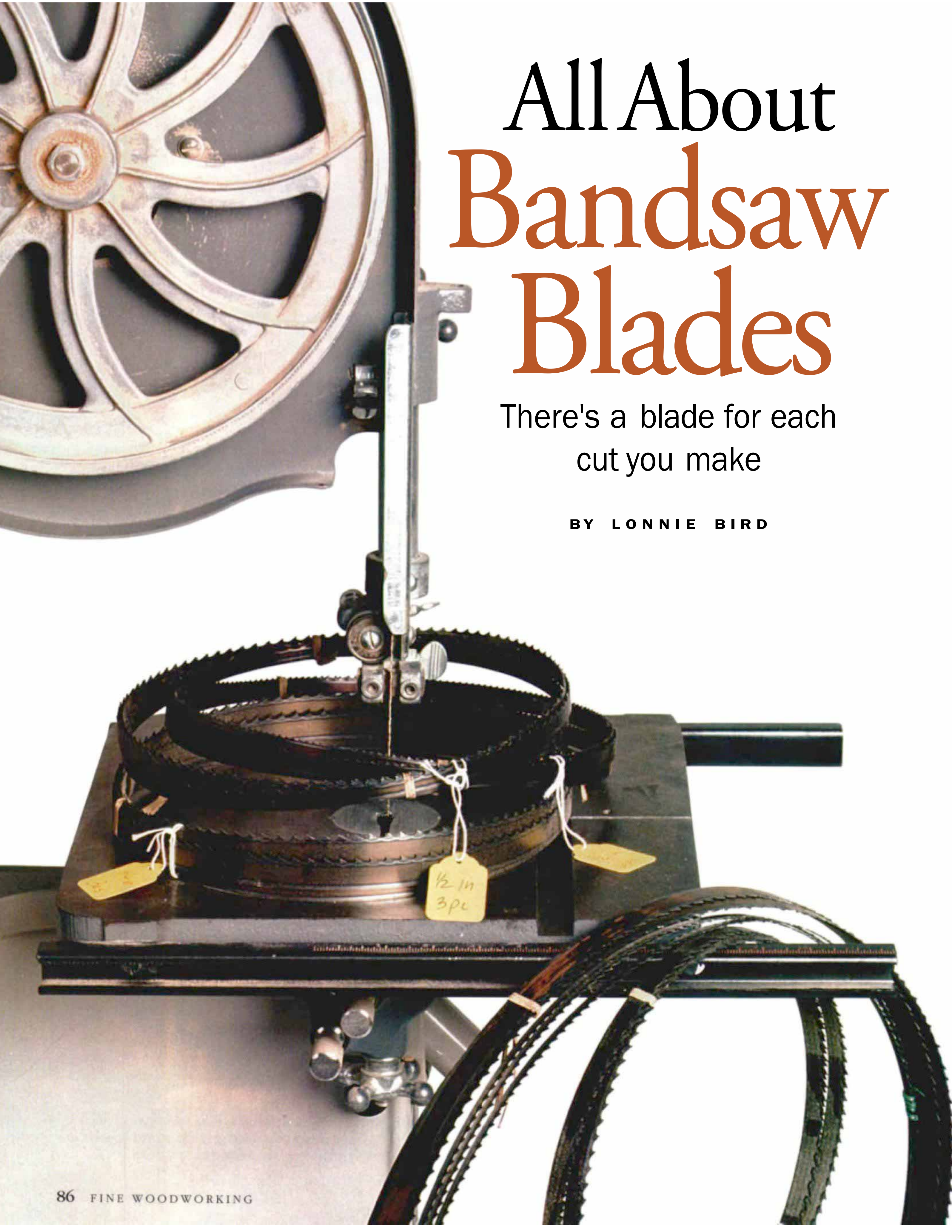


All About Bandsaw Blades

There's a blade for each cut you make

BY LONNIE BIRD

It didn't take long after I bought my first bandsaw to realize the importance of having the right blade. Whether you own an inexpensive home-shop bandsaw or the finest-quality industrial-grade bandsaw, the blade is, without a doubt, the most important part of the saw. An average bandsaw will cut much better when outfitted with a quality blade, but even the best bandsaw will disappoint with a poor blade.

