GEARS

A gear or more correctly a "gear wheel" is a rotating machine part having cut teeth, or cogs, which mesh with another toothed part in order to transmit torque.

The gears in a transmission are analogous to the wheels in a pulley. An advantage of gears is that the teeth of a gear prevent slipping

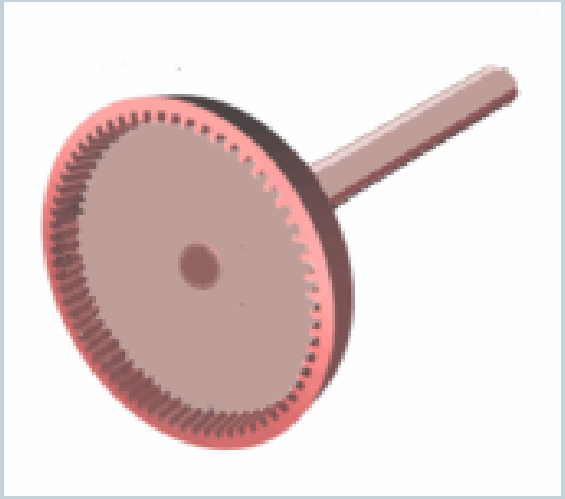
Gears are toothed members which transmit power / motion between two shafts by meshing without any slip. Hence, gear drives are also called positive drives. In any pair of gears, the smaller one is called pinion and the larger one is called gear immaterial of which is driving the other.

In transmissions which offer multiple gear ratios, such as bicycles and cars, the term gear, as in first gear, refers to a gear ratio rather than an actual physical gear. The term is used to describe similar devices even when gear ratio is continuous rather than discrete, or when the device does not actually contain any gears, as in a continuously variable transmission.

When pinion is the driver, it results in step down drive in which the output speed decreases and the torque increases. On the other hand, when the gear is the driver, it results in step up drive in which the output speed increases and the torque decreases.

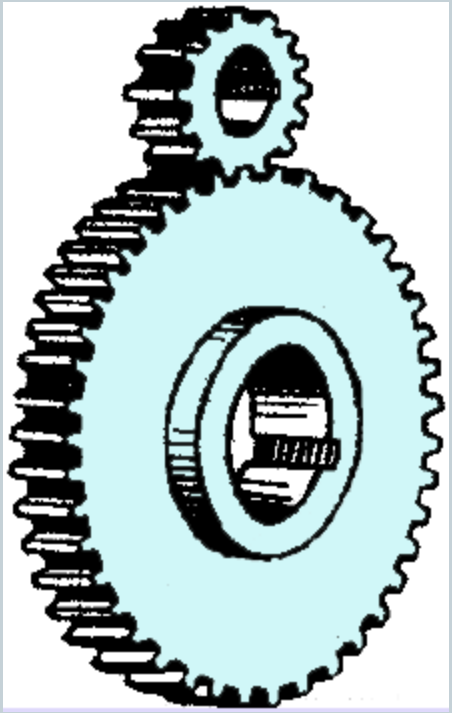
Types

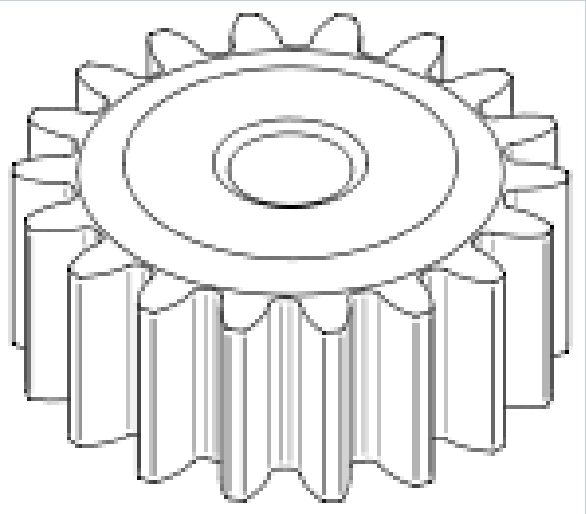
External gears
An external gear is one with the teeth formed on the outer surface of a cylinder or cone. Conversely, an internal gear is one with the teeth formed on the inner surface of a cylinder or cone. For bevel gears, an internal gear is one with the pitch angle exceeding 90 degrees.
Internal gears do not cause direction reversal



Spur gears are used for transmitting power between two parallel shafts.

