hyperboloid is the solid formed by revolving a straight line about an axis (not in the same plane), such that every point on the line remains at a constant distance from the axis.

(c) The worm gearing is essentially a form of spiral gearing in which the shafts are usually at right angles.

2. According to the peripheral velocity of the gears. The gears, according to the peripheral velocity of the gears may be classified as:

(a) Low velocity, (b) Medium velocity, and (c) High velocity.

The gears having velocity less than 3 m/s are termed as **low velocity** gears and gears having velocity between 3 and 15 m/s are known as **medium velocity gears**. If the velocity of gears is more than 15 m/s, then these are called **high speed gears**.

3. According to the type of gearing. The gears, according to the type of gearing may be classified as:

(a) External gearing, (b) Internal gearing, and (c) Rack and pinion.

In **external gearing**, the gears of the two shafts mesh externally with each other as shown in Fig. 2 (a). The larger of these two wheels is called **spur wheel** and the smaller wheel is called **pinion**. In an external gearing, the motion of the two wheels is always **unlike**, as shown in Fig. 2 (a).

In **internal gearing**, the gears of the two shafts mesh **internally** with each other as shown in Fig. 2. (b). The larger of these two wheels is called **annular wheel** and the smaller wheel is called **pinion**. In an internal gearing, the motion of the two wheels is always **like**, as shown in Fig. 2 (b).

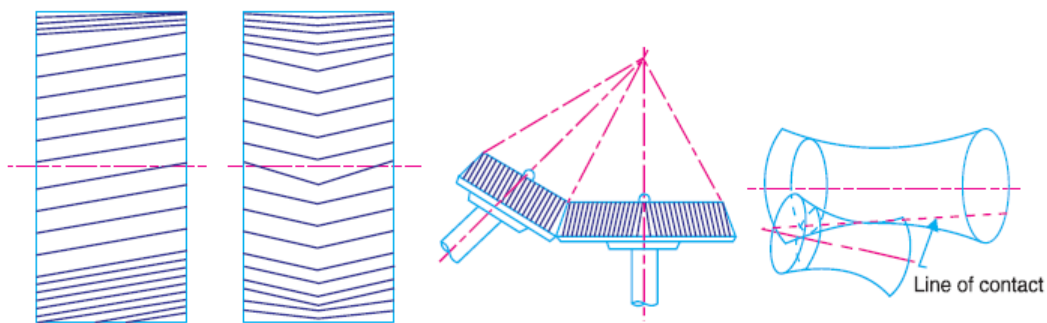


Fig. 1 (a) Single helical gear. (b) Double helical gear. (c) Bevel gear. (d) Spiral gear.

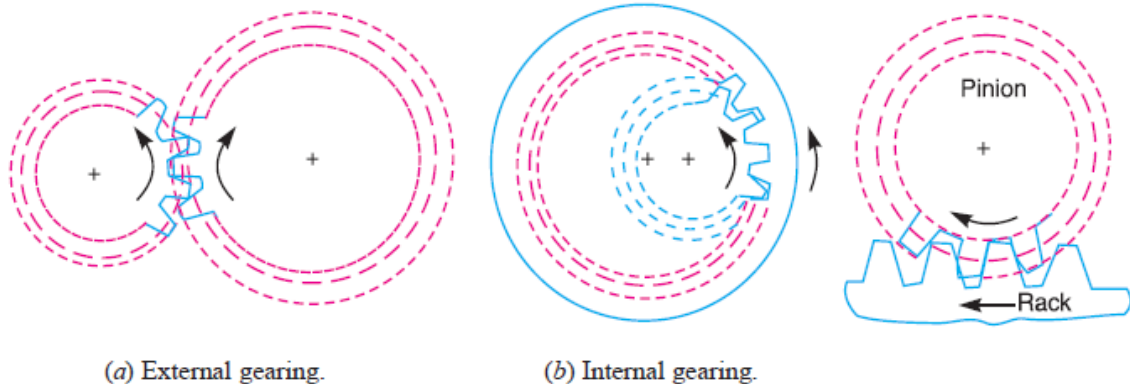


Fig. 2

Fig. 3. Rack and pinion.

Sometimes, the gear of a shaft meshes externally and internally with the gears in a straight line, as shown in Fig. 3. Such type of gear is called **rack and pinion**. The straight line gear is called rack and the circular wheel is called pinion. A little consideration will show that with the help of a rack and pinion, we can convert linear motion into rotary motion and **vice-versa** as shown in Fig.3.

4. According to position of teeth on the gear surface. The teeth on the gear surface may be (a) straight, (b) inclined, and (c) curved.

The spur gears have straight teeth whereas helical gears have their teeth inclined to the wheel rim. In case of spiral gears, the teeth are curved over the rim surface.

Terms Used in Gears

1. Pitch circle. It is an imaginary circle which by pure rolling action, would give the same motion as the actual gear.

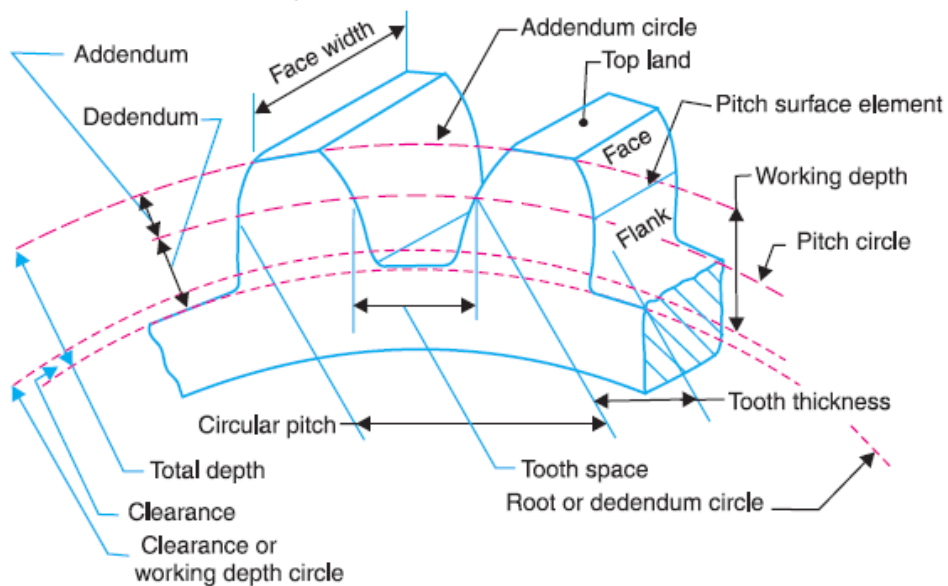


Fig. 4. Terms used in gears.