The versatility we all desire from our bandsaws depends entirely on selecting the proper blade for the job at hand. Most of us probably mount a 50-tooth alternate-top bevel (ATB) combo blade on our tablesaw and leave it there until it needs resharpening. That one blade will miter, rip, crosscut and do just about anything else we need it to do. But this approach doesn't work on the bandsaw, where the blades are much more specialized. The best blade for cutting the contours of a cabriole leg won't accurately resaw veneer. This article will help you develop an arsenal of blades appropriate for the work you do.

Bands of steel

A bandsaw blade performs a very demanding job. The back of the blade must be soft and pliable to flex around the wheels of the bandsaw at several hundred revolutions each minute, yet the teeth must be hard and resist dulling. Today's blades are stronger, cut smoother and stay sharp longer than ever before. They also cut with greater efficiency and less feed resistance.

Manufacturers use one of three methods to make the teeth hard and resistant to wear. For carbon-steel and spring-steel blades, teeth are cut into the band, set and then hardened. In the second method, a band of hard, high-speed steel is welded to a softer band, and the teeth are cut into the harder steel. These are called bimetal blades. For carbide blades, individual carbide teeth are brazed to a flexible steel band. Carbide blades are the most expensive because of the high cost of the material and the process used in making them. Each blade type has advantages and disadvantages, so I'll discuss them individually.

Affordable carbon-steel blades are best for less-demanding work—Bandsaw blades made entirely of carbon steel are the most

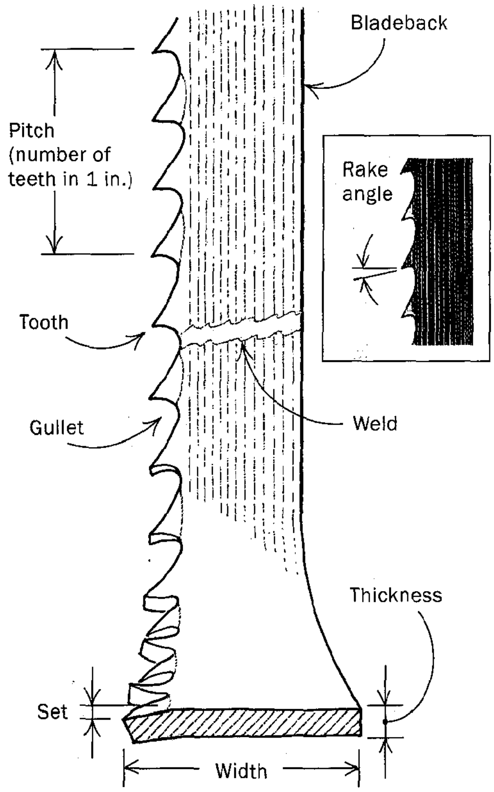
Terms you need to know

BLADEBACK The body of the blade not including the teeth. The bladeback must be both tough and pliable to withstand the continuous flexing as the blade runs around the wheels of the saw.

GULLET The curved area at the base of the tooth that carries away the sawdust. The size and efficiency of the gullets decrease as the pitch is increased.

PITCH The number of teeth per inch (tpi) as measured from the tips of the teeth. The pitch determines the feed rate at which the blade can cut and the smoothness of the sawn surface. Pitch can be either constant or variable.

RAKE ANGLE The angle of the face of the tooth measured in respect to a line drawn perpendicular to the cutting direction. Regular- and skip-tooth blades have a 0° rake angle, which gives them a slow, scraping action. A hook-tooth blade has a positive rake angle, which causes it to cut more aggressively.