Spur gears or *straight-cut gears* are the simplest type of gear. They consist of a cylinder or disk with the teeth projecting radially, and although they are not straight-sided in form, the edge of each tooth is straight and aligned parallel to the axis of rotation. These gears can be meshed together correctly only if they are fitted to parallel shafts

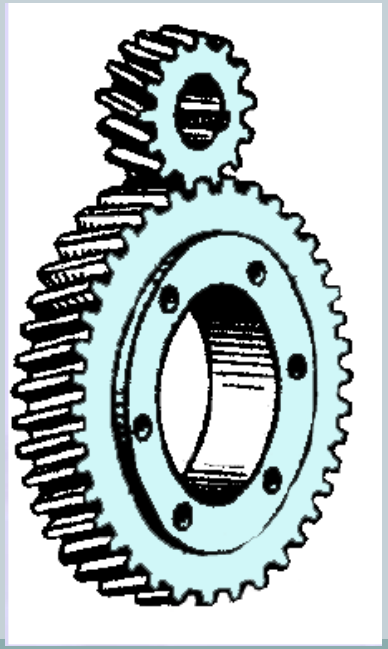




Applications

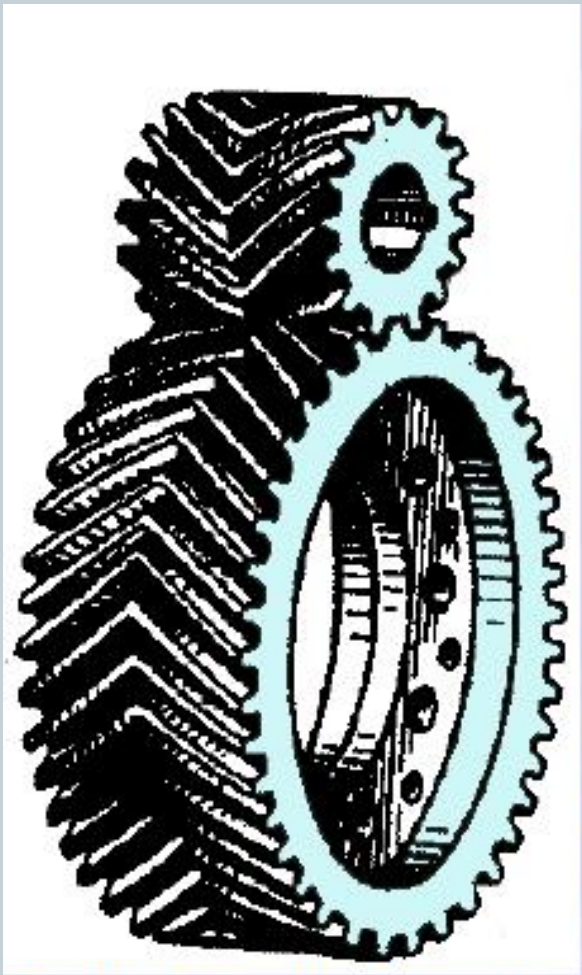
- Clocks,
- Household gadgets,
- Motor cycles,
- Automobiles,
- Railways
- aircrafts.

Helical gears offer a refinement over spur gears. The leading edges of the teeth are not parallel to the axis of rotation, but are set at an angle. Since the gear is curved, this angling causes the tooth shape to be a segment of a helix. Helical gears can be meshed in a parallel or crossed orientations. The former refers to when the shafts are parallel to each other; this is the most common orientation. In the latter, the shafts are non-parallel, and in this configuration are sometimes known as "skew gears"



Double helical gears, or *herringbone gear*, overcome the problem of axial thrust presented by "single" helical gears by having two sets of teeth that are set in a V shape. Each gear in a double helical gear can be thought of as two standard mirror image helical gears stacked. This cancels out the thrust since each half of the gear thrusts in the opposite direction. Double helical gears are more difficult to manufacture due to their more complicated shape.

