

There is potential danger lurking in the corner of woodturning shops, waiting for the most inopportune time to injure or maim. For some, the thought of operating a bandsaw strikes fear; we have all heard horror stories of bandsaw accidents. The bandsaw's negative reputation, however, is largely undeserved. If we follow a few guidelines, the bandsaw can be one of the safest, and most versatile, of all stationary woodworking equipment. Let's see if we can demystify this machine and acquire a comprehensive understanding of how to operate it safely.

Know your machine

Before operating any power equipment, it is imperative to have a basic understanding of its functions, adjustments, and maintenance and safety procedures. Read and periodically review the owner's manual; it contains necessary information required to properly set up and maintain your bandsaw. If you have misplaced your owner's manual, many manufacturers make copies available online. Excellent books and articles on setting up and operating bandsaws are also available (two books are listed at the end of this article). If you are unsure of any bandsaw function, most turning clubs have experienced operators who will be willing to

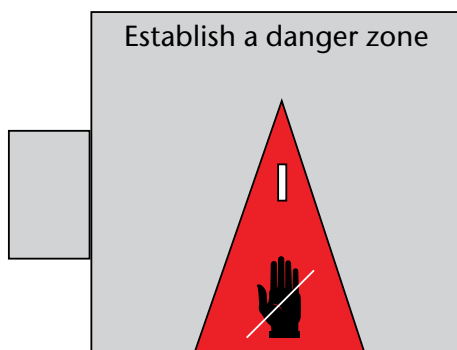


Figure 1. The red triangle illustrates the danger zone area: the area where it is not safe to place hands and fingers when making cuts on the bandsaw.

bandsaw SAFETY

Keith Tompkins

give proper instructions. Under no circumstance should you operate a piece of power equipment without proper training, when tired or under the influence of alcohol or medications, or when the equipment is not in good working condition.

Safety

While there have been many publications written about the bandsaw, very little information on bandsaw safety, as it applies to woodturners, is available. This article will focus on safe bandsaw operation and will cover the basic cuts employed by woodturners.

Before using any power woodworking equipment, ensure a clean work area free of obstructions. Remove rings, watches, and other jewelry. Avoid wearing loose-fitting clothing or shirts with long baggy sleeves, and if you have long hair, securely tie it back. Always wear eye protection (a faceshield is best). Even when every precaution is taken, you may find yourself in a dangerous situation. Be sure the on/off switch is located in a convenient, easy-to-reach location.

Establish and adhere to the concept of a danger zone (Figure 1). This zone is an area where an

operator's hands are not safely placed when cutting wood. The red area indicates the danger zone, as seen from above the saw's table. Keeping your hands out of the danger zone will significantly reduce chances of injury while operating the bandsaw. As obvious as this may seem, nearly all bandsaw accidents occurred because the operator placed his hand directly in the path of the blade (in direct line of the cut).

Good posture and body position are important; losing your balance can inadvertently place your hands in danger. Stand with a relaxed posture, feet balancing your body so that you are squared up in front of the table. Avoid reaching too far forward or to the sides. I recommend an open stance while cutting large pieces. This gives you the ability to react in any direction. Avoid standing flat-footed. Imagine you are resisting someone pushing: feet together, no resistance and easy to push over. Open stance, good resistance and balance.

Condition of the bandsaw

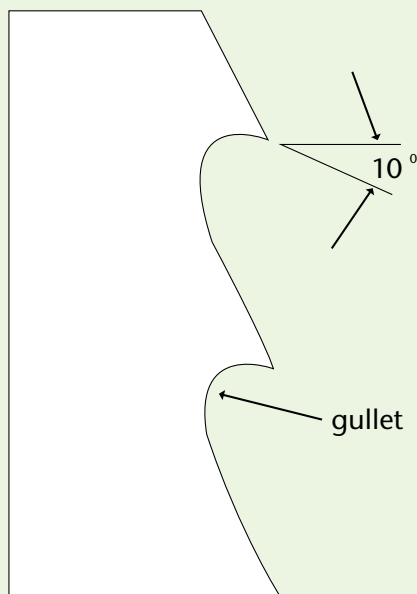
Cutting bowl blanks safely begins before the bandsaw is turned on. The condition of the saw blade is

of utmost importance; many accidents are the result of the operator attempting to cut with a dull blade. Never operate a bandsaw with a dull blade. Resist the temptation to take just one more cut when you *know* the blade needs replacing. For every action, there is an equal and opposite reaction: If you are pushing hard, trying to make a cut with a dull blade, as the blade exits the wood, the bowl blank will jump forward, possibly pulling your hand directly into the path of the blade. The blade may be dull, but it will still cut off a finger.

