Elements of spur gear

Objectives : At the end of this lesson you shall be able to
- **state the basic elements of a spur gear**
- **calculate spur gear tooth proportions with the given data.**

Spur gear elements

A spur gear is the simplest form of gears. The tooth proportions of the spur gears are expressed in terms of modules.

Module

It is defined as the ratio of the pitch diameter to the number of teeth of a gear. The module is denoted by the letter 'm' and is expressed in millimetres. The module is one of the major determining parameters of a gear.

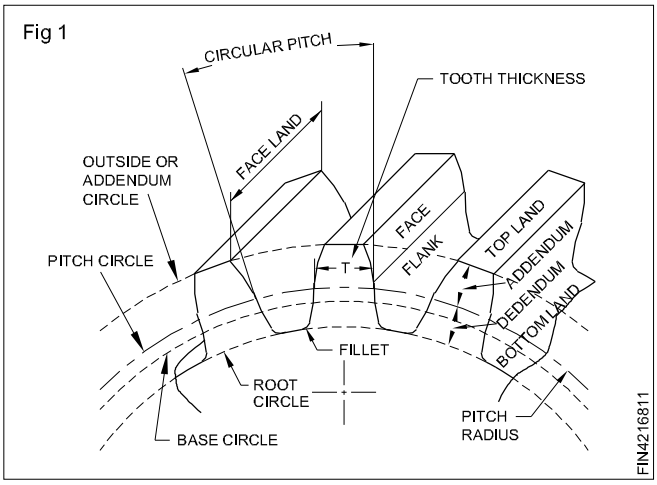
Basic Elements (Fig 1)

Pitch circle

It is the imaginary circle on which two mating gears seems to be rolling.

The gear calculations are based on this circle.

Fig 1



Circular pitch: 'CP or 'P'

It is the distance from the point of one tooth to the corresponding point of the adjacent tooth measured on pitch circle.

Pitch circle diameter (PCD)

The diameter is called pitch circle diameter (PCI) or simply pitch diameter.

It is denoted by the letter 'd' with proper subscripts *eg.* d1 for pinion and d2 for the matting gear.

Addendum circle

Addendum circle or outside circle bounds the outer edges of the teeth of a gear and its diameter is denoted by 'da'.

Root circle

The root circle or dedendum circle bounds the bottom of the teeth and its diameter is denoted by 'df'.

Base circle ('db')

This is the circle from which the involute tooth profile is developed. Its diameter is denoted by db.

Addendum (ha) (Fig 2)

It is the radial distance between the pitch circle and the addendum circle and is denoted by ha.

Dedendum (hf) (Fig 2)

It is the radial distance between the pitch circle and the root circle, and is denoted by hf.

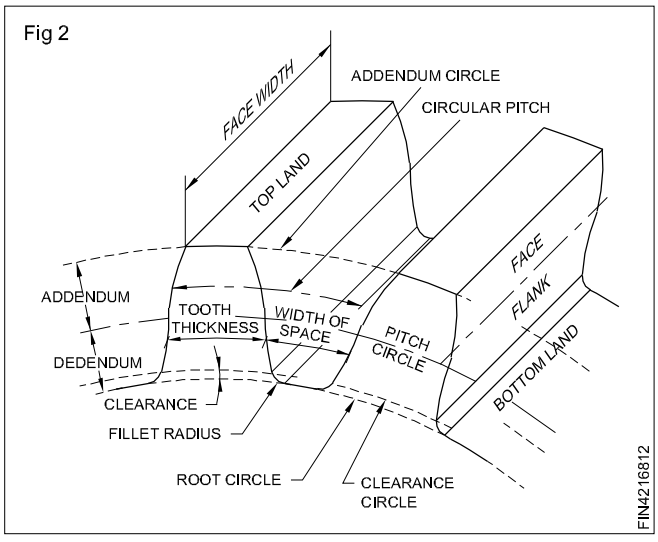
Land (Fig 2)

The land and the bottom land are surfaces at the top of the tooth and the bottom of the tooth space respectively.

