Part 1: Cut Accurate Segments

Segmented Turning School

By Jim Rodgers

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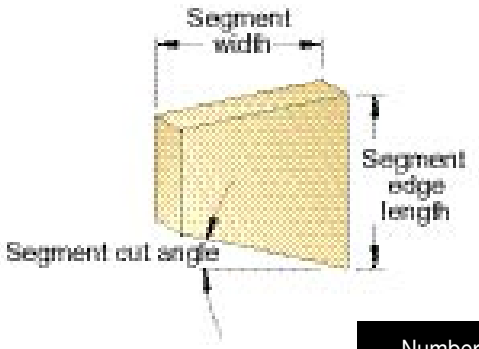
American Association of Woodturners

Ready to try your hand at segmented turning? Fearful of failure?

If you're ready to push forward, we want to help you get started. Join us for a series of three articles that will address the steps required: cutting accurate segments, designing and planning the projects, and eliminating sources of errors.

Like any other turning subject, there are many different and equally effective techniques. These articles will follow one approach —most of which can easily be modified or adapted.



Number of segments	Segment cutting angle
6	30.00°
8	22.50 °
12	15.00°
16	11.25°
24	7.50°
36	5°

The language above is standard terminology for building segmented rings. Make photocopies of this drawing and chart, then post them near your workbench and tablesaw or compound mitersaw.

Cut segments accurately

You probably possess the necessary turning skills. What you need is an accurate method for cutting the necessary segments and a plan for how to proceed.

Before you can perform quality work, you must have the proper equipment to cut accurate segments. That requires more than a simple miter gauge for your tablesaw. Lack of cutting accuracy will result in additional time to clean up poor joints and can even be dangerous to your fingers.

Tools and supplies

I prefer the tablesaw because of its stability, precision, easy acceptance of fixtures, and operator safety. However, some turners rely on a compound mitersaw.

To get started in segmented turning you will need:

- A method for cutting ring segments accurately. I prefer one cutting sled for each angle.
- A sharp precision crosscut 60– to 80-tooth carbide-tipped blade. Because blade stiffness is important, avoid thin-kerf blades.
- A 6×48" belt sander with an 80-grit belt for flattening rings and adjusting segments.
- A hold-down tool for safely cutting and sanding small segments as shown on *page 27*.
- A vernier caliper for setting and verifying dimensions.
- A straightedge for checking fit and flatness.
- Bright photo floods or a light source to highlight gaps.
- Hose clamps for clamping rings snugly during gluing.
- Gluing supplies including a flat nonstick surface and rags.
- Power tools for cutting accurately dimensioned stock: a planer, jointer, thickness sander—or a good friend who owns them.
- A polyvinyl acetate (PVA) adhesive such as Titebond II. To ensure the best adhesion, pay attention to expiration dates.