SET On blades designed for woodworking, every tooth is set (or bent) left or right, in an alternating sequence, to create a kerf wider than the bladeback. The set of *a* blade helps prevent binding during cutting. Although carbide teeth are not bent, they are wider than the steel body to which they're brazed. Then they're ground to create a set pattern that helps keep the blade running true.

THICKNESS The thickness of the steel band measured at the bladeback. (In general, thick blades are wider and stiffer than thin blades.) Thick blades require larger-diameter bandsaw wheels to prevent stress cracks and premature blade breakage.

TEETH The cutting portions of the blade. Teeth must be sharp, hard and resistant to both heat and wear. The tip is the sharp part of the tooth that shears away the wood fibers. During sawing, the tooth tip is under tremendous stress and is subject to both heat and wear. The heat produced from friction during sawing can sometimes rise to 400°F on the tip. This occurs because the wood insulates the blade during cutting.

WIDTH The dimension of a blade from the back of the band to the tip of the tooth. Wider blades are stiffer and resist side-to-side flexing, making them the best choice for resawing. Narrow blades can cut tighter contours.

Photos, except where noted: Author; facing page: Michael Pekovich common and can be found in almost every consumer woodworking catalog. Carbon-steel blades are sharp, cut well when new and are available in a variety of widths and tooth forms. They are also inexpensive, which is probably the major reason for their popularity. The main disadvantage of a carbon-steel blade is that it dulls rather quickly, particularly when used for demanding applications such as resawing.

CARBON STEEL

Pros: Inexpensive; weld or braze your own; readily available

Cons: Dulls quickly; cannot be sharpened

Use: Cutting contours in relatively thin stock

Sawing thick hardwood stock places the greatest demands on any blade. If the tooth tip becomes too hot, it becomes soft and quickly loses both its edge and set. Once the set and sharpness are lost, the blade deflects during cutting. The result is that the expensive stock you're sawing is ruined. For these reasons, I use a narrow carbon-steel bandsaw blade only for less-demanding applications such as sawing contours.

Thin spring-steel blades are used for veneer work—Spring steel is most often associated with the cheap, stamped-out blades found on new benchtop bandsaws. Spring steel is soft and flexible, which allow it to bend around the small-diameter wheels of benchtop saws. But because spring steel is so soft, it doesn't hold an edge for very long.

Several years ago, however, a unique spring-steel resaw blade—marketed under the trade name Wood Slicer and sold by Highland Hardware (800-241-6748)—was introduced. Instead of being stamped, the teeth on this blade are carefully ground, hardened and polished. The teeth have a variable spacing that limits harmonic vibration. These blades make smooth cuts, and best of all, the kerf is a mere 1⁄32 in.—approximately half the kerf width of a typical carbide or carbon-steel blade. This means you'll get more veneer and less waste out of each plank. Additionally, because the Wood Slicer blade is only 0.022-in.-thick spring steel, it easily flexes around the medium-sized wheels of benchtop bandsaws.

STAMPED SPRING STEEL

Pros: Inexpensive; very flexible for use on bandsaws with small-diameter wheels

Con: Stamped teeth dull very quickly

Use: Light-duty cuts on small bandsaws

Bimetal blades offer the best of two worlds—The methods used for making bimetal blades are very different from those used for making most carbon-steel and carbide blades. A bimetal blade is actually two steel ribbons that are welded together. The back of a bimetal blade is composed of soft, flexible spring steel; the blade front, where the teeth are milled, is made of much harder high-speed steel. This strip of cobalt steel is welded onto the spring-steel blank before the teeth are cut. When the teeth are cut, all that remains of the cobalt steel is the tooth tip.

This combination produces a relatively inexpensive blade with longer wear than

Stock thickness dictates blade pitch

Pitch, the number of teeth per inch (tpi) on a blade, determines the feed rate and the smoothness of the cut surface. A blade with a continuous pattern of teeth has a constant pitch. A blade with teeth that vary in size has a variable pitch.

