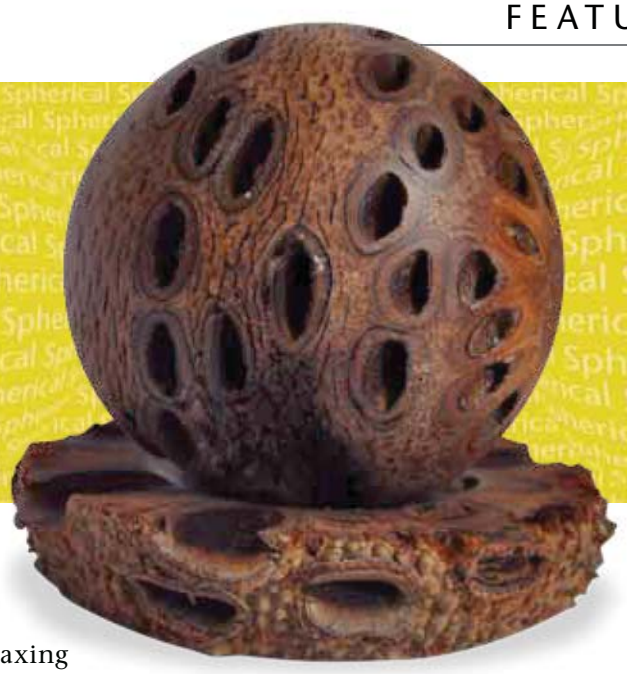
Spherical Thinking

Frederick C. Hill



Banksia, 2010, Banksia seed pod, 2¾" (7 cm)

In perusing past issues of *American Woodturner,* I found several woodturners who described in some detail the process of making spheres. Techniques involved the use of geometric guides ("Making Spheres," Brewer, *AW,* vol 16, no 2), ring gauges ("Turning Spheres," Simmons, *AW,* vol 16, no 3), and even a hole saw ("Wood Spheres," Brueckmann, *AW,* vol 15, no 1). I also found articles that described in some detail the process of making balls. In chronological order they are: "Ways to Have a Ball" (Burchard, *AW,* vol 10, no 2), "Have a Ball Turning Spheres" (Rosand, *AW,* vol 18, no 2), and "Turn a Bowl of Balls from Green Branches Overnight" (Hill, *AW,* vol 18, no 2). These three articles contain significant information, which I highly recommend reviewing. Check out the *AW* journal index in the members' area of the AAW website (woodturner.org) for further information on this topic.

No matter how carefully the turning is done, no ball will be perfectly round. Even Timken ball bearings have tolerances. As moisture in the atmosphere changes, all spheres will exhibit subtle changes in shape, which is one of the reasons I make them without too much regard for perfection. I want my turning experience to be a relaxing escape, so, using other woodturners' ideas and a few of my own, I developed a simple, no-measurement method to produce turned balls.

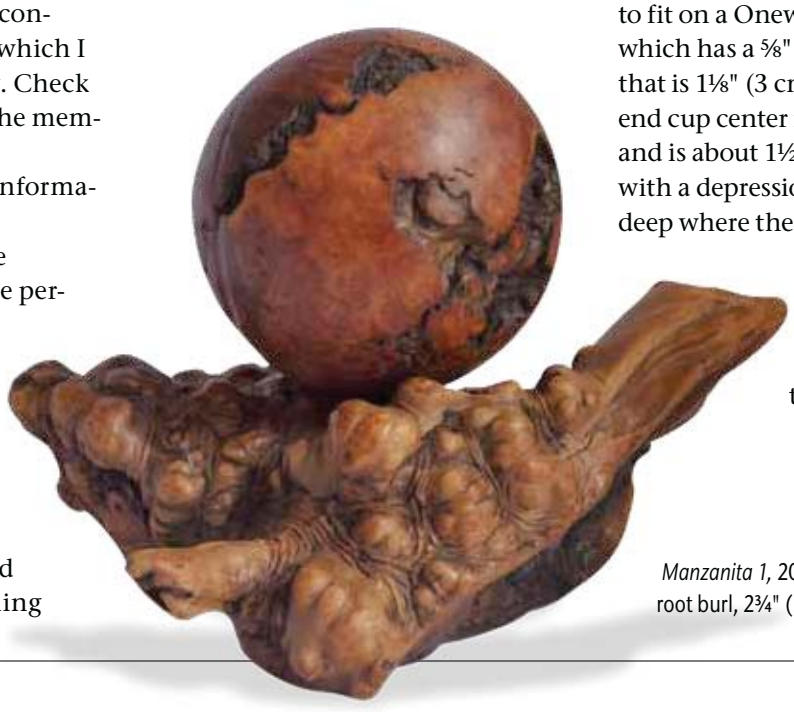
Always wear face and lung protection when woodturning. The ball will be held by wooden cup centers and could fly free. Additionally, fine dust is produced, so lung protection is important. Have good lighting—plenty of light is required to clearly see the ball as it takes shape.