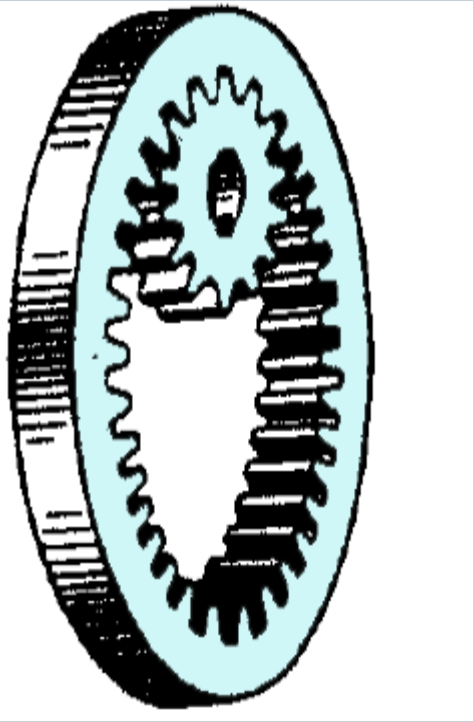
Double helical or Herringbone gears used for transmitting power between two parallel shafts. They have opposing helical teeth with or without a gap depending on the manufacturing method adopted . the shaft is free from any axial force.
Though their load capacity is very high, manufacturing difficulty makes them costlier than single helical gear. Their applications are limited to high capacity reduction drives like that of cement mills and crushers,



Internal gears are used for transmitting power between two parallel shafts. In these gears, annular wheels are having teeth on the inner periphery. This makes the drive very compact .

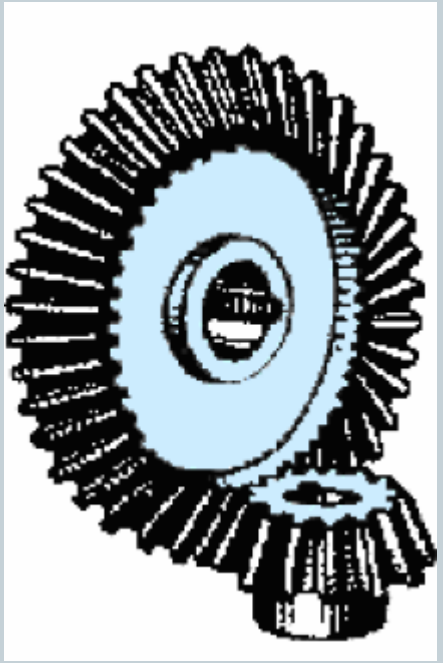
Their precision rating is fair. They are useful for high load and high speed application with high reduction ratio.

They are not recommended for precision meshes because of design, fabrication, and inspection limitations



Straight bevel gears are used for transmitting power between intersecting shafts,

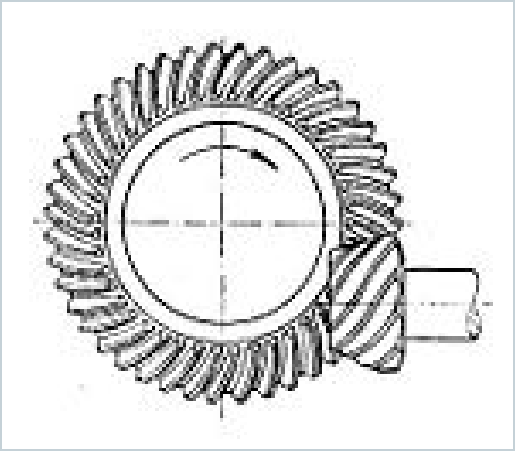
They are suitable for 1:1 and higher velocity ratios and for right-angle meshes to any other angles. Their good choice is for right angle drive of particularly low ratios. However, complicated both form and fabrication limits achievement of precision. They should be located at one of the less critical meshes of the train. Wide application of the straight bevel drives is in automotive differentials, right angle drives of blenders and conveyors.