When installing a new blade, disconnect the saw from the power source, then adjust the tension, blade guides, and rollers to the bandsaw's and blade's specifications. At the same time, inspect your saw and make necessary adjustments or replace worn parts. The following are things to check before and during installation:

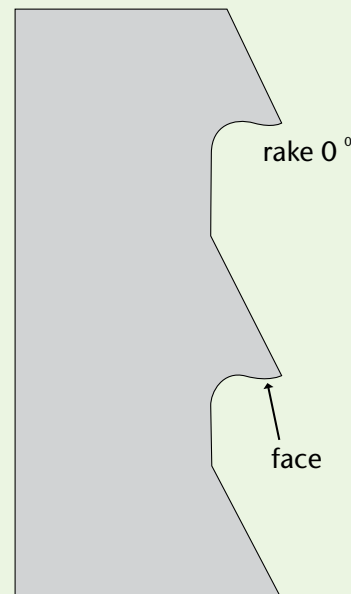
- Check the condition of the rubber tires on each wheel. Obvious cracks, chunks of missing material, or a loose rubber tire indicate replacement is required. If the tires are in good condition, clean each tire using a thin piece of scrap wood or stiff nylon brush.
- Bearings play a role in proper bandsaw setup and use. The bearings are located behind the blade (one above and one below the table), and they should move freely so that a slight pressure from the back of the blade against it during use will keep the blade from moving too far back. The bearings should not rotate while the saw runs idle, but should begin to rotate the instant the cut begins.
- Most bandsaws are equipped with upper (above the table) and lower guide blocks (below the ►

Bandsaw blade terminology



Hook-tooth blade

A hook-tooth blade has a deep gullet and widely spaced teeth that have a 10° undercut face, which helps the blade cut well. The gullets tend to curl the chips. Hook-tooth blades, alternate set, are good for harder woods.



Skip-tooth blade

A skip-tooth blade has a zero degree rake (a straight 90° tooth) and a sharp angle at the junction of the tooth and gullet. The large distance between the teeth aids in breaking up and clearing chips. Skip-tooth blades, raker set, are good for general-purpose woodcutting.

Terminology

Alternate set: How the teeth are set—in an alternating right, left pattern.

Gauge: The thickness of the material used to fabricate the bandsaw blade.

Gullet: The space within the curved area between two saw blade teeth. This space serves to remove chips.

Kerf: The slot created when a cutting tool parts through material.

Rake angle: The angle that the tooth face makes with respect to a perpendicular line from the back edge of the blade. The angle is positive when the tooth angles forward in the direction of the cutting action and negative when it angles backward from the direction of the cutting angle. A hook-tooth blade has a positive rake of 10 degrees.

Raker: A pattern of offsetting the teeth, one tooth right, one tooth left, one tooth unset. (Also referred to as *raker set* or *raker tooth*.)

Set: The bending of bandsaw teeth to right and left of center. The set allows for clearance of the back of the blade as it cuts, which enables the blade to cut straighter and to clear chips from the kerf.

Tension: The direct pull in pounds on the bandsaw blade.

TPI: Teeth per inch, also referred to as *pitch*.