I use an Ellsworth grind ⅝" (16 mm) bowl gouge for turning, and a parting tool (or a small fine-toothed saw) to part off the rough ball prior to final turning. Tools must be kept meticulously sharp. This means sharpening frequently, perhaps once for every sphere.

Shopmade wood cup centers

Begin by making two wooden cup centers, one for the tailstock and one for the headstock. Most solid hardwoods will suffice for this purpose.

The tailstock-end cup center will ultimately be attached to a revolving tailstock center *(Photo 1).* Mine is made to fit on a Oneway lathe's live center, which has a ⅝" (16 mm) threaded end that is 1⅛" (3 cm) long. My tailstock-end cup center is made from hardwood and is about 1½" × 1½" (4 cm × 4 cm) with a depression that is ¼" (6 mm) deep where the ball will rest. There is a hole that is ¾" × ⅞" (19 mm × 22 mm) deep that will fit over the threaded section of the live center. ▸



Manzanita 1, 2010, Manzanita root burl, 2¾" (7 cm)

The tailstock cup center will ultimately be attached to the live center in the tailstock.

Drill a hole in the tailstock cup center. Use a Forstner bit, mounted in a Jacobs chuck.

The tailstock-end cup center is ready for use. Not shown is the hole drilled in the other end.

Mark the position of the jaws on the headstock cup center so that it can be placed back into the chuck in exactly the same position as when it was made.

To make the tailstock-end cup center, begin with a piece of solid hardwood that is about 3" × 1⅝" (8 cm × 4 cm). Mark the center on one end and insert the other end into a four-jaw chuck. Bring up the revolving tailstock center and tighten its center point into the center of the wood so that the wood is held securely. Turn a cylinder that is about 1½" (4 cm) in diameter.

Drill a hole that is ¾" × ⅞" (19 mm × 22 mm) deep in the tailstock end of the center *(Photo 2)* using a Forstner bit held in Jacobs chuck, which is mounted into the tailstock. After drilling the hole, part off a piece that is about 1½" (4 cm) long and place the end with the hole back into the four-jaw chuck and center it for turning. Turn a depression about ¼" (6 mm) deep in the exposed end. The tailstock-end cup center is ready to use *(Photo 3)*.

For the headstock cup center, turn a similarly shaped piece with a depression in one end but omit the drilled hole in the opposite end. This cup center will need to be mounted into a four-jaw chuck. Or, it could be modified in order to be jam fitted into the headstock spindle by making a taper on the headstock end to match the spindle's Morse taper.

My headstock cup center is 2¾" (7 cm) in diameter and 2¼" (6 cm) long and has a depression in the end that is similar to the one for the tailstock but a bit deeper (around ⅜" [10 mm] is adequate). In order to ensure accuracy when placing the headstock cup center back into the four-jaw chuck, mark the position of the jaws on the cup center so that it can be placed back into the chuck in exactly the same position as when it was made *(Photo 4)*.