Straight bevel gears are used for transmitting power between intersecting shafts,

A Spiral Bevel Gear is shaped like a right circular cone with most of its tip cut off. When two bevel gears mesh their imaginary vertices must occupy the same point. Their shaft axes also intersect at this point, forming an arbitrary non-straight angle between the shafts. The angle between the shafts can be anything except zero or 180 degrees. Bevel gears with equal numbers of teeth and shaft axes at 90 degrees are called miter gears. They can operate under high speeds and high loads.

Hypoid gears resemble spiral bevel gears except the shaft axes do not intersect. The pitch surfaces appear conical but, to compensate for the offset shaft, are in fact hyperboloids of revolution.[8][9] Hypoid gears are almost always designed to operate with shafts at 90 degrees. Depending on which side the shaft is offset to, relative to the angling of the teeth, contact between hypoid gear teeth may be even smoother and more gradual than with spiral bevel gear teeth



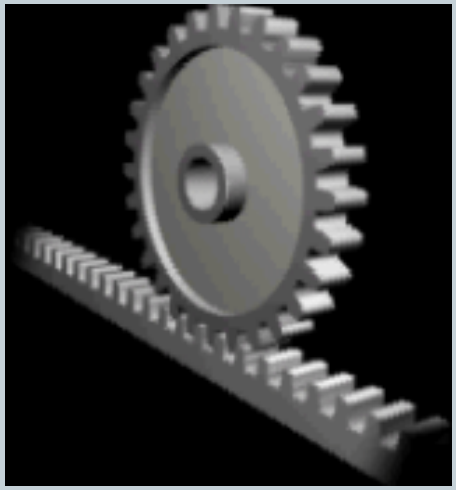
These gears are also used for right angle drive in which the axes do not intersect. This permits the lowering of the pinion axis which is an added advantage in automobile in avoiding hump inside the automobile drive line power transmission. However, the non – intersection introduces a considerable amount of sliding and the drive requires good lubrication to reduce the friction and wear

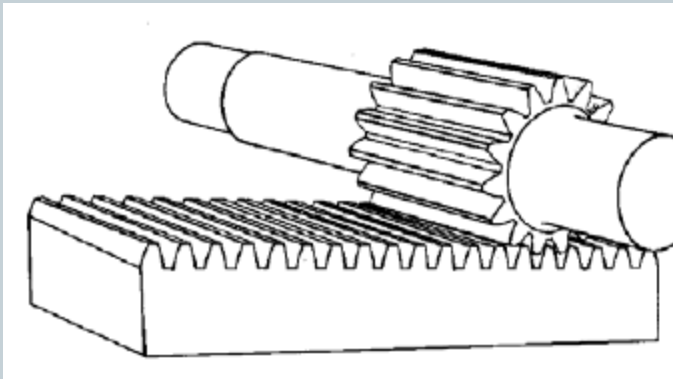
Crown gears or contrate gears are a particular form of bevel gear whose teeth project at right angles to the plane of the wheel; in their orientation the teeth resemble the points on a crown. A crown gear can only mesh accurately with another bevel gear, although crown gears are sometimes seen meshing with spur gears. A crown gear is also sometimes meshed with an escapement such as found in mechanical clocks.