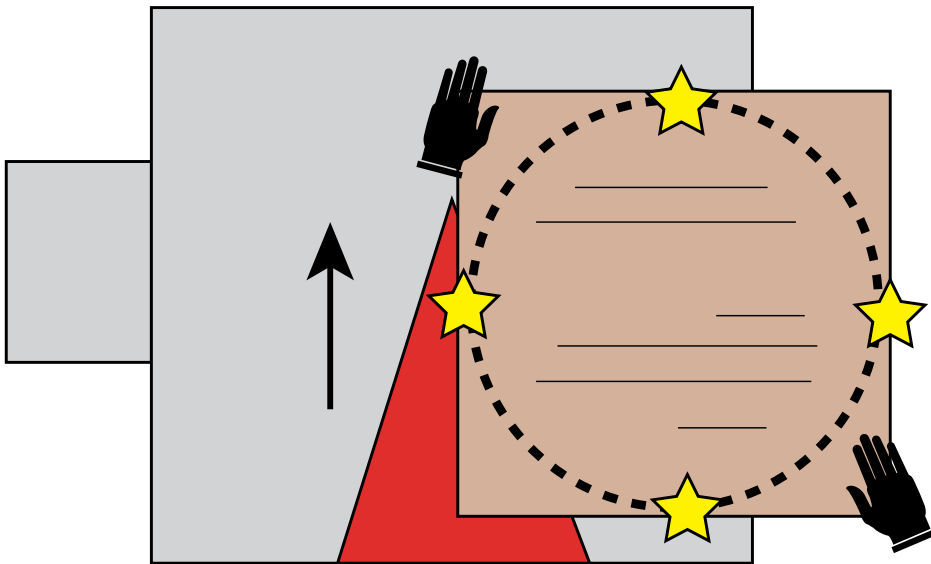


Figure 2. Position your left hand behind the sawblade and your right hand outside the danger zone as you cut a bowl blank. The stars represent the four places where the blade will exit the wood, potentially making the bowl blank jump forward.

throatplate) made from steel or ceramic material that guide the blade on each side. Inspect for wear or deep grooves worn into the face that contacts the side of the blade. Guide blocks play a critical role in the performance of your bandsaw and must be in top condition.

- Bandsaw blades, by their nature, are flexible, so the greater the distance between the upper and lower blade guides, the greater the chance the blade has to flex or develop a bow while cutting. Any maladjustment of the blade guides will only exacerbate the problem. If the guides are adjusted too far forward, the set of the teeth will be removed. If they are adjusted too far to the rear, or set too loosely, the blade won't steer properly.
- Make sure the throatplate does not have an overly large opening. An opening that has become too wide can cause a small piece of wood to fall into

the opening, get caught, and possibly break a blade.

- An additional safety consideration is the distance between the top of the wood and the blade guard. When cutting bowl blanks of uneven thickness, that gap might be significant for part of the cut. Adjust the guard to be as close as possible to the top of the wood.

Bandsaw blades

Blade type and width are important. Make sure the blade you use is capable of cutting the radius required for each size bowl blank. It is good practice to install a bandsaw blade that will allow at least three teeth to be in contact at all times with the material being cut.

The teeth on bandsaw blades are manufactured with a *set*, each tooth offset alternately right-left-right-left. This set is important because it produces a kerf that is wider than the thickness of the saw blade, which allows for clearance between

the wood and the blade so that the blade does not bind. This clearance also gives the blade the ability to cut along curved or circular lines. A blade that has lost its set (a dull blade) will not cut properly and will overheat, weakening the blade and burning the wood.

For cutting large chunks of green wood, a 3 tpi, ½"- (13 mm-) wide blade is a good size that will hold up well to heavy use. For cutting smaller stock, a ¾"- (10 mm-) wide, 4 or 6 tpi works well. Bandsaw blades for cutting wood are available in hook-tooth or skip-tooth configurations. (A standard-tooth blade is a good choice for cutting thin stock or non-ferrous metals.)

Hook-tooth blades, available in alternate or raker set, have a deeper gullet than skip-tooth blades. Their positive-tooth rake cuts more aggressively than a comparable skip-tooth blade. The deep gullet works well for eliminating shavings when cutting thick, green wood. A ¾"- or ½"-wide skip-tooth blade, alternate set, is a good selection for general resawing, cutting round sections to length, or cutting bowl blanks.

For inexperienced bandsaw users and for cutting soft wood, I suggest using a blade with a skip-tooth design, raker set.

Deconstructing an accident

Woodturners primarily use the bandsaw to cut bowl blanks, so it's not surprising that many bandsaw accidents occur while performing this operation. Cutting bowl blanks involves both ripping cuts along the grain, as well as cutting across the grain; it is important to understand the effect this change in grain direction has when cutting round bowl blanks. Ripping cuts require more force than crosscuts because the blade is pushing into endgrain fibers. In crosscut operations, the

blade feeds freely with little operator effort (assuming the blade is sharp and the bandsaw is set up properly). The change of grain direction is a leading contributor to bandsaw injuries while cutting bowl blanks—the operator does not take into consideration the difference in the amount of push required. If a dull blade is added to the equation, injury is even more likely.

Let's examine a common bandsaw accident in order to understand what went wrong. In almost every accident, the saw blade exited the wood at one of the points near the edge (*Figure 2, yellow stars*) while the operator's hand was positioned in the danger zone. Just slightly before the blade exits a piece of wood, resistance abruptly ends, the wood jumps forward (still pushed by the operator), and the operator is unable to react quickly enough to stop his or her hand from being cut, if it is in the danger zone. Keep your hands away from the danger zone and be aware at all times when the blade is about to exit the wood so that you can ease up on the pushing pressure and cut the last bit of wood with a slow, controlled push.