A blade with a fine pitch has more teeth per inch than a blade with a coarse pitch. A greater number of teeth means that each tooth is small, taking a small bite that leaves a smooth surface. A greater number of teeth also reduces the size of the gullets. Because small gullets can't haul away dust very quickly, a fine-pitch blade cuts slower and tends to get hotter than a coarse-pitch blade.

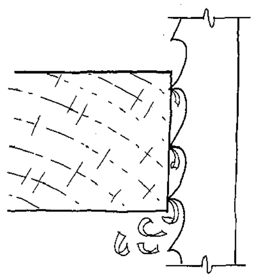
On a coarse-pitch blade, both the teeth and the gullets are larger, so each tooth bites off a greater amount of wood, and the large gullets can easily remove the sawdust from the kerf.

The major factor to consider when selecting proper tooth pitch is the thickness of the stock. In general, you want a blade that will have no fewer than six and no more than 12 teeth in the stock at any given time (see the drawings above). For example, if you're cutting 1-in.-thick stock, a 6-pitch blade would be a good choice, but a 14-pitch blade would be too fine. However, if the stock were only ½ in. thick, a 14-pitch blade would be best. Although the range of available pitch is broad, from 2 tpi to 32 tpi, wide blades generally have fewer teeth, and narrow blades have a greater number of teeth.

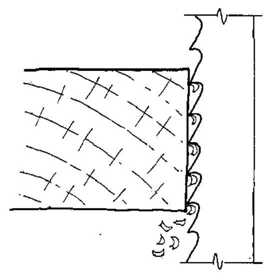
Choosing the correct pitch will substantially increase blade life. Take, for example, a carbon-steel blade, which is easily damaged by overheating. A fine-pitch carbon-steel blade will overheat when used on thick stock because the gullets become packed with sawdust. This causes the blade to dull quickly and lose its set, rendering the blade useless.

SELECTING THE APPROPRIATE PITCH

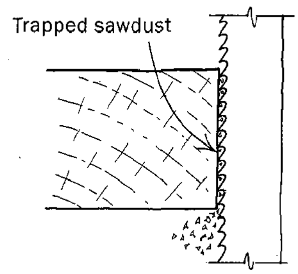
You'll get the best cuts when there are between six and 12 teeth in the stock (center). The cut is smooth, and because the sawdust is rapidly carried away, the feed rate can be faster.



Fewer than six teeth in the stock can cause vibration and a rough cut.



Correct pitch for board thickness results in a fast, smooth cut.



With more than 12 teeth in the stock, the small gullets fill with sawdust, and the blade overheats.

Drawings: Vince Babak

BIMETAL

Pros: Cobalt-steel teeth don't readily overheat; high tension means greater beam strength

Con: Don't last as long as carbide

Uses: Demanding applications that generate a lot of heat, such as resawing and cutting thick stock

an ordinary carbon-steel blade. Unlike a carbon-steel blade that loses its sharpness and set at 400°F, the cobalt-steel teeth of a bimetal blade can withstand 1,200°F.

Another advantage of a bimetal blade is the beam strength of its spring-steel back, which can withstand great tension. The beam strength (see the top drawing at right) of a bimetal blade, combined with its resistance to heat, has endeared this type of blade to many woodworkers.

Carbide blades are pricey but will last—I'm sure that almost every woodworker is familiar with carbide. Carbide cutting tools have almost made high-speed steel a thing of the past. A significant difference between carbide and steel blades is that each carbide tooth is individually brazed onto a strong, flexible spring-steel bladeback. In fact, the recommended tension for a carbide blade is almost twice that of a carbon-steel blade, giving a carbide blade much greater beam strength. The carbide teeth are precisely ground on the face, top and both sides, which results in truer, more precise cuts.