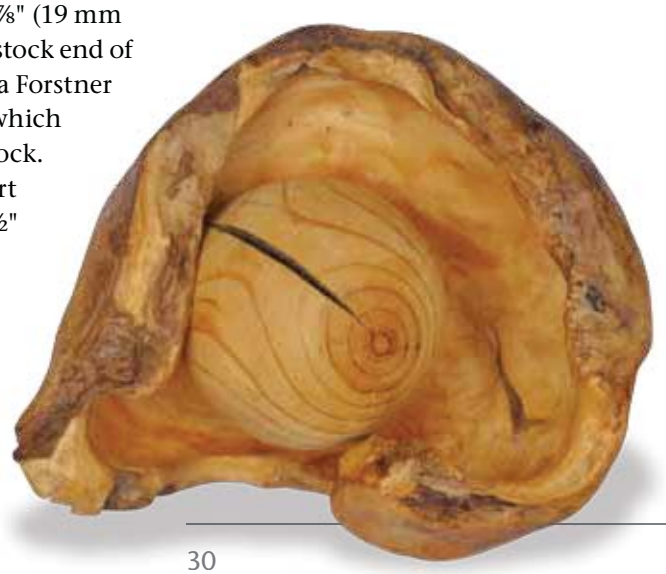
If turning balls that are more than about 3" (8 cm) in diameter, make the headstock cup center proportionately larger to accommodate the larger size. The size of the tailstock cup center will be adequate for most diameters.

Rough-turn a sphere

Select a piece of wet or dry solid wood. A length of firewood or a fresh tree branch that is between 2" and 4" (5 cm and 10 cm) in diameter will work just fine. Cut a length that is between 6" and 8" (15 cm and 20 cm) long and remove loose bark. Square off both ends to make it easier to center on the lathe.

I prefer to mount the wood into a four-jaw chuck; however, you could also turn it held between centers. Before tightening the chuck, bring the revolving center of the tailstock into contact at the center of the end of the piece. Lock the tailstock in place, advance the tailstock arbor tight, and then tighten the jaws of the four-jaw chuck. Take extra care to tighten the jaws so the wood is held securely in place *(Photo 5)*.

Rough turn the wood to achieve a uniform cylinder. Turn down the tailstock end of the cylinder to form a hemispherical end. Leave a nub at the end that is about ¼" (6 mm) long.



Unnamed is a compilation of a naturally shaped and carved boxelder blister and a white pine sphere, which cracked while drying. The sphere is 3" (8 cm) diameter.

Abranet Discs

Many Internet sites carry Abranet discs, but the 4½" (11 cm) rolls are difficult to find online. The eBay vendor I purchase from, stores.ebay.com/abglovesandabrasives, carries the 4½" (11 cm) wide by 10- and 25-yard rolls, as well as various-sized discs and sheets.

Once satisfied with what the tailstock end looks like, move to the headstock end of the wood, about the distance of the radius of the cylinder and turn a second hemisphere *(Photo 6)*. At this point, the sphere should be at least the length of the diameter of the cylinder (eyeball this). It will not be completely ball-shaped at this point but should be on its way to being a sphere. With the lathe running, part off the ball using a parting tool. Or, with the lathe stopped, use a fine-toothed saw.

Fine-tune the ball

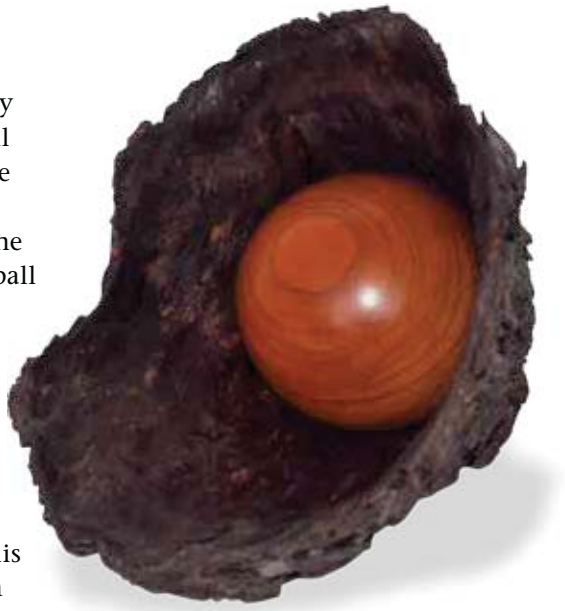
Now comes the fun part: the shaping of the ball. With the cup centers in place, mount the rough-turned ball onto the lathe, held between the two wooden centers so that the original axis of the more or less egg-shaped ball is at right angles to what its position was when first turned. Tighten the tailstock cup center carefully to hold the ball in place.

