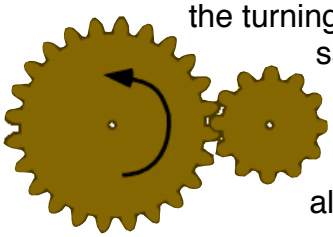
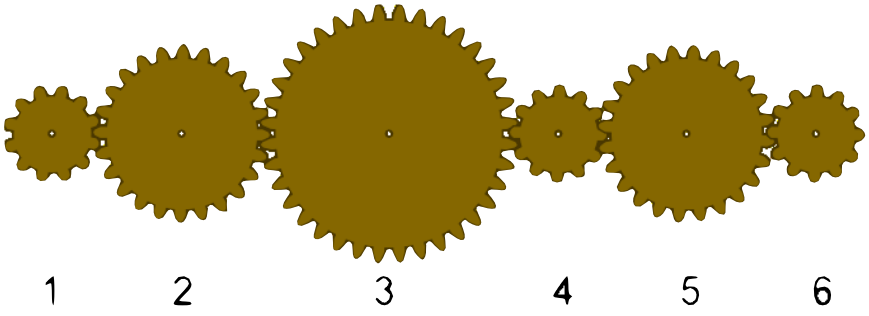
Gears

1.A gear is a toothed wheel or, less commonly, an object of some other shape with teeth cut into it, for example, a cylinder or cone. Gears are usually fastened to axles or shafts and are used to transmit rotational motion from one shaft to another. In doing this, gears change the direction of the force applied and may also change the magnitude of the force. They thus function as a machine. In fact, they are often considered a form of the wheel and axle, one of the basic simple machines.

2.When two gears are arranged so that the teeth of one mesh, or mate, with the teeth of the other, the turning of one gear will cause the other one to turn also. If the two gears have the same number of teeth, they will turn at the same rate of rotation (angular velocity), and the applied force and turning effort (torque) are changed in direction but not in magnitude. If the gears have different numbers of teeth, however, the magnitude of the torque and the angular velocity are also changed.

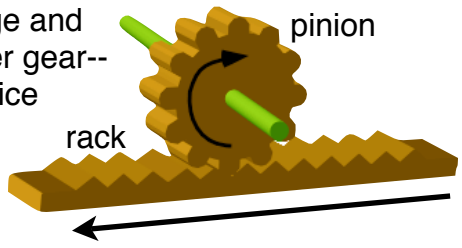


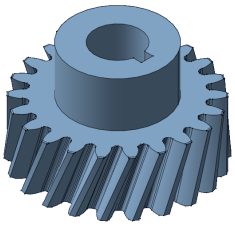
3.A small gear (one with fewer teeth) that drives a larger one (with more teeth) will increase the torque and reduce the speed of the driven gear. The opposite arrangement (a larger gear driving a smaller gear) will decrease the torque while increasing the speed. As with other machines these effects can be described in terms of the mechanical advantage of the system, which is the ratio of the torque of the driven shaft to that of the driving shaft.



4.There are numerous types of gears to suit various applications. They differ in the arrangement of the teeth, the orientation of the axles, and the angle at which the teeth mesh. Spur gears are perhaps the simplest, with the teeth cut parallel to the axle. They are used to connect parallel axles. A distinction is made between external spur gears, in which the teeth are outside the wheel and point away from the axle, and internal spur gears, or planetary gears, where the teeth are cut inside one of the wheels.

5.A rack-and-pinion arrangement may be considered to be an extreme case of external spur gears, where one of them--the rack--is infinitely large and becomes a flat strip with teeth in it. A rotational motion of the other gear--the pinion--is converted into straight-line motion of the rack and vice versa. This arrangement is used in steering systems for some automobiles, in machine tools, and on some steep railroads, where teeth on the locomotive wheels mesh with a rack imbedded in the ground, giving the locomotive improved traction.





6.Helical gears are like spur gears except that the teeth are oblique (at an angle) to the axle rather than parallel to it. They operate more quietly, can transmit heavier loads, and can couple shafts that are not parallel. They are used in most automobile transmissions.

7.Bevel gears have teeth cut from a conical shape. They can transmit power between axles that are not parallel; in particular, they are effective for axles at right angles, such as in the differential in the power train of automobiles, machine tools, and sewing machines.

8.A worm-gear system consists of a worm pinion (a threaded cylinder with the threads running around the cylindrical axle, which is essentially a screw) that usually meshes at right angles with a spur gear. When the worm pinion drives the spur gear, there is a large reduction in speed and increase in torque.

Bibliography: Drago, R.A., Fundamentals of Gear Design (1988); Dudley, Darle W., Handbook of Practical Gear Design, rev. ed. (1984);