CARBIDE

Pros: Smooth cut; high recommended tension; outlasts carbon-steel blades 25:1

Con: Initial cost is very expensive

Uses: Resawing and other demanding applications

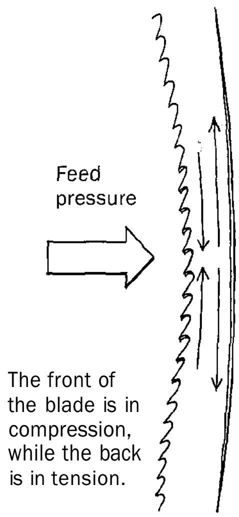
As you would expect, a carbide bandsaw blade is significantly more expensive than an ordinary carbon-steel blade. However, a carbide blade will typically outlast a carbon-steel blade 25:1, and carbide can be resharpened. Although more expensive initially, a carbide blade is much more economical than a carbon-steel blade, especially for resawing.

Stellite is softer and less brittle than carbide—Stellite is the brand name of a unique type of carbide that is reportedly better suited for woodworking applications. Stellite isn't as hard as regular car-

Wider blades need more tension

BEAM STRENGTH

A bandsaw blade bows when the beam strength isn't great enough to resist the feed pressure.



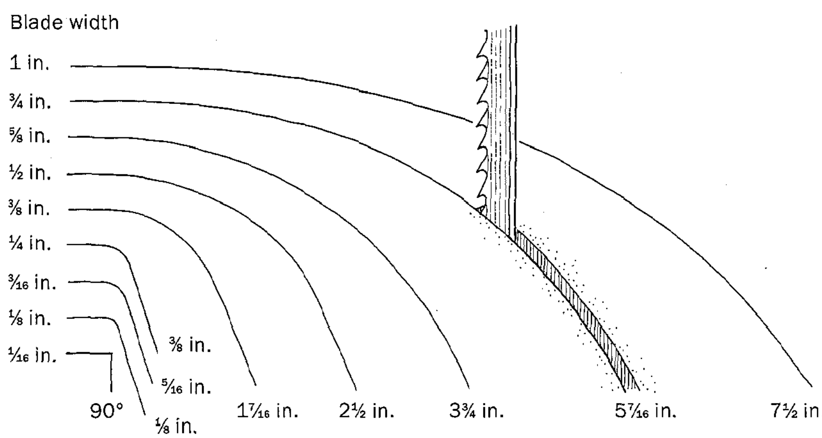
As blades get wider, the steel used for the blades gets thicker. The width of a blade relates to its beam strength—the wider the blade, the stiffer it will be (see the drawing at left).

A wider blade has more beam strength, but the blade must be properly tensioned. Overtensioning can stress and distort the bandsaw frame, possibly beyond repair. Excessive tension also places potentially damaging forces on the saw's wheels, shafts and bearings. When resawing, use the widest blade that your bandsaw can properly tension. Keep in mind that the widest blade *a* saw can tension may not be the widest blade it can accept. For smaller saws, you'll most likely get better results from the next-size narrower blade.

The most accurate way to determine the proper tension of a blade is to use *a* tension meter. But *a* meter has a price tag of around $300, so many choose a simpler route. If you set the upper guides about 6 in. off the table, the blade should deflect under the pressure of a fingertip, but no more than ¼ in. For resawing, the tension should be even a little tighter. Bear in mind that the 14-in. saws common in many small woodworking shops work best with blades no wider than ½ in. Each blade width has a minimum radius that it can cut. Squeezing a blade through a turn that is too tight can break the blade, twist the teeth into the guides (which causes them to lose sharpness and set) or pull the blade off of the saw's wheels, which could damage the teeth or bend the blade. The blade-radius chart below provides the minimum radius that each width of blade can turn. I keep a similar chart posted on my bandsaw.

You may be wondering why you can't mount a narrow blade (such as ¼ in.) and use it for cutting all curves. This does work, but only to a degree. Narrow blades have a tendency to wander. If you try to cut a large radius, such as a 36-in.-dia. tabletop, for example, you'll have a hard time keeping the blade on the line. You'll cut more precisely with a 1-in.-wide blade. However, with practice you'll probably cut a majority of curved work with a ¼-in. or ⅜-in. blade.

