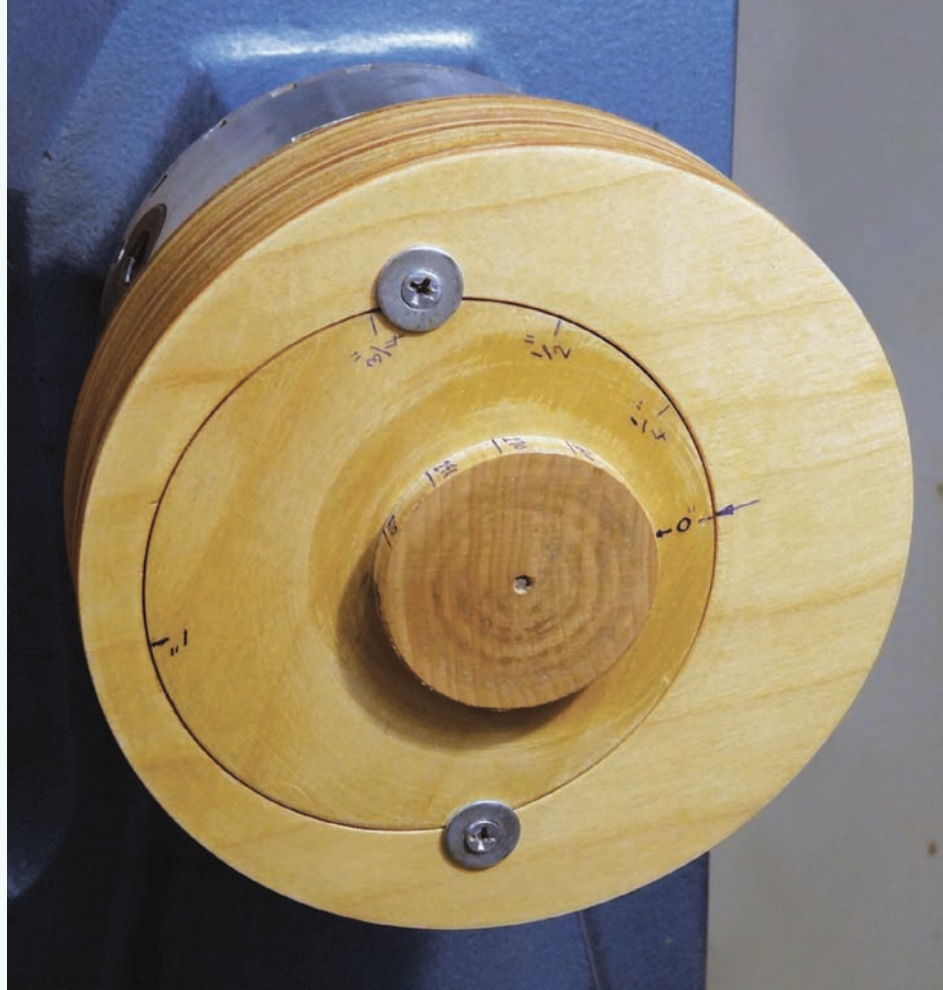


BUILD A SHOPMADE CHUCK FOR OFFSET TURNINGS

David Mueller



By using an eccentric chuck, you can add interest to turnings such as pendants and box lids. The workpiece is mounted out of alignment with the axis of your lathe (offset), producing interesting effects. However, I have found that commercially available metal off-center chucks have significant off-center mass, causing vibration and reducing maximum lathe speed. They also limit the possible degrees of offset and pendant rotation due to their fixed-hole design. To address these issues, I created my own off-center chuck using plywood. With my shopmade fixture, all the mass except the pendant blank and a lightweight pendant mount is centered and always balanced, enabling turning at higher lathe speeds with no vibration.

My chuck is also safer since the outer body is always on center and will not become a “knuckle buster” when turning or sanding. It also provides a continuously variable offset while keeping the whole chuck balanced. The dimensions offered here are for a chuck that has a maximum one-inch offset. Larger offsets are possible, but it will require a larger diameter body.