Select the correct angle

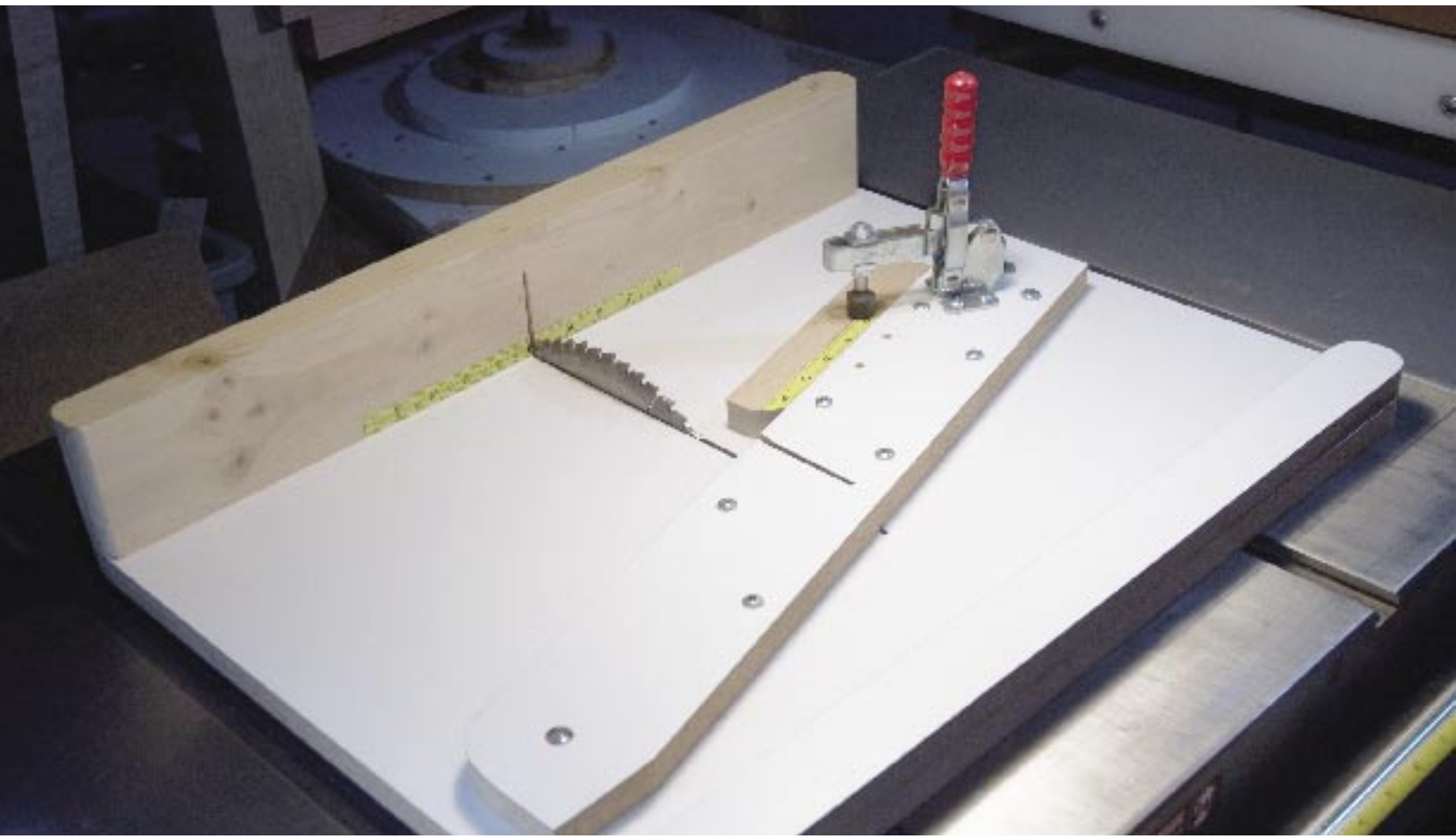
The angle for each segment is 360 degrees divided by the number of segments planned. One half of that angle is cut from each segment edge. For example, a 12-segment ring contains twelve 30-degree wedges cut 15 degrees on each edge:
$360^{\circ} \div 12 = 30^{\circ}$; $30^{\circ} \div 2 = 15^{\circ}$)

The most popular cuts are shown in the table *above*.

Build a cutting sled

To cut accurate segments, you will need a fixture that accurately cuts the desired angle repeatedly, allows for accurate segment edge length measurement, and provides safety when cutting smaller pieces.

What separates commerical miter gauges from these sleds for segmented bowls is that your task is to measure the small piece cut off—not what's left on the sled.



For each cutting angle, you'll need to build a cutting sled like the one shown *above*. Note the measuring tape adhered to the stop, which makes it easier to quickly measure segment edge length.

For detailed information on building your own cutting sled, download instructions from one of the sources listed on *page 29*.

For the best possible results from your sled, consider:

- Using dense, solid, stable stock like ½- or ¾"-thick Baltic birch plywood or MDF.
- Fitting a sled runner into both miter slots carefully and tightly. If you want accurate joints, there should be no wiggle room.
- Using acrylic or ultra-high molecular density (UHMD) plastic, available from many woodworking mail-order sources (woodcraft.com and leevalley.com) for long-life accurate runners.
- Adding a measuring tape to the stop, as shown *above*, which will save lots of time.
- Making a segment hold-down tool to keep your fingers away from the blade as shown *opposite*.