HOW BLADE WIDTH AFFECTS THE CUTTING RADIUS



Minimum radius the blade can cut without difficulty

STELLITE

Pro: More shock resistance than carbide

Cons: Cost; not as hard as carbide

Use: Resawing wide stock

bide, but it's also less brittle. This gives Stellite greater shock resistance. Like carbide, Stellite promises longer wear and better-quality cuts.

In many other ways, Stellite blades are a lot like carbide blades. The Stellite teeth are brazed onto the band, then precisely ground. And like carbide blades, Stellite blades are expensive.

Different tooth forms for different jobs

Tooth form refers to the design of the tooth and gullet, specifically the tooth size, shape and rake, or cutting, angle. The three commonly known tooth forms for cutting wood are regular, skip and hook. Another form that is gaining in popularity is the variable tooth.

Regular-tooth blades—The regular-tooth blade, sometimes called the standard form, has evenly spaced teeth for smooth, precise cutting. Teeth and gullets are the same size, and the rake angle is 0°. This combination of features leaves a smooth surface. For cutting curves, a regular-tooth blade is often the best choice because it has the greatest number of teeth. This, combined with a 0° rake angle, gives you a smooth finished surface that requires little cleanup,

The disadvantage of a regular-tooth blade is that the gullets are too small to cut thick stock effectively. Remember that the purpose of the gullets is to haul away the sawdust from the kerf. If you attempt to cut thick stock with a regular-tooth blade, the gullets become full before the teeth exit the stock, which slows cutting and overheats the teeth. Obviously, a regular-tooth blade is not designed for fast cutting. In fact, if you push the stock too hard in an effort to increase the cutting rate, the cut actually slows down as the gullets become packed with sawdust.

Skip-tooth blades—As you might assess from the name, the skip form "skips" every other tooth. A skip-tooth blade has fewer teeth and larger gullets than a regular-tooth blade. The large gullets can efficiently carry the sawdust away from the kerf, making a skip-tooth blade fast cutting. Like a regular-tooth blade, a skip-tooth blade also has a 0° rake angle that scrapes the wood away cleanly. But because it has fewer teeth, a skip-tooth blade doesn't cut as smoothly as a regular-tooth blade.

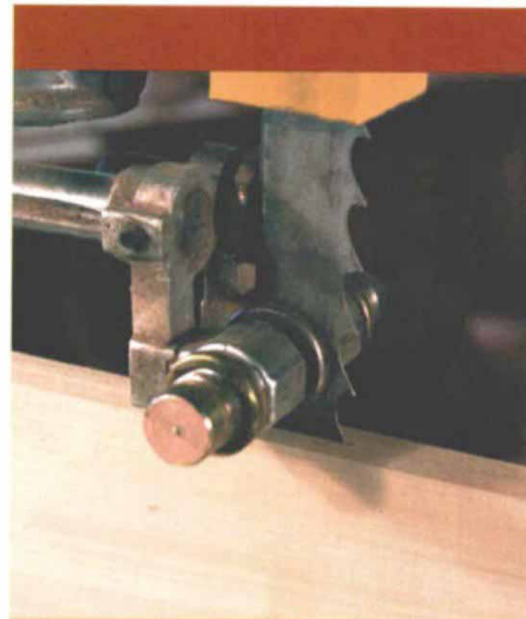
A skip-tooth blade is best suited for resawing and ripping thick stock. It also works well for cutting softwoods. But because the hook-tooth blade is more efficient, the skip-tooth blade is outmoded. Why do manufacturers still produce skip-tooth blades? One sawblade manufacturer said his company still makes skip-tooth blades mainly because—short of sending people a free hook-tooth blade—it's difficult to convince people to change.

Hook-tooth blades—The hook tooth is really a further development of the skip tooth. A hook-tooth blade has large gullets and teeth like that of a skip-tooth blade, but the teeth have a positive rake angle that makes them cut more aggressively. Because of this aggressive nature, a hook-tooth blade has less feed resistance than a skip-tooth blade. It is a great choice for resawing and ripping thick stock. A hook-tooth blade is my choice for general resawing, such as sawing thick planks into thin drawer parts. The coarser pitch and positive rake angle of a hook-tooth blade make quick work of any hardwood.