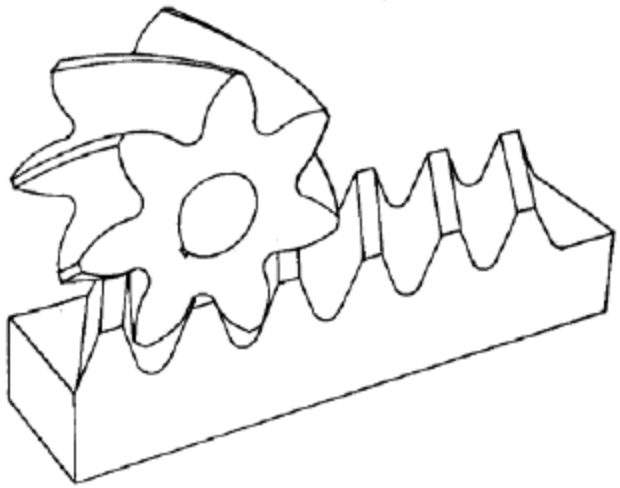
Worm gears can be considered a species of helical gear, but its helix angle is usually somewhat large (close to 90 degrees) and its body is usually fairly long in the axial direction; and it is these attributes which give it its screw like qualities. The distinction between a worm and a helical gear is made when at least one tooth persists for a full rotation around the helix. If this occurs, it is a 'worm'; if not, it is a 'helical gear'. A worm may have as few as one tooth. If that tooth persists for several turns around the helix, the worm will appear, superficially, to have more than one tooth, but what one in fact sees is the same tooth reappearing at intervals along the length of the worm. The usual screw nomenclature applies: a one-toothed worm is called single thread or single start; a worm with more than one tooth is called multiple thread or multiple start. The helix angle of a worm is not usually specified. Instead, the lead angle, which is equal to 90 degrees minus the helix angle, is given.

Rack is a segment of a gear of infinite diameter.

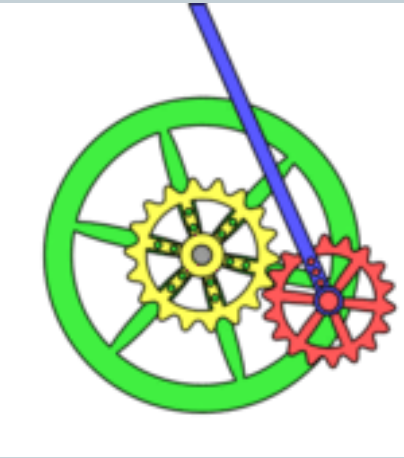
A rack is a toothed bar or rod that can be thought of as a sector gear with an infinitely large radius of curvature. Torque can be converted to linear force by meshing a rack with a pinion: the pinion turns; the rack moves in a straight line. Such a mechanism is used in automobiles to convert the rotation of the steering wheel into the left-to-right motion of the tie rod(s). Racks also feature in the theory of gear geometry, where, for instance, the tooth shape of an interchangeable set of gears may be specified for the rack (infinite radius), and the tooth shapes for gears of particular actual radii then derived from that. The rack and pinion gear type is employed in a rack railway