The chuck comprises three main components: the body, the inset circle, and the pendant mount. When assembled, the chuck will be mounted on the lathe either by a faceplate or glueblock with a tenon held in a chuck. I will focus on the tenon method in this article. Although this chuck can be used to turn pendants, box lids, and other items, I refer to the mounting component as a pendant mount for ease of description.

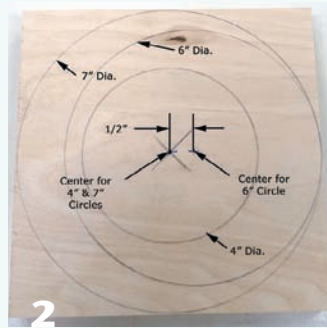
Build the chuck body

There are four pieces required—three cut from $\frac{3}{4}$ " (20mm) plywood and one from $\frac{3}{4}$ " hardwood. You will need a 7" (17.7cm) plywood square, 6" (15.3cm) plywood square (slightly oversized), 4" (10.2cm) plywood square (slightly oversized), and a hardwood glueblock square sized for making a tenon that will fit in your chuck (*Photo 1*).

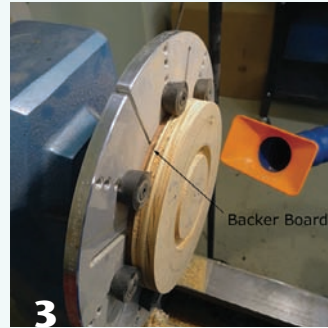
1. Draw a 7" diameter circle centered on the 7" plywood square. Draw a 4" circle using the same center as the 7" circle. Drill a small hole through the center to mark the center on both sides, making sure the hole is perpendicular so the piece will not wobble when mounted between centers. Mark a new center $\frac{1}{2}$ " (12mm) off the center of the 7" diameter circle and draw a 6" circle using this offset center (*Photo 2*). ▶



1 You will need three plywood squares for the body of the chuck and a piece of hardwood for the tenon.



2 Draw all reference lines on the 7" plywood blank.



3 Use a backer board behind the 7" disk when cutting out the 4" circle.



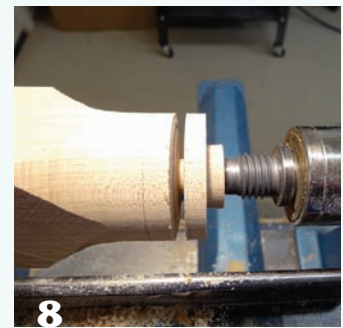
4 The 6" ring has a 4" hole offset by 1/2".