Forcing a bandsaw blade through the cut with a dull blade stretches the back of the blade and compresses the front edge, allowing a bow to develop in the blade while attempting curved cuts. Once the blade begins to develop a bow, it becomes even harder to follow a curved line; there is so much pressure on the inside of the cut that the blade will have a tendency to cut in a straight line instead of following the curve of the bowl blank. The more force the operator applies to turn and cut the blank, the more the blade begins to bow and an accident is in the making.

Most turning blanks made from log sections are rectangular or square in shape, so when cutting a circular

shape from the half-log, there are two or four points during the cut where the blade is close to the edge of the wood. Not coincidentally, these points are where the grain direction change occurs and where nearly all accidents happen. Be aware at all times when the blade is about to exit the wood and ease up on the pushing pressure.

Safe cutting method

Figure 2 illustrates the method I advocate for cutting bowl blanks. Notice that the operator's left hand is behind the saw blade as the blank is rotated toward the danger zone, where the blade is most likely to exit the blank. In the event that the blade exits the cut at that point, the operator's left hand has already been placed beyond the cutting edge of the saw blade, completely out of

harm's way. Having a slight bend at the left elbow keeps the operator's arm well away from the blade. By following this method of cutting blanks and planning your hand position in advance, chances of being injured while cutting bowl blanks will be significantly reduced.

Other considerations

Always ensure that bowl blanks (or any wood being cut) sit flat on the table of the bandsaw. Any gap between the blank and the table where the blade enters the wood will cause the wood to be pulled toward the table with enough force to damage or break the blade.

It is common practice to mount a fixture to the bandsaw table that utilizes a stationary pin to cut circles. A divot is created in the center of the ▶

Cutting large-diameter logs

When cutting round stock on a bandsaw, unsupported material can be caught and rotated, pulling it into the blade with a good deal of force. This can result in serious injury and/or jamming the blade, stalling the bandsaw motor, or kinking the blade, rendering the blade useless.

For small-diameter round stock, a simple V block works well. For larger stock, V blocks do not sufficiently support and stabilize the log, so for safety, I use a modified sled.

For the bottom two boards, use 2" × 4" lumber, screwed to the miter gauge at 90°. To that, attach with screws 2" × 2" cross pieces, spaced as wide apart as possible, yet still making contact on both sides of the log. This spacing may need to be adjusted for larger or smaller diameter wood.

Some logs are crooked or have knots and do not rest in the carrier as safely as I would like. For those, I use a bar clamp to hold the log securely to the fixture. Placing screws into the log and the carrier are another option, as are wedges hot-melt glued onto the log and carrier.

A refinement to the fixture would be to use ½" plywood for the bottom instead of the 2" lumber, which would allow cutting of even larger-diameter pieces.

