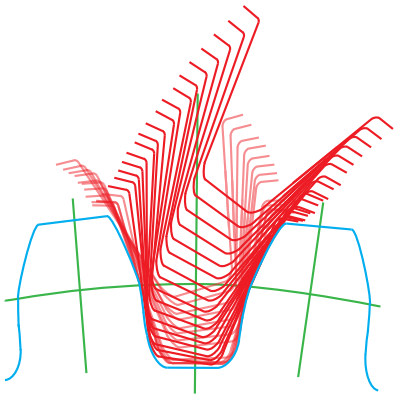


# How Gear Hobbing Works

Hobbing is one of the most fundamental processes in gear manufacturing. Its productivity and versatility make hobbing the gear manufacturing method of choice for a majority of spur and helical gears.

One of the most important concepts to understand about gear hobbing is that it is a generating process. The term *generating* refers to the fact that the shape of the gear tooth that results is *not* the conjugate form of the cutting tool. Rather, the shape of the tooth is generated by the combined motions of workpiece and cutting tool. During hobbing, both the hob and the workpiece rotate in a continual, timed relationship.

For a spur gear being cut with a single-start hob, the workpiece will advance one tooth for each revolution of the cutter. When hobbing a 20-tooth gear, the hob will rotate 20 times, while the workpiece will rotate once. The profile is formed by the equally spaced cutting edges around the hob, each taking successive cuts on the workpiece, with the workpiece in a slightly different position for each cut. Several cutting edges of the tool will be cutting at the same time. Figure 1a demonstrates the path of the cutting tool (in red) relative to the work-

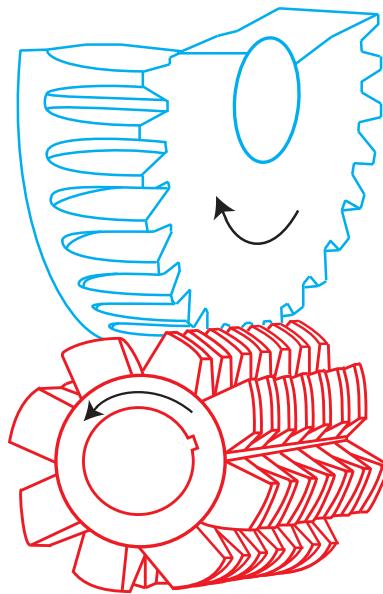


**Figure 1a** Hobbing is a generating process. The relative motions of the cutting tool and workpiece allow a tool with straight-sided cutting edges—the hob—to generate an involute curve.

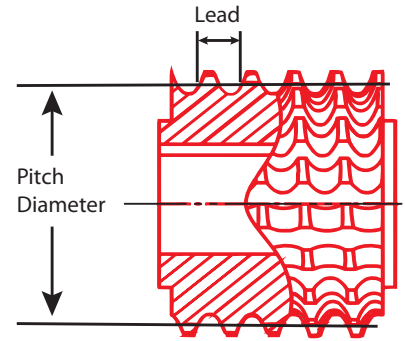
piece (in blue). As can be seen from the figure, the relative motions of the cutting tool and workpiece are what allow a straight-sided tool—the hob—to generate an involute curve.

During this rotation, the hob is typically fed axially with all the teeth being gradually formed as the tool traverses the work face (Fig. 1b).

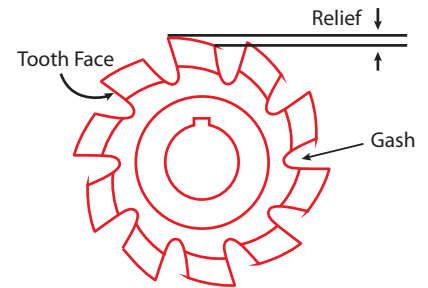
The hob itself is basically a worm with gashes cut across it to produce the cutting edges (Fig. 2a). Each cutting tooth is also relieved radially to provide chip clearance behind the cutting edge (Fig. 2b). This also allows the hob face to be sharpened and still maintain the original tooth shape. In its simplest form, the hob tooth takes on the shape of a straight-sided rack tooth (Fig. 2c). The final profile of the tooth is created by a number of flats blending together. The number of flats corresponds to the number of cutting gashes which pass the workpiece cutting tooth during a single rotation. Thus, the greater the number of gashes in the hob, the greater the number of flats along the profile, which improves the “smoothness” of the tooth profile.



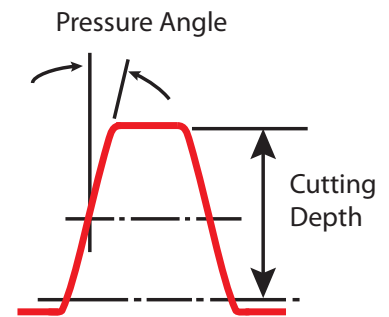
**Figure 1b** Hob and workpiece each rotate during the hobbing process. For a spur gear being cut with a single-start hob, the workpiece will advance one tooth for each revolution of the cutter.



**Figure 2a** The hob is basically a worm with gashes cut across it to produce the cutting edges.




**Figure 2b** This side view of a hob shows how each cutting tooth is relieved radially to provide chip clearance behind the cutting edge.



**Figure 2c** In its simplest form, the hob tooth takes on the shape of a straight-sided rack tooth.

## Where Can I Learn More?

The material in this Back-to-Basics Brief was adapted primarily from “The Gear Hobbing Process,” by Dennis Gimpert, which appeared in the January/February 1994 issue of *Gear Technology*. The original article goes into much greater detail about cutter modifications, hobbing machine mechanics, different hob feed approaches, multi-start hobs and hob thread-spacing errors. 

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