5 The completed chuck body has a centered tenon on the back side and an offset recess on the front side.



6 The 4" circle fits into the offset recess on the front side of the chuck.

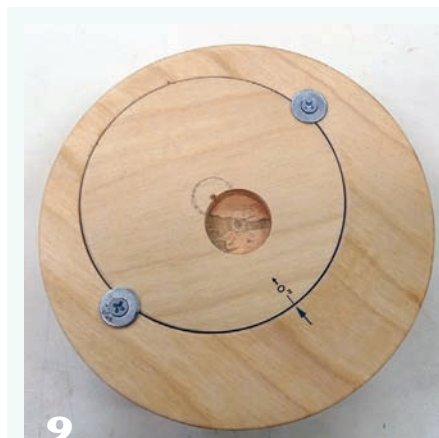


8 The pendant mount resembles a hat and has a hole drilled through it.

2. Cut out the 7" circle using a bandsaw or jigsaw. Mount the plywood blank between centers using the small hole for centering, and turn to the outer 7" diameter mark.
 3. Mount the 7" round into jumbo jaws or a Longworth chuck with a thin plywood backer behind it so you do not cut into the chuck (Photo 3). Cut out the 4" circle with a parting tool, being careful to keep inside the 4" diameter line. Clean up to the 4" line with a scraper or gouge. Make sure the final cut is perpendicular to the face. If you do not have jumbo jaws or a Longworth chuck, mount the 7" round onto a faceplate with a 7" waste block. Three screws inserted through the disk and into the waste block will hold the round while using a parting tool to cut through the plywood at the 4" mark.
 4. Remove the 7" round from the chuck (or faceplate) and cut on the 6" circle line using a bandsaw or jigsaw. You should now have a 6" diameter disk with a 4" hole offset by 1/2" (Photo 4).
 5. Cut out a round glueblock and drill a small hole through the center, again making sure it is perpendicular to the face. Select hardwood for the glueblock so it will stand up to multiple mountings in your chuck. Mount the block between centers using the center hole and turn a tenon sized for your chuck.
 6. Mount the tenon in the chuck, true the glue face, and mark jaw No. 1 so you can remount it the same way each time. Cut a 6" diameter circle from the second piece of 3/4" plywood (the 6" square). With the glueblock mounted in the chuck, glue the 6" plywood circle to the glueblock. Line up the live center in the tailstock to the mark used to draw the circle and apply pressure.
 7. After the glue dries and without removing it from the chuck, glue the previously prepared 6" disk (with the 4" offset hole) to the already mounted 6" circle, aligning the outside edges. Use a piece of scrap wood and the tailstock to hold it in place while the glue dries.
 8. When the glue is dry, apply thin cyanoacrylate (CA) glue to the outer edges of both 6" circles to minimize tearout and true them up.
- You should now have an assembly that is about 6" in diameter and 1.5" (3.9cm) thick with a tenon on one side and a 4" diameter hole 3/4" deep, offset 1/2" on the other side (Photos 5, 6).

Add the inset circle

Using the third piece of 3/4" plywood, cut out a slightly oversized 4" circle and drill a small perpendicular hole



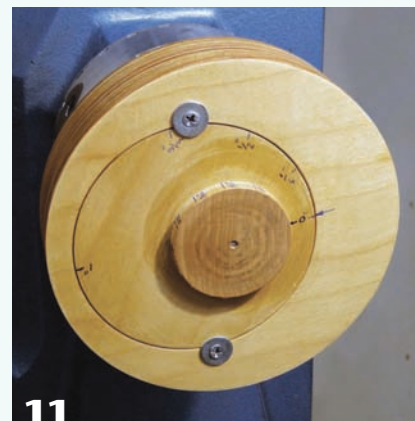
9

Mark a zero reference line on both the body and the insert. Then use a Forstner bit to drill a 1" diameter hole $\frac{1}{4}$ " deep into the inset circle.



10

Remove the 4" inset circle and countersink the screw hole on the side opposite the 1" hole.



11

A fully calibrated chuck includes pencil marks to aid in reproducing patterns.

through the center. Mount the piece between centers using the hole as a guide, and again saturate the edge of the plywood with thin CA glue. Turn the piece to closely fit into the 4" hole in the chuck body so it turns freely but is not a loose fit. You can sand and wax the edges of the 4" circle to make it turn more easily (*Photo 7*).

Make the pendant mount

For the pendant mount, you will need a 2½"- (6.4cm-) square spindle blank 2"-3" (5cm-7.6cm) long. Chuck the blank and turn it to a 2" diameter cylinder. Drill a small hole slightly more than 1" (25mm) deep into the end of the blank. This hole will accept a 1" flathead screw and should be sized to accept the threads snugly. Turn a tenon on the tailstock end 1" in diameter and $\frac{1}{4}$ " (6mm) long. Part off the pendant mount at $\frac{1}{2}$ " so you have a $\frac{1}{2}$ "-tall "hat" with a $\frac{1}{4}$ "-thick, 2"-diameter brim and a $\frac{1}{4}$ "-high, 1"-diameter crown with a hole through the center (*Photo 8*).

After parting off, chuck the pendant mount by the 1" tenon and true the 2" face. If your lathe has an indexing capability, make equally spaced marks around the outer edge of the brim while the pendant mount is still in the chuck.