John I. Giem



Ripping wide stock

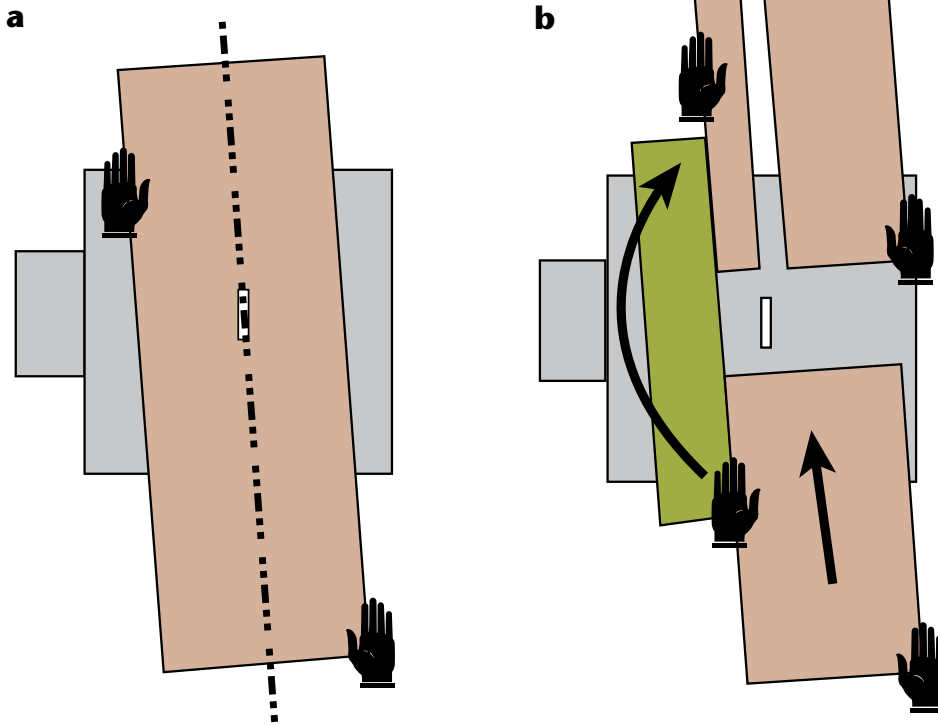


Figure 3a. (a) The operator's hands are placed correctly to avoid the danger zone. (b) If cutting a long board, the cut can begin with hands placed as shown in the lower portion of this illustration. As the cut proceeds, move your left hand to the back side of the blade, as shown on the top of this illustration.

Ripping narrow stock

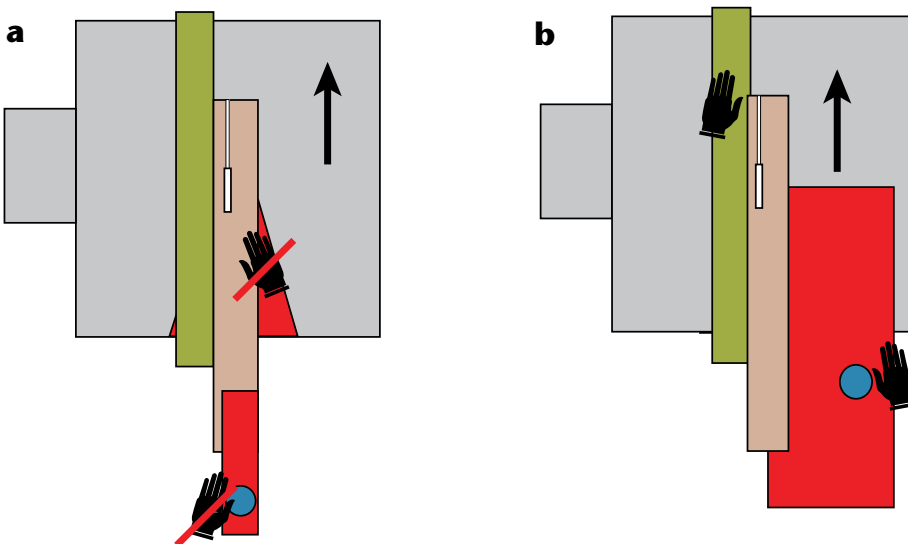


Figure 3b. (a) The operator's hands are not positioned correctly even though a push stick is employed. (b) The operator is using a push stick (depicted in red) and has placed both hands correctly to avoid an accident.

blank, which is then placed over the pin. The stock is pushed through the blade while rotating on the pin, and the result is a near-perfect circular shape. This setup works fine for thin stock, but never, under any circumstance, should you attempt to cut bowl blanks while using a pin guide such as the one described. The bowl blank must be allowed to “float” on the table, which helps compensate for blade drift and flex. Turning blanks do not have to be perfectly round—that’s the lathe’s job.

If you find yourself in a situation where the blade is having trouble following the desired line and the blade is in danger of exiting the blank, don’t continue to force the cut. Ease up pressure on the cut, be sure your hands are out of the danger zone, and carefully steer the blade out of the side of the blank.

Ripping wide stock

Woodturners often find it necessary to cut large blocks of wood into smaller pieces for pen blanks, furniture legs, or bottle stoppers. Properly tuned, the bandsaw is ideal for this. It provides a better yield and is safer than using a table saw.

Very few bandsaw blades cut in a perfectly straight line, though, even when new. That tendency to cut on either side of a straight line is known as *drift*. To compensate for drift, a bandsaw should be equipped with a fence that is capable of being adjusted to compensate. An easy way to determine the amount and direction of drift in a bandsaw blade is to draw a straight line, parallel to one edge, on a piece of flat scrap wood (Figure 3, a). As you guide the blade through the cut, notice the angle of the stock in relation to the square table. Set your fence to that approximate angle and make another test cut, keeping the stock against the fence and the guides close to the

wood. With minor adjustments of the fence, the blade will cut cleanly through a long piece without binding or drawing the stock away from the fence. You are now ready to rip your stock to width (*Figure 3, b*).