Working depth (Fig 2)

This is the distance of engagement of two mating teeth and is equal to the sum of addendums of the mating teeth of the two gears in the case of standard systems and is expressed as '2ha'.

Fig 2

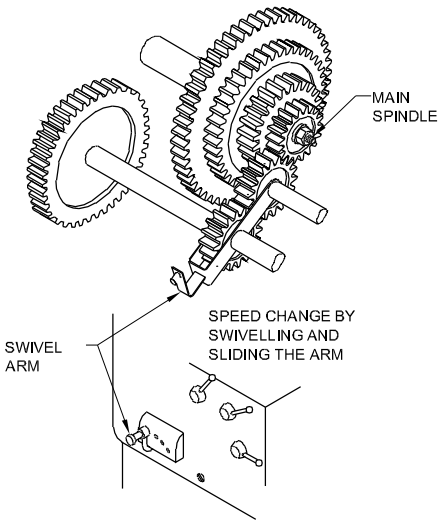


Velocity ratio of gear train

The gear train transmits motion without slip.

Different speeds can be obtained by shifting gear position in the gear- box. Fig 3 shows the feed change by swivelling and sliding the swivel arm in the Norton gearbox of lathes.

Fig 3



Formula for velocity ratio of gear train

$N_1 T_1 = N_2 T_2$

where

N_1 = RPM of driver gear

T_1 = number of teeth in the driver gear

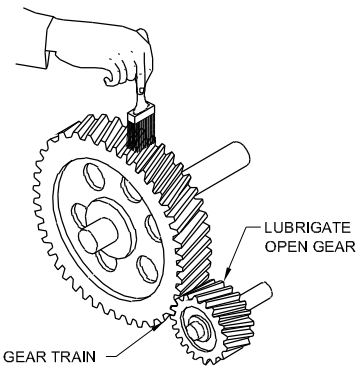
N_2 = rpm of the follower/driven gear

T_2 = number of teeth in the driven gear.

Lubrication of gear train

The low speed gears which are visible may be lubricated with an oilcan or brush. (Fig 4) The drop oil method of lubrication is shown in Fig 5.

Fig 4



The enclosed gear trains should be packed in grease or run in an oil bath. (Fig 6)

Fig 5

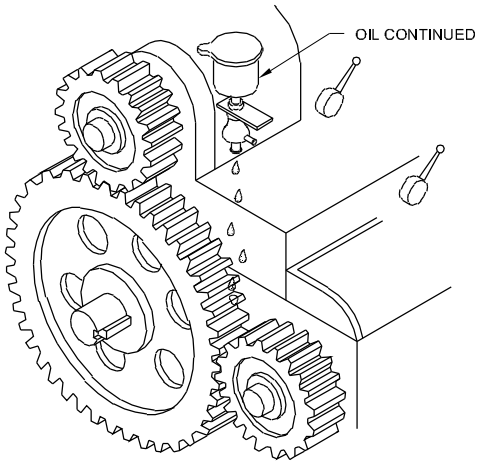
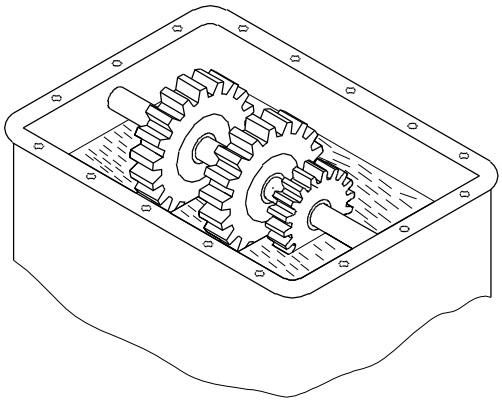


Fig 6



In the case of big gearboxes mounted with different levels of gear sets,they are provided with oil pumps for lubrication purposes. (Fig 7)

Fig 7