The number of marks is not critical since they will only be used for accurate repositioning later. If your lathe does not have an indexer, a simple alternative is to wrap a strip of paper around the outer rim of the pendant mount and mark where the ends overlap. Cut the strip on the mark and fold in half three times. Unfold the strip, place a mark at each fold line, wrap it around the pendant mount, and mark the eight equally spaced lines on the pendant mount.

Assemble the fixture

Give all parts a coat of wipe-on polyurethane and sand lightly. Drill two small holes on the front face of the chuck body 180° apart about $\frac{1}{8}$ " (3mm) outside the 4" recess. These are for small flathead screws and washers that will lock the inset circle in place and keep it from moving during use. The screw holes should be close enough to the 4" recess so the washers will extend over the inset disk. Glue abrasive in the bottom of the 4" recess; the added friction will help prevent the inset disk from turning and also raises it slightly above the face of the chuck body so the locking screws and washers will hold it tightly in place. Place the inset circle in the

4" recess and lock in place with the two screws and washers.

Make sure the locking screws and washers are tight and mount the fixture in your chuck. Draw a short arrow to be used as a reference line at the circular joint between the inset circle and chuck body pointing toward the center of the 4" disk. Place a mark on the inset circle opposite the point of the arrow and label it zero (*Photo 9*). This must be done before you move the inset circle because the marks establish an accurate zero offset position. Use a Forstner bit mounted in your tailstock to drill a 1"-diameter hole $\frac{1}{4}$ " deep into the 4" disk. This hole will be located in the center of the chuck body (at the zero offset position in relation to your lathe's spindle) but offset from the center of the 4" inset circle. Without moving the inset circle, replace the Forstner bit with a drill bit sized to accept a 1" flathead screw and drill a clearance hole through the inset circle at the center point left by the Forstner bit.

Remove the 4" inset circle and countersink the 1" screw hole on its back side. Place the 1" tenon of the pendant mount into the 1" hole in the inset circle and hold in place with the flathead screw driven from the back (*Photo 10*). You ▶

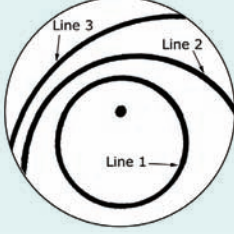
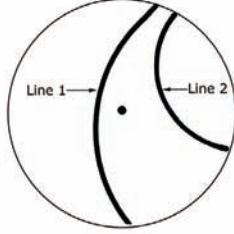
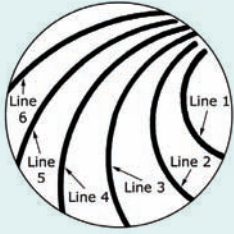
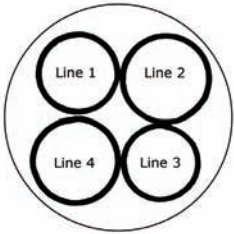
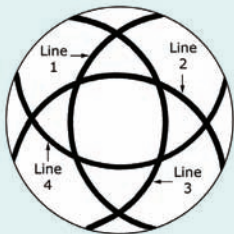
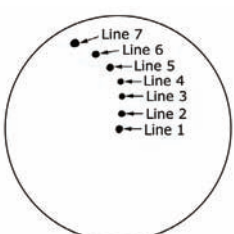
		Offset	Rotation	
Example 1	Line 1	¼" (6mm)	0°	
	Line 2	½" (12mm)	0°	
	Line 3	¾" (20mm)	0°	
Example 2	Line 1	1" (25mm)	0°	
	Line 2	1"	30°	
Example 3	Line 1	1"	0°	
	Line 2	1"	345°	
	Line 3	1"	330°	
	Line 4	1"	315°	
	Line 5	1"	300°	
	Line 6	1"	285°	
Example 4	Line 1	½"	0°	
	Line 2	½"	90°	
	Line 3	½"	180°	
	Line 4	½"	270°	
Example 5	Line 1	½"	0°	
	Line 2	½"	90°	
	Line 3	½"	180°	
	Line 4	½"	270°	
Example 6	Line 1 (Center of pendant)	0"	0°	
	Line 2	⅛" (3mm)	0°	
	Line 3	¼"	0°	
	Line 4	⅜" (10mm)	0°	
	Line 5	½"	0°	
	Line 6	⅝" (16mm)	0°	
	Line 7	¾"	0°	

