A Thermed THREE-LEGGED STOOL

Brian Horais

Therming can be described as off-center (not multiaxis) spindle turning. This article introduces readers to therming and shows how to make a thermed three-legged stool, using a therming "rig" from readily available hardware. The stool's legs are turned on the therming rig, resulting in shapes that are not possible on a centerline turning. The seat is cut in a triangular, curved shape on the bandsaw, and its surface is dished-out by turning it on-center.

You might look at thermed shapes and say, "I could do that on a bandsaw." But look more closely. Each surface on a thermed shape has a curvature determined by the diameter of its holding rig. The therming rig used for the stool in this article has an 8" (20cm) diameter. Therming allows you to make exact duplicates of three, four, or however many spindles a therming rig can hold (*Photo 1*). That's why therming has been used for fabrication of complex table legs since the 1700s. There is even mention of therming in a letter to Thomas Jefferson from his assistant Nathaniel Colley, dated January 22, 1791. Colley wrote about the delivery of tables from furniture maker "Samuel Titt, London, 25 Nov. 1790, charging £6 6s. for 'a fine Solid Mahagony [sic] Secret flap Table Taper feet fluted and Therm'd.'"[1]

In 2012, I took a class at Arrowmont from Art Liestman and Barbara Dill called, "Round Is So Over-Rated." The class focused on therming and multi-axis turning. I credit Art and Barbara with getting me started turning

1

Production therming rig

An early therming rig built to hold multiple spindles. From *AW* Summer 1998 (vol 13, no 2, page 10), "Angular Turning on the Lathe: Profiles with Edges," by Sigi Angerer.

Photo: Sigi Angerer

[1]Source: founders.archives.gov/documents/Jefferson/01-18-02-0192

Shopmade therming rigs

A therming rig with center shaft.

The simpler faceplate-mounted rig used for the stool shown in this article.

Therming rig layout and components

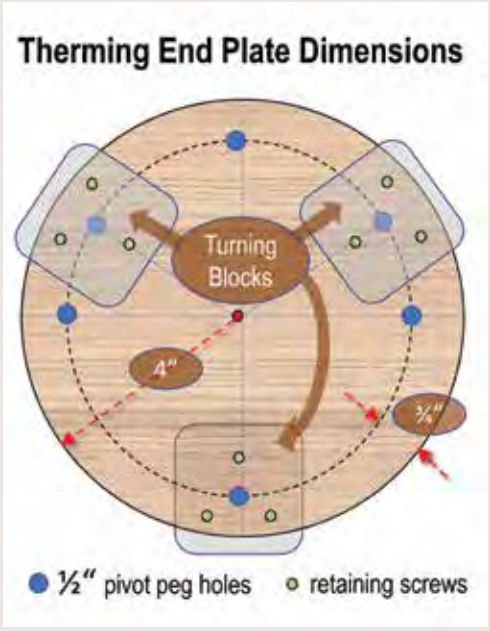


Figure 1

Two endplates are drilled for pivot dowels as well as for spindle mounting screws, all spaced inside the "footprint" of the spindle turning blocks. A faceplate is used to mount the rig on the lathe.

non-round objects on the lathe. Prior to this class, Art published a detailed article in the April 2010 *American Woodturner* (vol 25, no 2, page 48), titled, "Beyond Round: Therming." After I took the class, I made a rustic three-legged stool using the techniques I had learned. More recently (with extra time on my hands), I decided to make another, more refined "thermed" stool. Here is how I made it.

Make a therming rig

Two variations of therming rigs are shown in *Photos 2 and 3*. These rigs are based on designs provided by Art Liestman in his Arrowmont class. The one in *Photo 2* has a center shaft ending in a Morse taper and endplates that can be adjusted for different lengths. This type of rig is best for frequent use. For very frequent use, the endplates could be made from metal. The rig shown in *Photo 3* is simpler and is not meant to produce large quantities of thermed spindles. It comprises two plywood endplates and a threaded faceplate for mounting on the lathe. This is the rig I used in illustrating this article.

You can make this therming rig from readily available items. The most expensive part is the faceplate, less than 4" (10cm) in diameter, for attaching to the lathe's drive center. You might already have a faceplate that you could use. The other items—some ¾"-(19mm-) thick quality plywood, dowel pegs ½" (13mm) in diameter and 1½" (38mm) long, and screws—are probably within reach for any woodturner. Phillips screws are recommended (1¼" to 1½", or 32mm to 38mm, long, size #8 or #10). These will provide sufficient penetration through the plywood endplates and into the spindle blanks.

