

MULTI-AXIS CANDLESTICK

Turning with a different slant

BY MARK SFIRRI



PHOTO BY RANDI BVE

In 1992 I demonstrated at a particularly exciting conference in Saskatoon, Saskatchewan. The energy and collaborative spirit of the presenters and attendees motivated me to try something new. Turning had played a major role in my work since the mid-1970s, but I was mainly making furniture and I used turned pieces as elements in those designs. Now I wanted to turn a simple object out of one piece of wood, and I wanted it to be something that I could demonstrate in an hour and a half, the typical length of a rotation at a turning conference.

I had an idea that I could turn a piece of wood on two sets of centers and make it look bent. I took a stab at it and accomplished what I set out to do (1). The next step was to apply this technique to a functional object. A candlestick came to mind. In order for the candlestick to be stable, the base needed to be the full size of the wood. I did not want it to appear heavy, so I wanted several sections of it to be narrow. For aesthetic reasons, I thought that one area other than the base should be the full diameter. Since the first section is turned on an extreme axis, the only possibility for this large area is mid-height, where the axis passes through the center of the stock. Geometry determines that location.

Amazingly, I was happy with the results of the first try. And while I have made numerous variations of this form, the basic shape has remained pretty much unchanged over the years. I've tried incorporating three and sometimes more axes, thinking that maybe I could take it a step further, but came to the conclusion that keeping it simple produces a more effective visual statement.

SIZE

I use kiln-dried wood that I buy in plank form. Many woodturners use "road kill" or other green wood, but since I come from a furniture background, I always want to have the option of making parts that fit together. Dry wood is essential for that pur-

pose. Sometimes it's a challenge, but it is possible to find wood that is 12/4 and 16/4 (3" and 4", respectively). I've used both of these sizes and think that 3" isn't quite large enough and 4" is too much. The ideal thickness is 3-1/2" square by about 12" high. If I use 3" stock, I lower the finished height to 10". Using 4" allows greater height, but the final object is just too big.

When I'm trying something new, I always test the idea in a smaller scale and in a soft and inexpensive wood like poplar. It takes less time than making the full-sized piece and you can make mistakes and throw it away without getting too upset. Mistakes are very important. It's not just a cliché; it really is how you learn. I also strongly recommend laying out at least two identical pieces, drawing the centers on both blocks, saving one to record the layout and turning the second one. Sometimes I turn a third piece halfway, to remind myself of the process. For years, I made a drawing for this purpose, but often what seemed clear on paper at the time was indecipherable six months later, and I had to figure out the whole layout again to achieve the same result. The three-dimensional block is a clearer way of taking notes on a three-dimensional form.

LAYOUT

This multi-axis candlestick is an example of using two non-parallel axes in one plane. In the side view, you see elements that are angled to one another, and from the front view, the candlestick is bilaterally symmetrical, sort of like looking at a person from the front or back, symmetrical only from those views. I've attempted using multiple planes, but it gets complicated quickly. It's harder to envision the results, so the turning can end up too thin and weak. And in any case there's enough challenge working in one plane.

The layout of the design is straightforward. I draw a centerline on the top and bottom of the wood blank, defining a plane. The first centers are placed as far as possible toward the opposite edges of the wood on that centerline. A safe distance is about 3/8" from the outer edge. This allows the cup centers to be positioned fully on the wood. It is possible to be a little more extreme, but at the risk of having the wood fly off the lathe. The bottom center of the second set of centers is on true center. The



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top center is 7/8" in from the outer edge on the opposite side from the first center at the top. Next, I lay out a 7/8" diameter hole for the candle, leaving 7/16" from the edge of the hole to the edge of the wood.

PROCEDURE

Before using the lathe, I make the hole for the candle about 1" deep. It is the only part of the object that is not turned and I want it to look as finished as the rest of the piece. I use a slot mortiser with a router bit; the result is cleaner than the cut from a drill bit. The hole is not parallel to the edge of the wood, but angled and aimed at the cen-

ter of the wood at the bottom. This is easy to accomplish on a mortiser simply by angling the block of wood before clamping it down. To achieve the correct angle on a drillpress, I would draw the line of the axis on the side of the candlestick blank and shim the blank until that line was vertical (2). If it is not drilled at the correct angle, the candle will end up tilted (3).