Put on a faceshield and turn the lathe on to a speed of approximately 1,000 rpm so that the revolving ball creates a ghost around its outer edge from the out-of-round parts whirling by *(Photo 7)*. When looking at the spinning ball, there will be a solid ball shape plus a ghost outside of this shape. Turn away that ghost using a combination of cutting, scraping, and shearing cuts. When a decent ball shape is achieved (no ghost visible) on this axis, reposition the ball on a new axis and turn away the new ghost. Repeat this process, repositioning the ball each time, until no ghost appears.

Close is good enough. This process does not require switching to a new axis countless times in order to obtain a respectable round shape. Try making a sphere by changing the axis only four times. You might be surprised with the results. If, however, greater perfection is desired, simply change axes as many times as required until no ghost is visible. In most cases critical accuracy is unwarranted.

Sand the ball

Minor imperfections can be removed by hand sanding with the lathe running. Recently, following David Ellsworth's advice, I started using Mirka-brand Abranet (www.mirka.com/abranet).



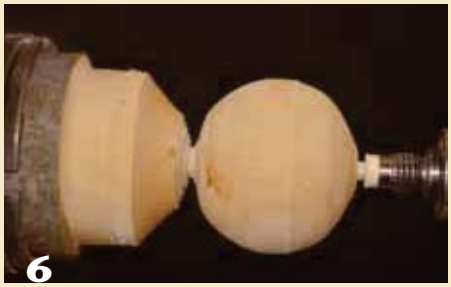
Safe at Home was created from a piece of bark that covered a bump on a log. The sphere is black cherry, 2¼" (6 cm)

Abranet is aluminum oxide bonded to a see-through hook-and-loop–style fabric mesh. This product easily smoothes rough surfaces and does not leave noticeable scratches on the wood. And it can be used on both dry and wet wood since it doesn't easily clog. If the wood dust fills up the mesh, simply blow or wash it out and reuse the abrasive. The sanding dust easily passes through the fabric of the Abranet *(Photo 8)*.

I normally start with 120 grit and then finish with 180, 240, or 320 ▸

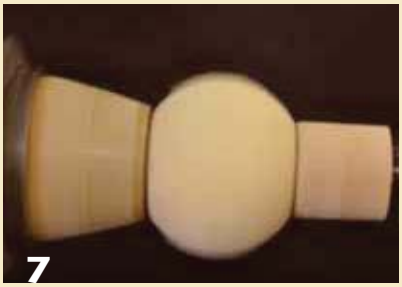
5

Mount a length of freshly cut wood into a four-jaw chuck. Turn it into a cylinder.



6

Turn the ball into a rough shape, then part it off the lathe.



7

With the lathe's speed set at about 1,000 rpm and the ball held in between the cup centers, the revolving out-of-round form creates a ghost around its outer edge. Turn away this ghost.

Sand the sphere. An Abranet abrasive is used here. Note that the sawdust flows through the mesh of the fabric.

When buffing the sphere, hold it tight against the wheel and support it against the direction of rotation.

A sphere turned, sanded, and buffed in about ten minutes.

grit, depending on the wood and my needs. Generally, stopping at 240 grit is enough to achieve a smooth finish on most woods. When using Abranet, don't press hard—light pressure will do a much better job and won't produce heat that can warp the wood.

