

How a Saw Cuts

The teeth of a saw function like a series of knives, making progressive simultaneous parallel cuts and releasing the wood between them (figure 8). These teeth perform three functions. They:

- Cut the wood fibers
- Break the cut fibers loose
- Remove the fibers from the kerf

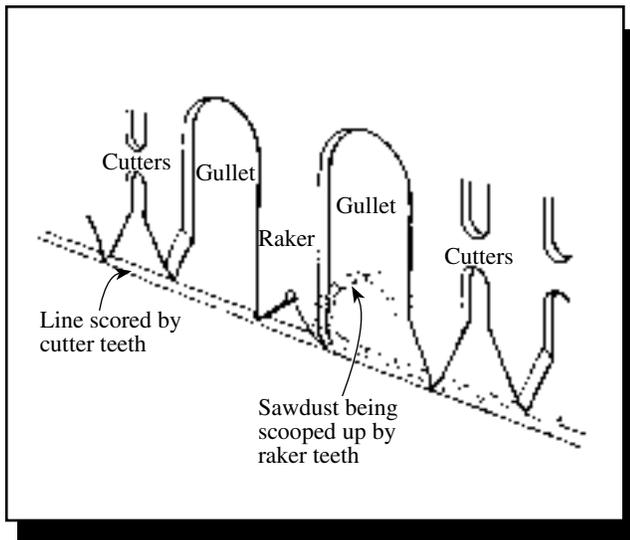


Figure 8—The way that the teeth of a crosscut saw work.—*Saws and Sawmills for Planters and Growers, with permission of John M. Morris*

Cutter Teeth

All saws, regardless of the tooth pattern, are made up of two rows of cutting edges. The saw releases wood fibers on each side of the kerf as it passes through a log. Cutters (figure 9) work best in brittle, seasoned wood. The weakened fiber is easily removed.

Rakers

Wet or green wood is hard to remove from the kerf because it is resilient. Even when the fiber is dislodged, it clogs a saw's cutter teeth.

A special kind of tooth, the raker, allows the cutter teeth to work more effectively with less effort. I prefer saws with rakers for general work in the woods.

Even though the rakers don't sever fiber, they perform the other two functions of saw teeth: breaking loose the cut

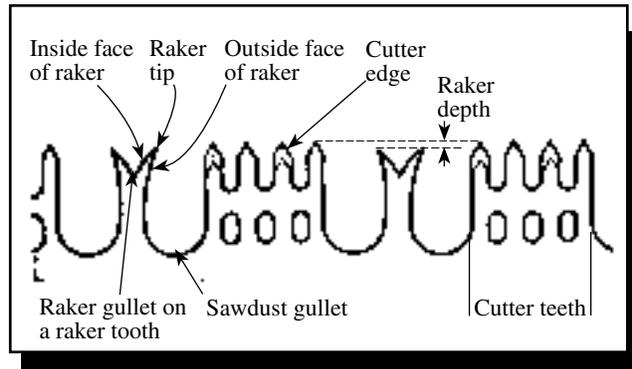


Figure 9—The configuration of the teeth of a crosscut saw. This is the perforated-lance tooth pattern.

fiber and removing it from the log. Rakers remove material whether the saw is being pushed or pulled.

When rakers are shaped properly and their depth has been set accurately, they pull out long shavings of wood rather than sawdust (figure 10).



Figure 10—Long, clean shavings like these indicate a well-sharpened saw. In some parts of the country these shavings are called *noodles*.