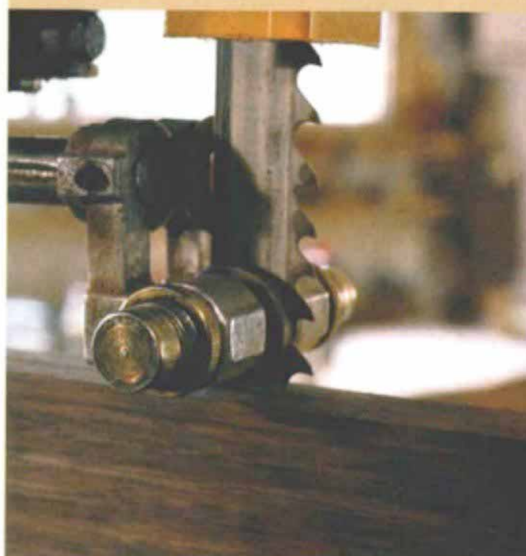
Variable-tooth blades—The variable-tooth blade is a hybrid among bandsaw blades. A variable-tooth blade can have regular teeth with a 0° rake angle or a more aggressive, positive rake angle. But the unique feature of this type of blade is that the tooth size and spacing vary on the same blade. This means that both the teeth and gullets vary in size but not in shape. The unique design dramatically reduces vibration; the result is a quieter blade and a very smooth cut.

To understand how this works, it's helpful to think of a bandsaw blade as a string on a musical instrument. A bandsaw blade is under tension, just like the strings on a violin but for different reasons. You want a string on an instrument to vibrate so that it produces a sound. This is called harmonic vibration. But you want to limit vibration on a bandsaw blade because vibrations create a rough surface on the stock. By varying the tooth and gullet size, you effectively limit the vibrations and create a smoother surface.

When sawing veneer from a plank of valuable hardwood, a hook-tooth blade will do a great job, but a variable-tooth



Resawing poplar is easy. *This 2-pitch bimetal blade makes quick work of softwoods. A carbide blade would also work well but would be more expensive.*



Smooth operator. *A variable-pitch, hook-tooth carbide blade cleanly slices $\frac{1}{16}$-in.-thick veneer from this crotch walnut plank.*

Which blade should you use?

Choosing a blade can be confusing until you're familiar with all of the factors. Here are some examples to get you started.

RESAWING 6-IN.-WIDE POPLAR FOR DRAWER PARTS

Option 1: carbide, 3 pitch, hook tooth

Option 2: bimetal, 2 pitch, hook tooth

Comments: Poplar is soft and cuts easily. The bimetal blade would be less expensive, but the carbide blade would last much longer. For greatest beam strength, use the widest blade that your bandsaw can tension.

SLICING 1/16-IN.-THICK VENEER FROM A 9-IN.-WIDE CROTCH WALNUT PLANK

Option 1: carbide, 2/3 variable pitch, hook tooth

Option 2: spring steel, 3/4 variable pitch, hook tooth

Option 3: carbide, 3 pitch, hook tooth

Option 4: bimetal, 3 pitch, hook tooth

Comments: Walnut crotch has dramatic figure and is expensive. I try to get as much veneer as I possibly can from a valuable plank like this. A carbon blade would be my last choice because it dulls quickly. The variable-pitch carbide blade is very expensive, but the cut is incredibly smooth. Both of the carbide blades are stiff and require a strong frame to tension properly. The spring-steel variable-pitch blade is an excellent choice, particularly for saws with wheel diameters under 18 in. It tensions easily because it's only 0.022 in. thick. This blade cuts incredibly smoothly, and it's relatively inexpensive compared to carbide blades—although you can't expect it to last as long. Best of all, the kerf from this blade is a slim 1/32 in., half that of the other blades in this category. You'll definitely get more veneer from this blade.