Pay attention to the hand positions in the diagrams. Similarly to cutting bowl blanks, the left hand is moved to a position behind the blade, while the right hand is never in the path of the blade. In the event of a slip, there is little danger of operator injury.

Ripping narrow stock

When cutting a board into narrow stock, your hands can come dangerously close to the bandsaw blade. It is good practice to use a push stick to guide your work through the blade. Even then, it is important to position your hands away from the danger zone. *Figure 4 (a)* shows the operator using a push stick; however, both hands are potentially in the blade's path.

A safer method is placing your left hand behind the blade to secure the stock, while your right hand is safely off to the side of the blade holding the push stick (*Figure 4, b*). By the time the cut is completed, your right hand will be beyond the cutting edge of the bandsaw blade as well, out of harm's way.

There are many circumstances where a small piece of wood requires cutting on the bandsaw, and there are many ways to safely cut each piece. For example, a wooden clamp is useful for holding small objects safely while they are being trimmed to length. You could use a piece of scrap wood and use hot-melt glue to temporarily affix the small item to the larger piece of wood, sacrificing the scrap wood instead of your fingers.

Cutting round stock (cylinders)

Another cut frequently employed by woodturners is cutting cylinders, such

as tree limbs, into manageable lengths. Cutting cylinders on the bandsaw, however, is a potentially dangerous operation. Aggressive saw blades may work just fine for cutting bowl blanks, but that same blade will cause an unsecured round piece to roll rapidly into the blade, possibly carrying the operator's hands with it. There is also the possibility that the workpiece will roll with enough force to break the saw blade. Even something as small as a ½" (13 mm) dowel rod can break a bandsaw blade.

There are several ways to prevent injuries when cutting cylinders. (A chainsaw may be a safer alternative when cutting large-diameter logs.) A shopmade V block will help stabilize smaller pieces and allow them to be cut safely (*Figure 5*). A miter gauge, in combination with the V block, is a good choice as well. Never attempt an unsupported cut on round stock. The material to be cut must be sitting flat on the bandsaw table.

A common, and incredibly unsafe, mistake made by some woodturners is attempting to shorten a too-long tenon on the bottom of a bowl blank using the bandsaw. The saw *will* pull the stock down to the table, rolling the round bowl at the same time. Even the most experienced bandsaw operator should never attempt this cut.

Do not attempt to cut a sphere using the bandsaw unless you know how to correctly and securely attach it to a jig.

A last word of caution

There are two categories of woodworkers who receive the most injuries, beginners and, oddly enough, the most experienced operators. It's possible that experienced operators begin to take the bandsaw for granted since they've made thousands of cuts without incident. It is easy to become complacent and gradually let your guard down. Always

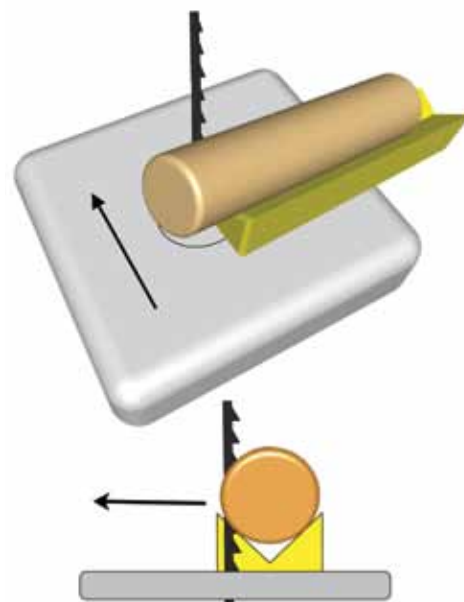


Figure 5. Never cut a cylinder without supporting it in a jig of some sort. This cylinder is correctly supported in a V-block jig. (Do not attempt to cut spheres using a bandsaw without the use of a proper jig—a V block is not sufficient support for cutting spheres.)

use common sense and think safety first. If it is used properly, you will discover the bandsaw is a versatile, safe machine.

Suggested References

The Band Saw Handbook by Mark Duginske, Sterling Press, 1989.

The Bandsaw Book by Lonnie Bird, Taunton Press, 1999. ■

Keith Tompkins is a professionally trained cabinetmaker, experienced in all phases of industrial woodworking, including CNC programming. In addition to operating a successful woodturning studio, he is currently employed by the State of New York as an Industrial Training Supervisor, responsible for training inmates at a maximum-security facility to work in a high-tech industrial woodworking environment. He may be contacted at keithptompkins@frontiernet.net or through his website, keithptompkins.com.