

2.7.4 Other Special Gears

1. Face Gear

This is a pseudobevel gear that is limited to 90° intersecting axes. The face gear is a circular disc with a ring of teeth cut in its side face; hence the name face gear. Tooth elements are tapered towards its center. The mate is an ordinary spur gear. It offers no advantages over the standard bevel gear, except that it can be fabricated on an ordinary shaper gear generating machine.



Fig. 2-19 Face Gear

2. Double Enveloping Worm Gear

This worm set uses a special worm shape in that it partially envelops the worm gear as viewed in the direction of the worm gear axis. Its big advantage over the standard worm is much higher load capacity. However, the worm gear is very complicated to design and produce, and sources for manufacture are few.

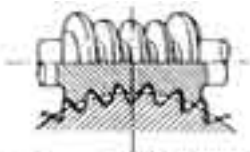


Fig. 2-20 Double Enveloping Worm Gear

3. Hypoid Gear

This is a deviation from a bevel gear that originated as a special development for the automobile industry. This permitted the drive to the rear axle to be nonintersecting, and thus allowed the auto body to be lowered. It looks very much like the spiral bevel gear. However, it is complicated to design and is the most difficult to produce on a bevel gear generator.



Fig. 2-21 Hypoid Gear

SECTION 3 DETAILS OF INVOLUTE GEARING

3.1 Pressure Angle

The pressure angle is defined as the angle between the line-of-action (common tangent to the base circles in Figures 2-3 and 2-4) and a perpendicular to the line-of-centers. See Figure 3-1. From the geometry of these figures, it is obvious that the pressure angle varies (slightly) as the center distance of a gear pair is altered. The base circle is related to the pressure angle and pitch diameter by the equation:

$$d_b = d \cos \alpha \quad (3-1)$$

where d and α are the standard values, or alternately:

$$d_b = d' \cos \alpha' \quad (3-2)$$

where d' and α' are the exact operating values.

The basic formula shows that the larger the pressure angle the smaller the base circle. Thus, for standard gears, 14.5° pressure angle gears have base circles much nearer to the roots of teeth than 20° gears. It is for this reason that 14.5° gears encounter greater undercutting problems than 20° gears. This is further elaborated on in SECTION 4.3.

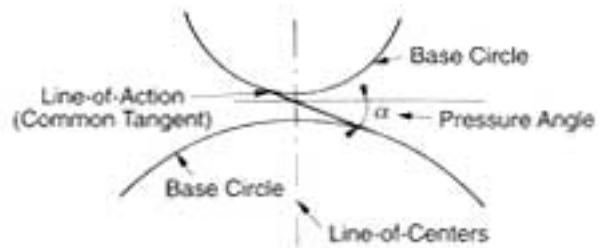


Fig. 3-1 Definition of Pressure Angle

3.2 Proper Meshing And Contact Ratio

Figure 3-2 shows a pair of standard gears meshing together. The contact point of the two involutes, as Figure 3-2 shows, slides along the common tangent of the two base circles as rotation occurs. The common tangent is called the line-of-contact, or line-of-action.

A pair of gears can only mesh correctly if the pitches and the pressure angles are the same. Pitch comparison can be made by the equation:

That the pressure angles must be identical becomes obvious from the following equation for base pitch:

$$P_b = \pi m \cos \alpha \quad (3-3)$$

Thus, if the pressure angles are different, the base pitches cannot be identical.

The length of the line-of-action is shown as ab in Figure 3-2.

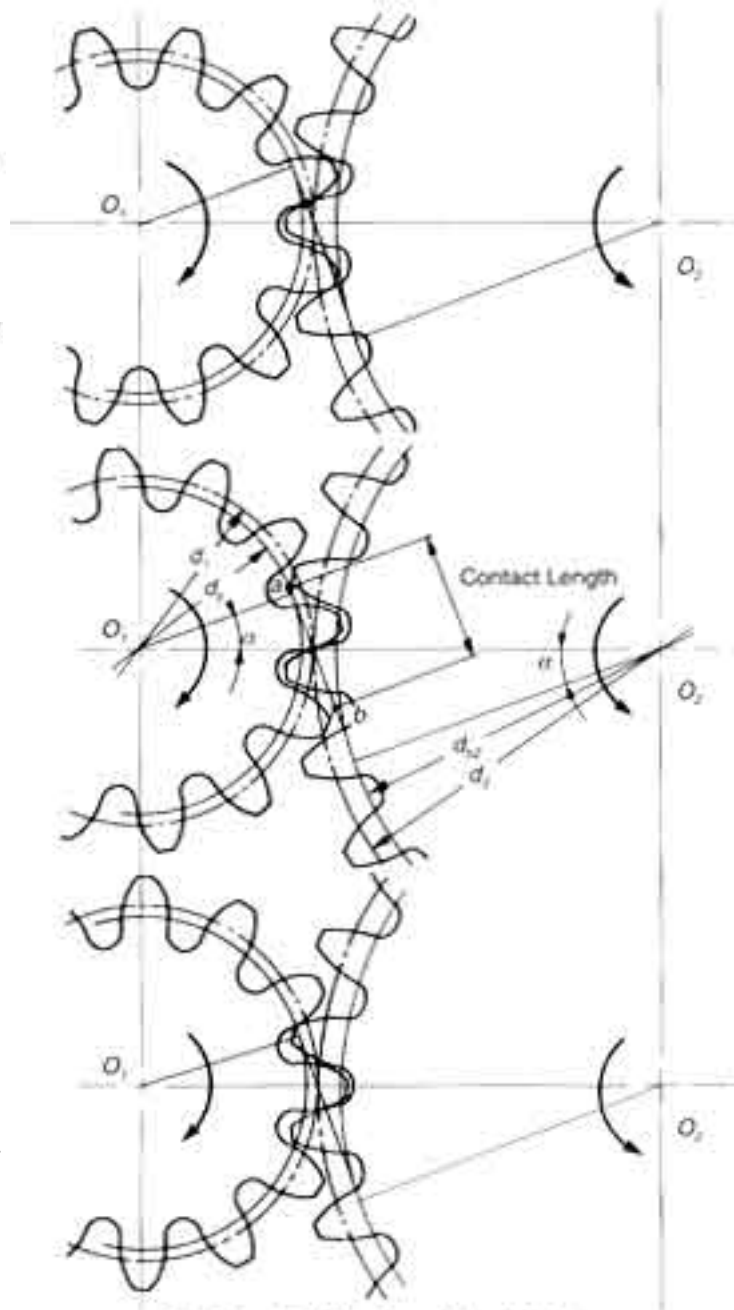


Fig. 3-2 The Meshing of Involute Gear