Table 1. Examples 4 and 5 have identical offset and rotation settings but different tool placement relative to the center of rotation, showing the significant impact of tool placement. Example 6 shows how the center moves with different offsets. Tool placement changed for Examples 1–5, but not for 6.

may have to grind off the tip of the flathead screw so it does not protrude past the front surface of the pendant mount. The chuck assembly is now complete.

Calibrate your offset chuck

To calibrate the chuck, mount the inset circle/pendant mount assembly into the chuck body, set it to the zero mark, and tighten the two screws. Turn the chuck by hand and verify that the pendant mount is concentric with the lathe's spindle. If it is not centered, loosen the screws and adjust the inset circle until the pendant mount runs true. Retighten the screws and, if necessary, re-mark the zero offset on the chuck body.

Cover the face of the pendant mount with masking tape or an adhesive label. Place a dot at the center and draw circles with ¼", ½", ¾", and 1" radiuses on the tape by turning the chuck by hand. These circles should be concentric with the outer diameter of the pendant mount. Bring the tailstock with a live center up close to the face of the pendant mount. Loosen the locking screws and washers and rotate the inset circle until the point of your live center is lined up with the ¼"-diameter circle. Put a mark on the inset circle opposite the reference line on the chuck body and label it ¼". Repeat this process until you get to the 1" offset. In theory, this should be 180° from the zero mark (*Photo 11*). Note that the offset marks are not evenly spaced. This is normal because the relationship between the rotation of the inset circle and the offset is not a linear function.

The accuracy of the calibration is not critical since the purpose of these marks is to allow you to reset the fixture to reproduce a given pattern.

Examples of offsets and rotations

The three factors affecting the patterns generated are the offset, the rotation of the pendant mount, and where the tool is placed on the toolrest when the cuts are made. Of the three, subtle changes in the tool placement will probably have the most profound effect, so experiment with a lot of different tool positions with the same offset and rotation. Practice with scrap wood until you achieve the desired effect, recording the offset and rotation settings as you go. After that you should be able to accurately reproduce that effect using the same settings.

As a learning aid, test your offset designs with a piece of adhesive label attached to the pendant mount. Adjust the offset and rotation and then turn the chuck by hand, using a pencil to lightly mark the center and tool path for various tool placements to see what effects the three settings have. You can get good tool placement reproducibility by measuring from the mark at the center of rotation. If you don't like the result, just erase the lines and start over. After you find an attractive offset pattern, the label is easily peeled off and pasted in a notebook with the settings used. When you

are ready to turn a pendant, you can also use the pencil mark technique on the pendant blank to make it easier to see where to place the tool.

Table 1 shows examples of various offsets, rotations, and tool placements. They were created on labels stuck to the pendant mount while turning the chuck by hand. They were not chosen because they are especially attractive, but to provide an understanding of how each can change the appearance of the pattern.

Using the fixture

The amount of offset is controlled from the front face by loosening the two flathead screws and rotating the inset circle using the pendant mount as a handle. The rotation of the pendant mount is done by removing the inset circle and loosening the 1" flathead screw from the back.

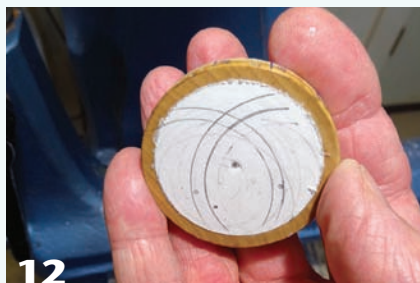
I typically make a pendant with a diameter slightly larger than the diameter of the pendant mount. With the edge of the pendant proud of the pendant mount, you can turn and finish the edges and front face without removing it from the mount. If you prefer smaller pendants, make a smaller diameter pendant mount.