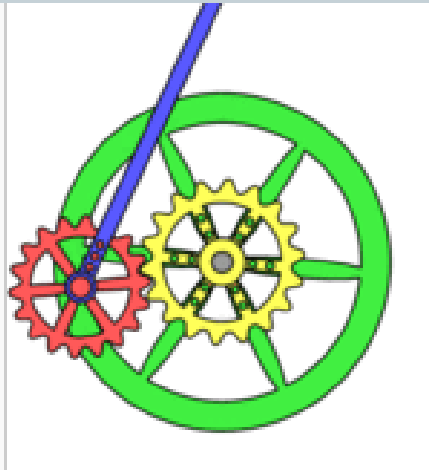




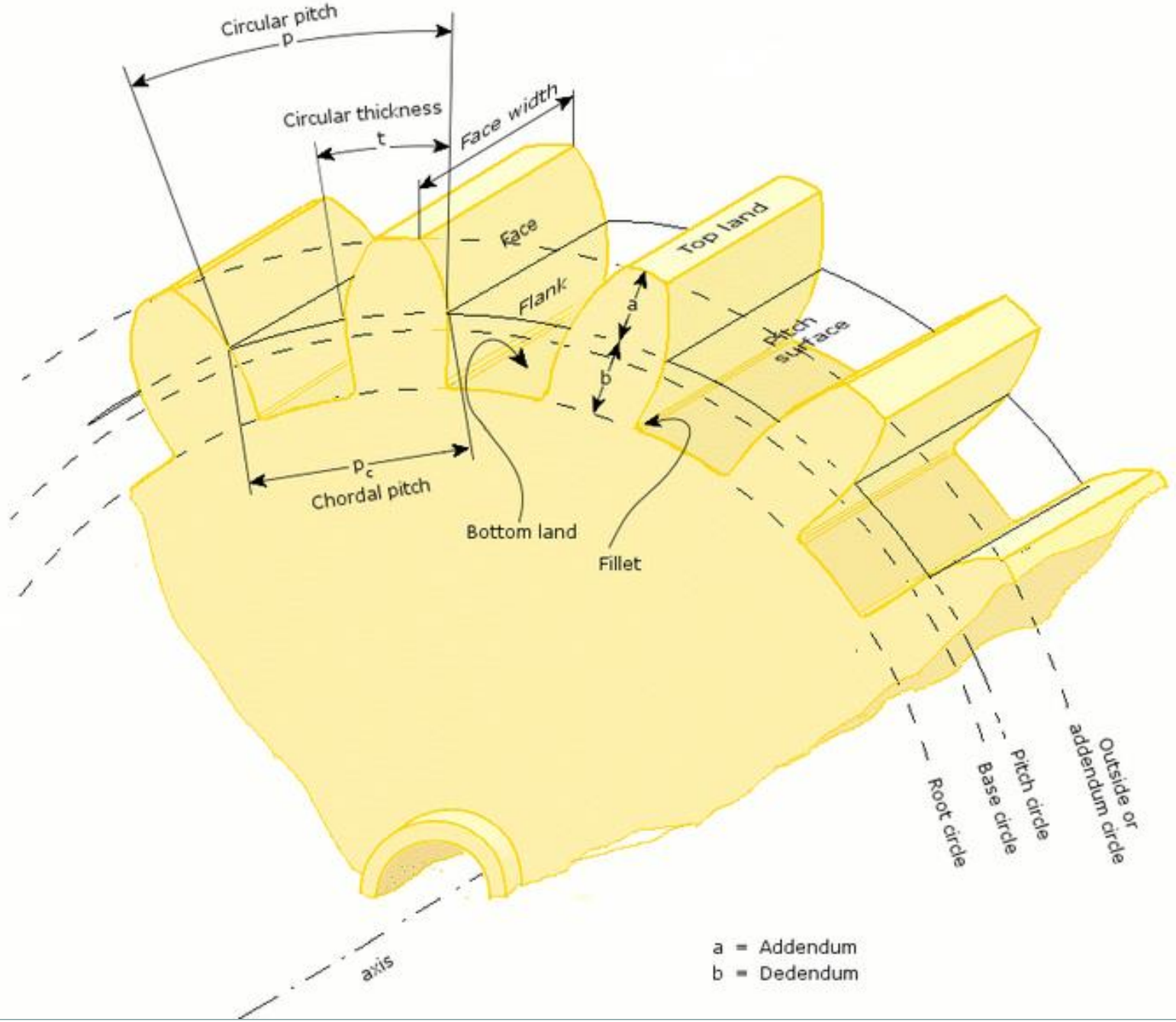


Sun and planet gearing was a method of converting reciprocal motion into rotary motion in steam engines. It played an important role in the Industrial Revolution. The Sun is yellow, the planet red, the reciprocating crank is blue, the flywheel is green and the driveshaft is grey.





A *cage gear*, also called a *lantern gear* or *lantern pinion* has cylindrical rods for teeth, parallel to the axle and arranged in a circle around it, much as the bars on a round bird cage or lantern. The assembly is held together by disks at either end into which the tooth rods and axle are set.


Circular pitch
p
Circular thickness
t
Face width
Face
Flank
Top land
a
b
Pitch surface
p_c
Chordal pitch
Bottom land
Fillet
Root circle
Base circle
Pitch circle
Outside or addendum circle
axis
a = Addendum
b = Dedendum