Cut two plywood endplates to 8"-diameter circles. Be sure to maintain a mark/divot for your center. To keep the endplates aligned on center, stack them together with the metal faceplate centered on top. Then use 1½"-long screws to fix the faceplate on top. These screws are long enough to penetrate into the second endplate, ensuring the two are held tightly together. Mount this assembly on the lathe and smooth the outer edges. Sanding works best because trying to turn the edge of plywood usually results in a lot of chips and splinters.

With the joined endplates still on the lathe, mark a circle that is inset ¾" from the outer edge to provide an alignment guide for drilling the ½" pivot dowel holes. After removing the still-joined endplates from the lathe, mark the hole positions for three- and four-spindle configurations and then drill the pivot dowel holes with a ½" Forstner bit on the drill press. Note that the holes are separated by 120 degrees for three-spindle applications and by 90 degrees for four-spindle applications. Full dimensions are shown in *Figure 1*. Brad point drills will also work, but be sure to put a sacrificial piece of wood below the endplates when drilling to keep the exit hole from splintering. If you don't have a drill press, take care in drilling ▸

these pivot holes to make sure they are perpendicular to the endplate surfaces. The pivot posts are ½"-diameter dowels, 1½" long (*Photo 4*).

Prepare and mount spindles

You can mount two, three, or four blanks on this rig as desired. For this stool, we are turning three legs, so cut three spindles 10" (25cm) long and 2¾" (7cm) square. I used cherry, but other hardwoods would do fine. This length results in a seat height of 12" to 13" (30cm to 33cm), depending on your seat thickness. Narrower spindle blanks will also work but will give you less width to explore dramatic thermed shapes.

Mark a centering hole in each end of the blank. Then drill holes ½" in diameter and ½" deep for the pivot dowels, as shown in *Photos 5, 6*. Be sure the spindle ends are perpendicular to the blanks and the holes are perpendicular to the end surfaces. Drilling on a drill press is recommended but not absolutely necessary. Pay attention to the alignment of the holes to ensure your therming rig assembles properly and functions as designed. If the spindle blanks are not all the same length and/or if their ends are not perpendicular to the long dimension, your rig will not fit together well and alignment will suffer when you rotate the spindles for each turning sequence.

Insert three pivot dowels in each endplate in the three-spindle configuration, then mount the spindles on the pivot pins between the two endplates. The assembled rig looks like a barrel, as shown in *Photo 7*, with circular endplates and the turning blanks mounted between them. Each blank is mounted with a centering dowel at each end, so it can be rotated the desired amount between turning sequences. The faceplate end will be screwed together first, after aligning the outer surfaces of the spindles perpendicular to the centerline of the therming rig. Insert three screws into each spindle blank through the endplate to immobilize the blank during turning. Tighten the screws on the faceplate end of the rig.

Next, use only one screw per turning blank for now to attach the other endplate. Do not tighten these screws all the way, but take out any gaps between the spindle ends and the endplate. Then mount the assembly on the lathe. You may need to make a couple of taps with a mallet to take out any gaps between the endplates and spindle blanks. Now tighten the screws on the endplate nearest the tailstock and insert/tighten the remaining screws (*Photo 8*).

This process ensures the entire therming rig is mounted on center before all screws are tightened. If there are any gaps between the turning blanks and the faceplates, you either did not tighten the screws fully or your

Mark and drill spindles

Mark the center at the ends of the spindles, and drill ½"-diameter holes to accept the pivot dowels.

Mount spindles on rig

(7-8) Position the spindles in the therming rig before tightening the mounting screws. Ensure there are no gaps between the ends of the spindles and the endplates.

(9) Mark a clear "Do Not Turn" region as a reminder of the length of the mounting screws.

turning blank ends are not square and perpendicular. If this is the case, it is best to remove the blanks and square them up before proceeding.

Note that there is a region at the end of each blank, depending on the length of the screws used, where the screws extend into the spindle blank. This is a "keep out" region for turning so you don't hit the screws. Mark this area (*Photo 9*), and then turn a groove on each end as a visual and tactile indication of your available turning area.

Turn four surfaces

Because the spindles are mounted separate from one another, you will be turning wood on only a portion of each rotation. This is known as turning air (*Photo 10*). All four surfaces will be turned in succession for each of the three legs. After each surface is turned, the blanks are rotated 90 degrees. It is important to hand-rotate your assembled therming rig before each turning sequence to make sure the toolrest does not interfere with rotation.

When turning, present your tool carefully. First, place the tool on the rest, handle down, and move it toward the spinning rig. When the tool begins to touch the wood, slowly lift the handle to engage your cut. You can use a bowl gouge for the initial cuts, but I do not recommend starting with a roughing gouge, as it tends to chip and splinter the spindle blank edges during the initial cuts. Once the surface cuts have been started, a roughing gouge works well. You can use other traditional tools to cut beads, coves, and sharper curves.