Pendant blanks are attached to the pendant mount with double-sided tape. I normally turn pendants from a 2"-square sidegrain blank approximately ¼" thick and finish with CA glue.

Make multiple pendant mounts so you can remove the mount and pendant from the offset chuck to apply creative enhancements like epoxy fill or other inlays, or to let a finish dry while turning other pendants. If the off-center work is complete, you can do the final sanding and finishing by holding the pendant mount and its attached pendant in a scroll chuck, eliminating the need to remove and remount the pendant itself.

The chuck settings to produce the pattern in *Photo 12* are ½" offset, rotation at 0° and 120°, and tool placements of ¾" and ⅞" (22mm) from the center of rotation for each rotation setting. To make this pattern, follow these steps:

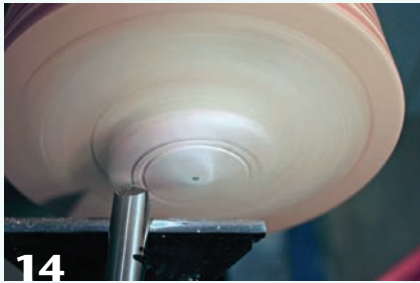
1. Flatten one side of a pendant blank with abrasives and mount that side to the pendant mount with double-sided tape. Turn the exposed side flat, sand, and finish. This will be the back side of the pendant and should be flat so the tape will hold it firmly.
2. Remove the blank, turn it around, and mount the back to the pendant mount. Turn the front face to a gentle curve at the edges, sand, and finish. The curve adds interest and is necessary to keep the cut lines from going all the way to the edge.
3. Adjust the offset to ½" and the rotation to 0° and lightly draw a dot at the center of rotation. Measure the ¾" distance from that center for the first line and draw a pencil line on the blank by turning the chuck by hand. Repeat for the second line as shown in *Photo 13*. ▶



12 Use a pencil to confirm where the cut lines will be on a test blank.



13 With the pendant blank mounted onto the fixture, again use a pencil to confirm location of the cut lines.



14

When satisfied with the pattern, make the actual cuts.



15

After final cuts are made and finish has been applied, add jewelry findings and a neck cord.

7. Finally, install the jewelry findings and neck cord (*Photo 15*).

The use of various woods and other materials can create stunning results. Consider using colored epoxy or other fillers in the cut marks (*Photos 16, 17*). This shopmade chuck provides a safe, vibration-free way to turn offset patterns and is easy and inexpensive to make. ■

4. Cut the grooves as shown in *Photo 14* using a pointed scraping tool or the long point of a skew.
5. Remove the screws and the inset circle, adjust the rotation of the pendant chuck to 120° for the second set of cuts, and re-install the inset circle at ½" offset. Draw a new set of lines as in Step 3 and cut the grooves.
6. After making the desired cuts, you can spray the pendant with

flat black paint to enhance the cuts. However, the pendant must be pre-finished before spraying or the black paint will penetrate the grain and become very difficult to remove. Immediately after spraying, wipe off most of the black paint and let it dry. Once dry, gently sand with fine grit abrasive to remove the remaining paint, being careful not to sand through the finish, and buff.

Dave Mueller, a retired radiopharmaceutical executive, began traditional woodworking in 1962 but started turning just five years ago. He is an active member of the Brazos Valley Turners and the Gulf Coast Woodturners Association. He enjoys both turning and enhancement and makes many of his own tools and fixtures. Dave's formal training as a scientist has influenced his focus on wood spalting, epoxy enhancement, gilding, and patination of turned pieces. For more, visit aggieturner.com.



16

Exotic woods can create stunning results.



17

Colored epoxy adds interest to a Corian® pendant.

You read the article— now see the video!

This article has an accompanying online video in which Dave Mueller demonstrates the use of his shopmade offset pendant chuck. To view the video, visit tiny.cc/offsetchuck (case sensitive) or scan the QR code with your mobile device.

