Turning Spheres

the easy way

by Tim Kennedy

Turning a sphere doesn't need to be difficult or require special skill, and you don't need to buy special tools or equipment. If you can use a spindle gouge, you can turn a perfect sphere. It is assumed that you already know the basics of woodturning, so I won't go into a lot of detail about tool selection or technique. In this article I will illustrate step by step, how to turn a sphere. Then I will illustrate how to make the cup chucks used to hold the sphere. You will need to make a set of these before you can get started on the sphere. This technique is similar to one I saw on an instructional video years ago. Several years later I told someone I could turn a sphere and I had to make good on it. I spent one whole morning in the shop working from my sketchy memory of that video and this is what I came up with. I hope you find turning this perfect shape as delightful as I have.

Roughing the Sphere

Spheres can be turned out of any wood. The blank should be in the form of spindle stock about 3/4 inch longer than it is wide, as shown in **Figure 1**. It is nice if there is some interesting figure in the wood. Many of my spheres are turned from pieces I felt were unfit for bowls or other woodturnings due to cracks, knots or other defects. Those same defects can make a sphere more interesting.

Start out by mounting the work piece between centers with the long dimension parallel to the lathe axis. Rough the piece into a cylinder and turn off the lathe. Using outside calipers, measure the diameter of the cylinder at the mid point of its length, as shown in **Figure 2**. Mark that dimension on the cylinder lengthwise with a pencil, as shown in **Figure 3**. Use a ruler to find the mid point of those two marks and mark it with a pencil, as shown in **Figure 4**. Turn on the lathe and draw lines around the cylinder at all three marks. You have just laid out the ends and middle of your sphere.

Figure 1

Figure 2

Next, using a square scraper or skew, peal away the waste at either end. Be careful to make this cut square with the axis of the lathe. If you angle into the piece, your sphere will end up smaller than you want.

Now it's time to rough in the shape of the sphere. I like to use a spindle gouge for this. Starting at the middle line and working outward in both directions, make a series of cuts until the piece looks somewhat spherical. It doesn't need to be perfect. The shape will get refined in the next step. You should have a small tenon at both ends where the centers meet the wood. If the tenons are too long, you should part them off. The tenons shown in **Figure 5** are short enough to be turned away in the next step.

Figure 3

Figure 4

Figure 5

Using the Cup Chucks

Remove the spur drive from the lathe and replace with your cup chuck. Now, fit the tail cup over the revolving center. Position the sphere so the center line is along the lathe axis and mount it between the cups. The tenons will be perpendicular to the lathe axis, sticking out toward you, as shown in **Figure 6**. Apply just enough pressure from the tail stock to hold the piece firmly. Too much pressure can leave dents in the sphere or worse, break the cups. Too little pressure will allow the work piece to spin in the chuck, resulting in a nice burnt circle on your sphere.

Figure 6

Spin the piece by hand to be sure the tenons clear the tool rest. Turn the lathe on. You will now see a shadow line marking the round cylinder you turned earlier. See **Figure 7**. Using the spindle gouge, remove everything which sticks out beyond the shadow line. As you get closer to the line, you will not be able to see the shadow. As a guide, use the chatter resulting from the chisel on the uneven surface.

Figure 7

Remount the sphere at different angles between the cups, to make refining cuts, as many times as needed, until you have a fairly smooth surface. The surface in **Figure 8** is ready for sanding.

Figure 8

Sanding should start at 80 or 120 grit, depending on the tooled surface. You should sand the whole sphere with the same grit before moving on to the next. To accomplish this, sand the exposed area between cups first. Then, in order to sand the surface under the cups, stop the lathe and rotate the piece 90 degrees, so the axis parallel to the lathe is now perpendicular. Sand it in this direction with the same grit. Sand with the next grit, then rotate the piece as before and finish sanding. Repeat this for as many grits as you see fit. I usually go up to 400 grit, as shown in **figure 9**.

Figure 9

Apply your favorite wood finish to the sphere. I like to use wipe on polyurethane or tung oil. Using a 4" swatch of old t-shirt folded in thirds, I wipe finish on the top half and sit the sphere on something to keep it from rolling away. After it is dry, I repeat for the bottom half. I build up as many layers as I need to achieve the desired sheen. If there is any dirt in the finish causing unsightly bumps, remove it with extra fine steel wool prior to applying the next layer of finish.

Making the Cup Chuck

The wood doesn't need to be anything special. I just look around the shop for a scrap of hardwood, the harder the better. A short piece of spindle stock about 4 inches in length and 2 to 3 inches square will suffice. These dimensions will vary based on the size of sphere you are turning. Just make sure there is enough length to create a morse taper on one end and a reasonably sized cup on the other.

The diameter of the cup chuck will be determined by the size of sphere you intend to turn. A large diameter cup provides more gripping power. It also causes less indenting on the workpiece, since the pressure is spread over a greater area. Keep in mind, the cup chuck covers a portion of the work piece. A larger cup will result in a smaller work area. A small cup results in a larger work area, but it provides less gripping power and requires a more gentle touch with chisel and sandpaper. The diameter of the chuck should fall somewhere between one third and one half the diameter of the sphere you intend to turn.