Teeth that Both Cut and Rake

Some saws have teeth that both cut and rake. These teeth are asymmetrical (not uniform). One face is bevel filed to be the cutter while another face is filed almost flat to be the raker. The M tooth and Great American patterns are examples (figure 11). Teeth that are filed to both cut and rake are an improvement over the plain tooth in severing and removing wood fiber. However, these combination cutter-raker teeth

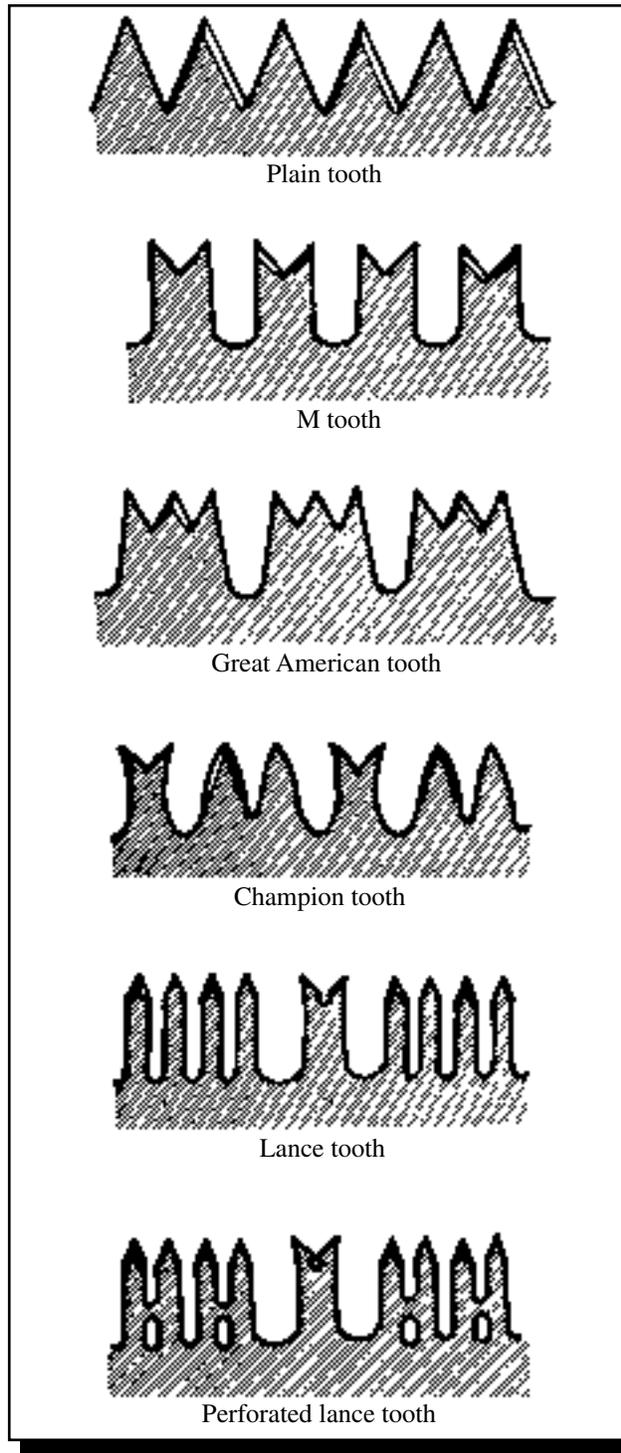


Figure 11—Common crosscut saw tooth patterns.

are a compromise. Without a raker to determine how far the tooth may penetrate, M tooth saws can cut very deeply and require a lot of strength to operate. While such an aggressive cutting action is appropriate for competition sawing, using such saws all day long for trail work is very fatiguing.

Gullets

Wood fiber that has been severed must be stored within the saw while the fiber is moved through the kerf. This storage area (the largest space between groups of cutters, or cutters and rakers) is called a gullet.

Gullets have a rounded shape so shavings will bend rather than break (figure 8). The gullet must be large enough to store all the shavings until the gullet clears the log and the shavings fall free. Saws that become worn out after repeated filings reduce the amount of shavings the gullet can hold.

The gullets determine the length of saw to use for a given application. For example, a gullet in the middle of a log 3 feet in diameter must travel $1\frac{1}{2}$ feet to allow its shavings to clear the log. At least a $6\frac{1}{2}$ - or 7-foot saw would be needed to allow the shavings to clear a log 3 feet in diameter if the saw is being used by two persons. A shorter saw can be used by a single sawyer.