It helps to draw a line, showing your desired curve, on the side of one blank. This can't be seen very well while turning, but it serves as a good reference when you stop cutting periodically. You can monitor the overall shape of your cut surface on each leg by viewing the upper shadow line of the rotating surfaces.

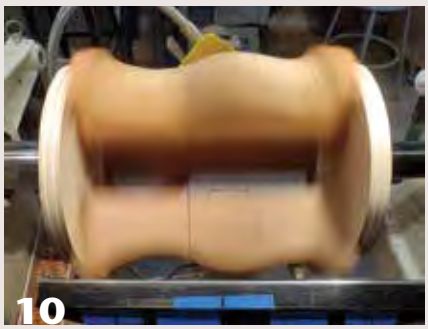
After you turn your desired contour on the first side of the spindles, remove the end screws and rotate each spindle blank 90 degrees in the direction away from the lathe's rotation. The completed first contour cut is shown in *Photo 11*. If you want to duplicate this contour on adjacent surfaces, make a template to transfer the contour to a side of the spindle blank before turning it. It helps to sketch out the desired contours on opposing sides to make sure you are turning the surfaces correctly. With the curved design shown here, opposing sides are mirror images. If you make the contours of opposing sides the same, there may be a section that becomes too thin. Sketch first, then cut. In this case, I was not trying to be exact in duplicating the contours, so I just hand-drew the approximate line and then cut the contour after each rotation. Again, refer to the shadow line of the rotating therming rig to monitor progress and smoothness of your contours.

After rotating the blanks (and reinserting/tightening the screws) and completing the surface cuts, you begin to create a well-defined edge (*Photo 12*). Rotating the blank away from the turning direction will ensure that the uneven edge on the trailing surface is always cut clean on the next blank (except for the last blank, which may need some additional sanding).

A variety of leg shapes are possible. Three-sided shapes can be made by simply rotating the pieces 120 degrees between each turning sequence.

The therming rig is also an excellent sanding rig, but not while the lathe is running. You may want to sand the surfaces of each blank by hand before rotating them. When all surfaces have been turned, you can remove the screws on each endplate so that you can hand-rotate ▸

Turn "thermed" spindles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11


12

(*10-11*) You'll be turning air and wood intermittently. Present your tool cautiously and shape the first surface of the legs.

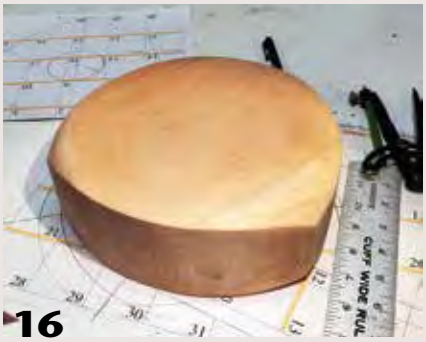
(*12*) After rotating the spindles 90 degrees (and retightening the mounting screws), the second surface is turned and a defined edge appears. The legs of this stool feature four surfaces, or faces, but other configurations are possible.

Shape the foot, sand

Each leg is mounted individually on the lathe, now on its true center, so the foot profile can be formed.

Final sanding is accomplished off the lathe.

Turn the seat



The seat block is mounted on a chuck by expanding the jaws into a drilled recess on the bottom. Turn a dished-out profile in the top of the seat for added comfort.

Marking the Seat Contour

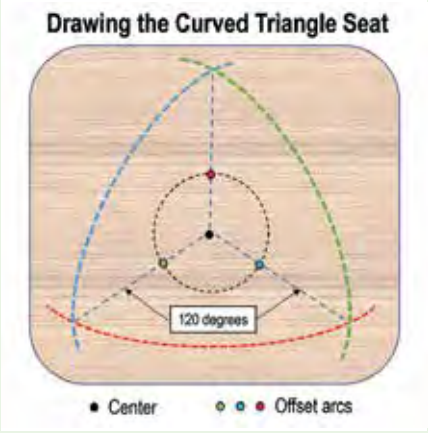


Figure a. Using three pivot points and a compass, draw the outer arcs to form a curved triangle.

To complement the contours on the thermed legs of this stool, I opted for a curved triangular seat. Here's how I laid out this shape.

1) Mark the center of the seat on your block of wood. Then draw three radial lines from the center, separated by 120 degrees, as shown in *Figure a*.

2) Draw a smaller circle with a compass for the offset contour centers. I spaced my offset contour centers about two inches from the main center to generate a pleasing curve. The more you offset your contours, the "flatter" the arcs will be.