Figure 10

First mount the stock in a four jaw chuck as shown in **Figure 10**. Turn the exposed end of the work piece to a cylinder and create a shoulder so you can flip the piece and remount it in the four jaw chuck. See **Figure 11**. After flipping the piece end for end, turn the other end to a cylinder. This could all be achieved between centers, but I like to use a four jaw chuck for the next step. This just saves time.

Figure 11

With the piece still mounted in the four jaw chuck, use a spindle gouge to rough in the morse taper. The taper should be about 3 inches long. To get the correct small and large diameters, use outside calipers to take measurements from a spur drive. Continue turning the taper using the spindle gouge. When the taper looks about right, dismount the four jaw chuck from the lathe, without removing the work piece. Turn the whole assembly around and fit the taper into the head stock, as shown in **Figure 12**. Give it a couple turns to burnish the wood. The resulting smooth marks (or dirty marks) will show the high spots, as shown in **Figure 13.**

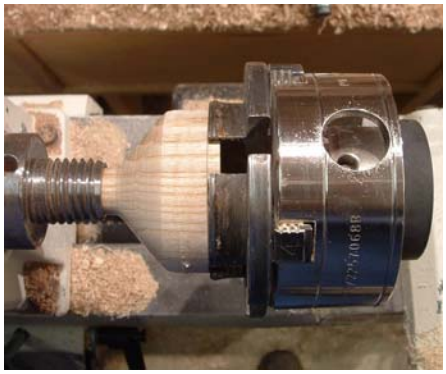

Figure 12

Figure 13

Remount the four jaw chuck and fine tune the morse taper. Repeat this process until the taper has a good fit with the head stock. The taper should at least make contact at both ends. See the burnish marks in **Figure 13**.

When you are satisfied with the morse taper, use the spindle gouge to shape the backside of the cup. Then take the work piece out of the four jaw chuck and remove the four jaw chuck from the lathe. Mount the work piece directly into the head stock, via the morse taper you just turned as shown in **Figure 14**. Give it a couple taps into the head stock to assure it is mounted securely. Now use the spindle gouge or round nosed scraper to hollow out the cup. Leave enough wood in the wall of the cup to provide adequate support when pressure is applied from the tail stock. Be careful not to leave a sharp edge around the rim of the cup which might indent the sphere. **Figure 15** shows the completed cup chuck.

Figure 14

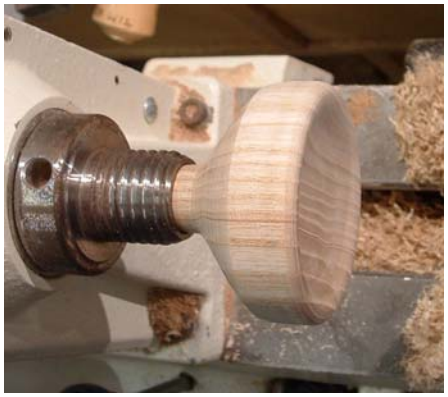

Figure 15

Turning the Tail Cup

In order for the tail cup to turn freely, I hollow out one end so it fits over the revolving center on the tail stock. The other end is cupped to hold the sphere. Use a piece of hard wood spindle stock about 2.5 inches long. The width is determined by measuring the diameter of your revolving center and adding 1/2 inch. This will allow for a 1/4 inch wall thickness on the completed piece.

Start out by mounting the work piece in a four jaw chuck. Using a spindle gouge or skew chisel, turn the exposed end to a cylinder. True up the end grain and make a shoulder for remounting in the four jaw chuck. Using a square scraper, hollow out the end of the work piece so it fits over the revolving center. While it is still in the four jaw chuck, test the fit by sliding the revolving center into the work piece as shown in **Figure 16**. The tail cup needs to fit loose enough to get back off the revolving center but should not fit so loose as to wobble.

Figure 16

Once you are satisfied with the fit over the revolving center, hollow out a cone-shaped void at the back of the hole as required to fit your revolving center. See **Figure 17**. Then remove the work piece from the four jaw chuck, flip it end for end, and remount it in the four jaw.

Figure 17

The tail cup does not need to be as big in diameter, as the cup chuck, since there is no torque at this end of the work piece. I use one tail cup for spheres ranging in size from 3 inches to 8 inches. Using the spindle gouge, turn down the diameter of the work piece to about 1.5 inches, as shown in **Figure 18**.

Figure 18

On the end of the work piece, hollow out the cup using a spindle gouge or round nosed scraper. Don't make the rim too sharp, or it will indent the sphere. See **figure 19**.

Figure 19

The last thing is to bore a 5/8" diameter hole through the center of the cup. I just use the spindle gouge for this. The hole is handy if the tail cup gets stuck on the revolving center, like mine did. You will be able to push something through the hole to dislodge the revolving center. Another function of the hole is to telescope the tail cup onto the cup chuck for convenient storage, as in **figure 20**.

Figure 20

That's all there is to it. Now you have another great use for all those cut-offs and shorts lying around the shop.

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Collection of Square Bowls with Spheres

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