After sanding, remove the ball from the lathe and buff it on a buffing wheel to give it a shine *(Photo 9)*. I use a wheel charged with Tripoli buffing compound, which will hide small scratches. Be careful while buffing—the buffing wheel can grab the ball and fling it. Hold the ball tightly against the wheel and support it against the direction of the wheel's rotation. The results are amazing! The ball shown in *Photo 10* was turned, sanded with 120-grit Abranet, and buffed in less than ten minutes. No finish was applied. There *are* some tool marks, but the speed at which this sphere was finished shows what can be done with this method.

Finish with any type of finish and, voilá, an (almost) perfect ball! After making several, spheres can be produced in a matter of minutes.

Specific sizes

If specific-sized balls are needed (say, for a croquet set or Chinese balls), grab a set of calipers or make a sizing jig. Generally, a finished sphere will lose about 10 to 20 percent of the wood's initial rough diameter, so start with wood that is of sufficient size.

What you can do with a sphere

Spheres make excellent gifts. People love to pick them up and roll them in their hands. Combine balls in various ways with other lathe-turned work. Spheres enhance mundane objects; imagination is the only limit to the possibilities.

Use freshly cut wood so that spheres will intentionally change shape and possibly even crack as the wood dries.

Interesting results can happen. Wet spheres dried in a microwave might become egg-shaped and crack. Perhaps that is just the look needed for a certain project.

Try a variety of surface decorations. Burchard ("Ways to Have a Ball," *AW*, vol 10, no 2) and Nelson ("Shape and Texture," *AW*, vol 13, no 2) provide ideas. Delhon ("Spherical Box," *AW*, vol 20, no 4) provides excellent details about making spherical boxes and Roberts ("Play Ball," *AW*, vol 20, no 1) shows how to engrave the lines for making a wooden baseball.

Turn grooves in the wood and then burn them by holding a wire in each groove while the ball is turning at high speed. Or, alternately, char the surface of the wood with a torch. (Do this outside, not in your shop!) Many woods change colors remarkably when they are heated and produce stunning appearances after being shined with the buffing wheel. Don't be afraid to experiment. The possibilities are endless! ■

Frederick Hill is a retired university biology professor who lives in the Endless Mountains of Pennsylvania. He does production and artistic turning plus teaching woodturning. Learn more about his work at FredHillWoodworking.com.

Black Gum with Mistletoe, 2010, 4" (10 cm)

JOIN

If woodturning is your hobby, your passion, your art, the American Association of Woodturners is for you.

Membership Benefits

In addition to the benefit of joining one of the largest craft associations in the country, currently greater than 13,500 members strong with more than 325 local chapters in the United States and internationally, each one-year membership includes:


Bert Marsh

Rolly Munro

American Woodturner

- Six issues of *American Woodturner*, official journal of the AAW, each jam-packed with
  - New one-of-a-kind projects
  - Inspiration and insider secrets
  - Time- and money-saving shop tips and techniques
  - Step-by-step instructions with helpful how-to images and diagrams
  - Beautiful color photos throughout
  - Calendar of events, seminars, and exhibitions

Education and Advice

- Annual AAW Symposium
- Expert woodturning advice at woodturner.org in both the online public and members-only Forum areas
- AAW Forum and members-only access on woodturner.org
- Local AAW chapters with local demonstrations, show-and-tell, mentors, and tool and wood swaps
- Access to Educational Opportunity Grants for members and AAW chapters
- Biennial Resource and Membership Directory


Curt Theobald

Opportunities

- Marketing opportunities on the AAW website for artists, collectors, galleries, and museums
- Juried exhibit opportunities


John Ferrell

Lou Metcalf

Insurance and Savings

- Bodily injury liability insurance for members involved in AAW activities
- Commercial and liability insurance available for professional members
- Group rates for health, life, and commercial business insurance
- Discounts on AAW books, DVDs, and logo merchandise with savings up to 50%
- Access to merchandise discounts from multiple suppliers


John Jordan

Helga Winter

Click on the link below to check out our official website!

woodturner.org

Click on the "Join AAW" link for membership information.

Or call:

651-484-9094