3) At each of the three points where your small offset circle intersects the three radial lines, use your compass to draw three larger radius offset contours (arcs, or portions of a larger circle). After drawing the first contour, use the same radius setting on your compass for the other two arcs. Cut out this profile at the bandsaw.

the blanks for finish-sanding, again with the lathe off. Sanding with the lathe on is NOT recommended. By tightening the tailstock after each rotation, you will effectively clamp the blanks in place. This is fine for sanding, but not for the turning/shaping sequences.

Complete the parts

When you've finished sanding your legs/spindles in the therming rig, remove the spindles from the rig and mount them, individually, back on the lathe on-center to add details, such as the rounded feet shown in *Photo 13*. I used a negative-rake scraper to round the edges, but a spindle gouge can also be used. You can use the dowels glued into holes in the base of each leg to hold the leg in a chuck, while inserting a conical live center in the upper dowel hole. The base dowels can be easily cut off when you have completed your on-center turning. Finish sanding the legs off the lathe (*Photo 14*).

The seat can be made as a separate item that will be used in final assembly. Draw a pattern of the seat, using three intersecting circles to create a curved triangle (*see Marking the Seat Contour sidebar*). Cut the shape of the seat on a bandsaw. I used a 3"- (8cm-) thick block of maple, but you can choose your seat material and thickness.

Mount the seat on the lathe using a four-jaw chuck. I expanded the jaws into a recess in the base of the seat blank. Then turn the dished-out "comfort" surface on the top of the seat (*Photo 15*). I then sanded the seat on the lathe, much like finishing a shallow bowl.

I drilled three ½"-diameter holes in the bottom of the seat for the leg dowels. With the seat blank off the lathe, use your completed legs to determine where to make the holes in the seat so that the leg tops do not protrude beyond the edge of the seat.

Make center block, finish

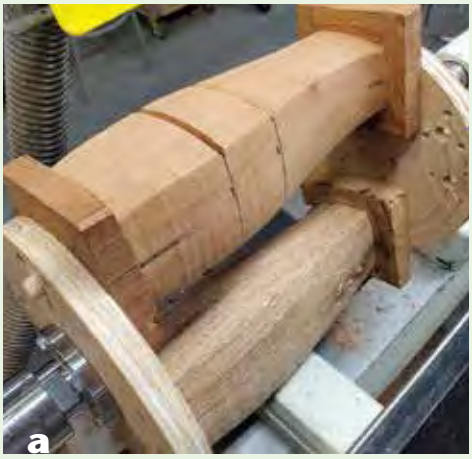
17 The author made a triangular center block, attached to the legs with separate dowels, for added stability (*shown in the lead image*).

18 Finish is applied, then buffed, prior to assembly. The legs are mounted to the seat bottom using dowels.

Other Therming Possibilities

Therming enables turners to expand their bag of tricks beyond round objects and create some truly unique works on the lathe. A thermed stool is just one of many projects that can be made with a therming rig. A major benefit of the rig is that it allows you to create multiple identical turnings at the same time.

I made a variety of vase shapes and embellished them by carving and adding texture and color (*Photos a, b*). I also made a thermed sculpture, as shown in *Photos c and d*.



a

b

Several of these vases were turned two at a time on the therming rig.

c

d

The author's sculpture, Ascending Woods.

Remount the seat on the lathe and pre-mark a circle on the bottom to serve as a guide for drilling the leg mounting holes. *Photo 16* provides a view of the completed seat, ready for finishing and final assembly.

Finish and assemble

The legs are fairly sturdy and would probably be stable when glued to the seat with dowels. Still, you can add a stabilizing brace to the legs, as shown in *Photo 17*. A triangular centerpiece, cut from maple and held between the legs with ⅝" (16mm) dowels, adds a measure of stability.

For this stool, I applied multiple coats of Briwax Hard Wax Oil (*Photo 18*). When the final coat was dry, I buffed the unassembled parts. Other finishing approaches, such as wipe-on polyurethane, will also work.

It's always good to dry-fit the parts before final gluing. In this case, I found that the leg stabilizing dowels were a little smaller than the ⅝" holes, so a few veneer shims were needed for a tighter fit. For final gluing, I used Titebond II, an excellent adhesive with a slow enough drying time to get all parts aligned.

Give therming a try and let your imagination guide you. You may be surprised at what you can create. ■

Brian Horais has been turning since 2010. Former president of the East Tennessee Woodworkers Guild, he has been an instructor in "Twisted Turning" at the Appalachian Center for Craft at Tennessee Tech, and he was a demonstrator at the 2019 AAW Raleigh Conference. For more, visit horais.com.