RIPPING 2-IN.-THICK HARDWOODS

Option 1: carbide, 4 pitch, hook tooth, 1/2 in. wide

Option 2: carbon steel, 4 pitch, hook tooth, 1/2 in. or 3/4 in. wide

Comments: If you have a 14-in. bandsaw, you'll probably get truer cuts with a 1/2-in.-wide, 0.025-in.-thick blade than with a 3/4-in.-wide, 0.032-in.-thick blade. Your saw stands a better chance of tensioning the thinner and narrower blade.

CUTTING CONTOURS IN 7/8-IN. THICK MAPLE (MINIMUM RADIUS 3/16 -IN.)

Option 1: carbon steel, 10 pitch, regular tooth, 1/4 in. wide

Option 2: carbon steel, 6 pitch, regular tooth, 1/4 in. wide

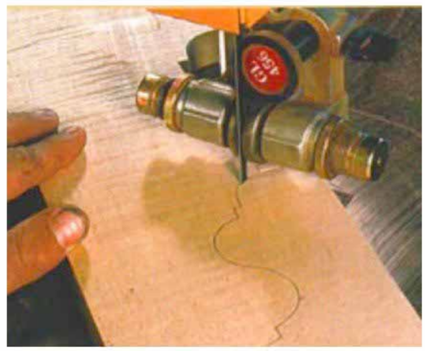
Comments: The 10-pitch blade would create a smoother surface, thus requiring less cleanup of sawmarks.

CUTTING SCROLLS IN 1/4-IN.-THICK HARDWOOD (MINIMUM RADIUS 1/16 IN.)

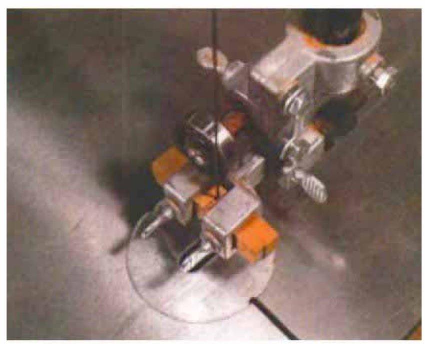
Option: bimetal, 24 pitch, regular tooth, 1/16 in. wide

Comments: This tiny 1/16-in.-wide blade is your only choice for cutting tight contours. You'll need to replace the steel guide blocks with hardwood blocks or Cool Blocks. This blade can't be used on bandsaws equipped with bearing guides.

The right blade for hardwoods. *Ripping hardwoods on the bandsaw is easy with a 1/2-in.-wide, 4-pitch blade.*



Good for most curves. *A 1/4-in., 6-pitch blade can cut most contours, but a 10-pitch blade leaves a smoother surface.*



Tight curves, clean cuts. *A 1/16-in., 24-pitch blade cuts intricate scrolls with little or no cleanup required.*

blade will leave a much smoother finish.

Tooth form affects the performance of the blade more than any other factor. A regular-tooth blade gives the smoothest cut; a hook-tooth blade cuts aggressively; and a variable-tooth blade cuts both smoothly and aggressively.

The right blade choice

Rather than thumbing through the pages of an industrial bandsaw blade catalog, it's much easier to narrow the blade choices based upon the types of cuts you'll be making. For every job, it's important to consider the blade width, pitch and tooth form. I always begin by selecting the blade width. Width is determined by the type of cut you're making—whether you're sawing a straight line or a curve. Tooth pitch is dictated by the thickness of the stock you'll be cutting, and tooth form influences how aggressively or smoothly the blade will cut.

To get the most out of your bandsaw, you'll have to change blades often from wide to narrow or from few teeth to many. Each type of blade is best for a certain kind of cutting. You must decide which is more important to you—speed or smoothness. You can't get the best of both in the same blade. However, you can select a blade that is a good compromise. □

Lonnie Bird is a woodworking teacher and author. This article was adapted from The Bandsaw Book *(The Taunton Press, 1999).*