Next I turn a small piece to act as a plug for the hole. It needs to be at least 1-1/2" long so that it can be removed when the turning is completed. It is also important that the plug is a true cylinder and that it slides all the way to the bottom of the hole



without any slop, because I want to clamp the plug against the bottom of the hole. I once made a plug that was more of a wedge. Initially it worked fine, but as the top of the candlestick got reduced down to its final dimension and the piece was just about done, the plug caused the wood to split. Not convinced that that was the problem, I did it again with the same result. Sometimes you only have to make a mistake once to learn a lesson, but sometimes repeating it several times helps to convince you to do things differently. In turning, I've found that when pain is involved, I try to learn my lesson the first time, but everyone is different, so pick what works best for you.

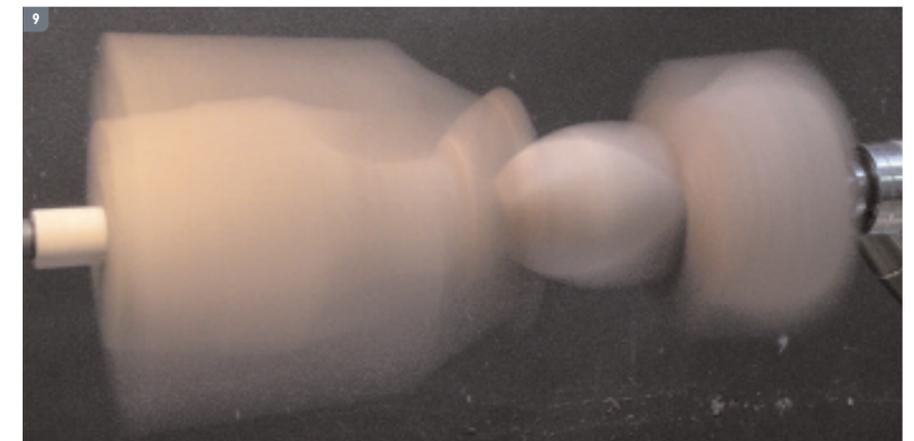
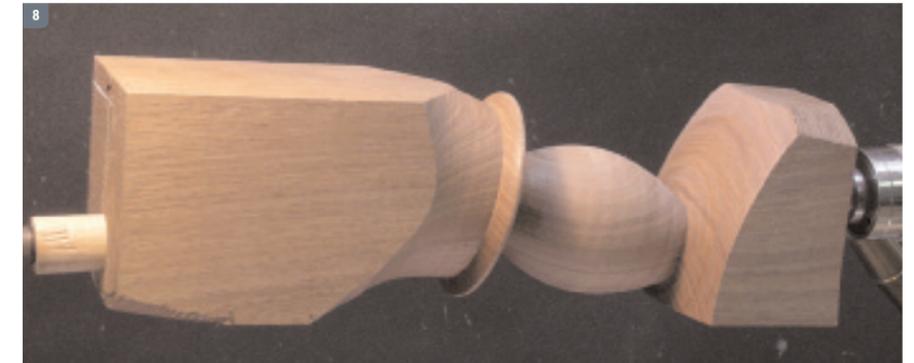
I don't use any special chucks or fixtures for any of the work that I do, and this project is no different. Using a safe center (cup center) in the drive end, as opposed to a spur center, is a very safety-conscious plan,

one that I live by for all between-center turning. In the tailstock I also use a live center that ends with a cup center. The best supplier for both of these is Oneway Manufacturing. Robust Tools has come out with the most accommodating toolrests to date. They allow you to have your hand fully under the tool and to use your index finger as a guide, a need that has gone unaddressed for many years. Although they designed it for their own lathes (which I haven't tried), it is an excellent after-market item for any lathe. In my article on "The Rolling Pin" [*Woodwork* #55, August 2007], there is detailed information about centers and tools that I use for spindle turning.