Tooth Spacing

The teeth of most crosscut saws lie on an arc of a circle (figure 3). This is sometimes called the circle of the saw, or the arc of the saw. This arc makes cutting faster, easier, and smoother. Especially on larger trees, when more teeth are being used, the arc causes the teeth to share the workload progressively instead of all at once. The circle of the saw works in conjunction with the arc of the sawyer's arm to effectively deliver power to the saw teeth as the saw feeds itself into the log.

The spacing of the saw's teeth ranks in importance with tooth pattern. Saw designers had to consider questions such as:

- Is the tooth strong enough for the intended work?
- Are the gullets far enough apart to effectively pick up all the fibers severed by the cutters?

- Is there enough room for the teeth and rakers to be sharpened and maintained?
- What's the best way to reduce vibration and chatter so the saw cuts smoothly?

The answer to these questions centers on tooth spacing. Generally, the longer the saw, the larger the teeth and the wider the space between teeth. Knowing tooth spacing helps the sawyer select the proper length of saw. Larger crosscut saws, with more space between the teeth, work poorly on small branches. Likewise, a small saw with small, closely spaced teeth doesn't work well on large trees or logs.

Tooth Patterns

For centuries, only the plain tooth (or peg tooth) pattern was used. Modifications to the plain tooth pattern were developed to make the saw easier to use. We will discuss six patterns: the plain tooth, the M tooth, the Great American tooth, the champion tooth, the perforated lance tooth, and the lance tooth.

Plain Tooth (Peg Tooth) Pattern

This pattern just includes cutter teeth. It is best used for cutting dry, very hard, or brittle small-diameter wood. Examples include many bow saws and pruning saws. These saws do not have special large gullets for sawdust. The sawdust is carried out in the small spaces between the teeth. Wet or resinous sawdust can bind up this tooth pattern.

M Tooth Pattern

The M tooth, still manufactured today in a modified form for competition saws, dates back to the 1400s in southern Germany. This tooth is designed to cut the fiber, break the severed fiber, and clean out the shavings. The tooth pattern consists of pairs of teeth set alternately and separated by a gullet. The outer edges of the teeth (the legs of the M) are vertical and act like rakers. The inside edges of the M are filed to a bevel, making a point. This tooth pattern is best suited for cutting dry, medium-to-hard woods.

Great American Tooth Pattern

This pattern consists of a group of three teeth, each set alternately, separated by a gullet. It is sometimes called a crown tooth because of its shape. The Great American tooth pattern is designed to cut dry, medium-to-hard woods. A special file is used for these saws. The file can be purchased today and is called a crosscut file or a Great American file. The file is shaped somewhat like a teardrop. The thicker rounded edge is for filing out the gullets. The sides of the file are used to file the rakers and cutters. This file also can be used to sharpen other tooth patterns.

Champion Tooth Pattern

This pattern is especially popular in the hardwood regions of North America. It consists of two cutter teeth set alternately and an unset raker with a gullet between them. The cutters are wider and more massive than the lance tooth pattern, allowing heavy sawing in extra hard, dry, or frozen wood. The larger teeth are sharpened in more of an almond shape rather than in the pointed shape of a lance tooth.

Lance Tooth Pattern

The lance tooth pattern also may be called the racer or four-tooth pattern. For many years the lance tooth pattern was the standard for felling and bucking timber in the American West. It consists of groups of four cutters set alternately, separated by an unset raker with gullets on each side. The lance tooth pattern is best suited for cutting soft green timber, especially fir, spruce, and redwood.

Perforated-Lance Tooth Pattern

This tooth pattern is considered a general utility pattern that can cut all but hard and frozen wood. It consists of groups of four cutters set alternately separated by an unset raker with gullets on each side. The "bridges" between the teeth form the perforations that give the pattern its name. These bridges strengthen the teeth and reduce chatter when the saw is used to cut harder wood. The perforated-lance tooth pattern is sometimes called the racer pattern and old-timers called it the four-tooth pattern. It was popular historically in the pine country of the American West, and is still popular there.