One of the biggest differences between multi-axis turning and straight turning is that a lot of multi-axis turning requires an interrupted cut, when the tool is only in contact with wood for part of each rotation.

The best way to deal with that is to understand where the pressure on the tool needs to be applied. It is not by forcing the tool against the wood or by riding the bevel. You should exert pressure down on the tool onto the toolrest rather than onto the wood (4), and touch the bevel rather than ride it. It's a problematic cycle: pushing the tool against the wood will result in a very uneven cut because the wood will constantly be pushing the tool back toward you and you will be countering by pushing the tool toward the wood. This effect would continue until the wood was round, but since some parts of off-center turning will never be round, proper technique is essential.

Vibration is an additional factor. Turning a piece that is out of balance usually requires slowing the lathe speed. The proper speed depends on how out-of-balance the wood is, whether the lathe is bolted securely to the floor, and how substantial the lathe is in the first place. A variable speed lathe is really useful because it allows you to turn the wood as fast as possible without vibration. Additionally, tool vibration occurs because the toolrest has to be further away from the work than is usually desirable. A detail gouge will tend to vibrate if it is extended 1-1/2" beyond the toolrest, causing a chattered cut, which, while interesting, may not be what you're looking for. The tool that I use primarily for turning this candlestick is the 5/8" bowl gouge, ground to a 30° angle (5). I do the final clean up of the entire form with a 1/2" detail gouge. When the form is close to the final shape, I angle the toolrest to allow very little tool extension, thereby avoiding vibration.



The first set of centers positions the wood at a significant angle on the lathe. It is actually quite balanced, but as the turning progresses, it becomes less balanced, sometimes requiring the lathe speed to be adjusted. Before changing centers, I sand the work (6, 7).

When positioned on the second set of centers (8, 9), the piece starts out of balance at an even slower speed. As the candlestick approaches completion on the second set of centers, the work becomes more and more balanced, allowing for a much faster speed, which in turn allows cleaner cuts for the final surface before sanding.

I leave a 3/8"-long stem at the bottom, and then undercut the bottom by shear scraping from the center point out to the outer edge, so that the finished work sits flat on the outer edge (10). Later, I carefully saw and pare off the stem in order to leave no evidence of the way the piece was held onto the lathe (11).

EVALUATION OR CRITIQUE

It's important to have your work evaluated by someone whose opinion you respect. That perspective is invaluable in helping you improve what you make, and can help direct your future work. My best critic is my wife. She is more than willing to give me her honest opinion when I ask for it. Sometimes I don't like her opinions, but I get over it. In this case, after I had worked out the form to a point where I was pleased with it, I asked her what she thought. She said that she liked it, but then said, "I can't wait to see how this concept influences your furniture." I was quite annoyed. I saw this as a successful end point, but within a year, I started thinking about how I could use the concept in the design of a table leg, and went on to make numerous designs that led to my "Walking Tables," among other things. So I really do have to give her full credit for making that assessment, however irritating it was at the time.

ADDENDUM

The design of this piece is a combination of visual considerations and engineering decisions based on the geometry of the axes. I think that the proportions and contrast of the elements are aesthetically pleasing. There is an intended precariousness to it, but it is still quite functional. On the other hand, I never considered this object with a candle in it. I don't like the way it looks with

a candle in it. It changes everything.

In 1992, a candlestick of this design could not be sold in Canada. I was surprised by that, but found out that the reason is that it did not have a "bobeche," a piece of nonflammable material like glass or metal separating the burning candle from the flammable wood. If the candle burns down without a bobeche, the wooden candlestick becomes the wick and could devastate the candlestick and maybe the building that it's in. Please heed my words and always use a bobeche!

Since these candlesticks are supposed to be functional, I needed bobeches. I was disappointed by the appearance of commercially available bobeches, so I hired a jeweler to fabricate my own design out of copper. The candle and the bobeche are incorporated from the beginning into the overall design of subsequent versions of the candlestick, with a much more satisfying result

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