Calibrate the cutting sled

You can build a sled for a fixed angle using either trigonometry or a protractor. Whichever method you choose, you will always have to perform a one-time calibration of the sled before you can cut segments accurately.

Calibration is essential. But once completed and the sled is locked down, you'll never need to repeat the process. If you use a calibrated miter gauge (Incra is one brand), the calibration process is similar.

To perform the calibrations, purchase inexpensive stock (I prefer poplar) that you can rip and crosscut cleanly. Ensure that the

stock is flat with square edges. Rip the stock on your tablesaw to approximately 1½" wide; then crosscut it to approximately 16".

With an accurate 90-degree square, check that your tablesaw blade is accurately set at 90 degrees to the table.

To cut your first test ring with 12 segments, set your sled to cut segments about 1½" in length; this will create a test ring about 6" in diameter. Take the time to cut the segments carefully. Hand-sand burrs or whiskers and assemble the ring with a rubber band.

Next, hold the ring up to a bright light and carefully examine for gaps. If the ring is perfect, you should quickly buy a lottery ticket because you are extremely lucky! Otherwise, you will need to adjust the sled's angle and recut another test ring.

Is light visible on the outside-edge gaps? The angle of the sled is too acute (too small). Increase the sled's angle slightly.

Is light visible on the inside-edge gaps? The angle of the sled is too oblique (too large). Decrease the sled's angle slightly.

Adjust and repeat until no gaps appear in your segments. Don't be discouraged if it takes five test rings to get a precise ring. Once the angle is perfect, secure the sled's fence with lots of screws so nothing will move. (I have 10 screws on my fence.)

If you plan to build vessels with other than 12 segments, you'll need to build a dedicated sled for each angle. I have built four sleds and use each of them regularly.

Prep the wood

You must prep stock from the lumber company so the faces are parallel and uniform and the ripped strips are straight. Most lumber companies sell S2S stock (surfaced two sides) to approximately 13/16". Select stock from the same lot for uniformity, grain, and color. Allow it to stabilize in your shop for five to seven days before processing.

Joint one face and one edge of the stock 90 degrees to each other, then make the second face parallel to the first and to the desired thickness. Prepare enough stock for the entire vessel at one time.

Starting with the widest ring first, rip the wood to the required width. Then crosscut stock to the necessary length (I add 20 percent to the length for safe handling). Label each strip with the ring number as you go.

Cut the segments

Recheck the tablesaw blade for squareness. Then using the cutting sled on your tablesaw, cut the segments to length. To get the best use of your wood stock, flip the wood over before cutting the next segment.

This homemade "finger saver" will help you hold segmented pieces in place and safely retrieve them. The steel is made from a discarded Allen wrench modified with a ground tip.

Quick starts

Can't wait for the next journal to arrive in your mailbox? At the AAW website (woodturner.org), follow the link for a drawing, cut list, and basic instructions for the beginner project 7¼×7¼" vessel shown *above*. This project is suitable for turning on any lathe with a 10" or larger swing.

Bud Latven has developed segmented plans and kits that are sold through Craft Supplies, Packard Woodworks, and Woodworkers Supply. All Bowl Company plans contain full-scale drawings and are rated from easy to difficult (1–5). The "Tulipwood Open" and "Segmented Bowl" are the easiest. Some of Bud's plans are for more complicated designs but are a good way to learn about segmented tips and shortcuts.

To ensure accuracy in your rings, follow good practices. As you cut segments with the tablesaw sled, number the pieces as shown *above*. After dry-fitting the pieces, glue only six adjoining pieces separated by dowels. After the half rings dry, remove the dowels, flatten the half rings, and glue together the rings using the same band clamp. Add enough clamp pressure to create glue squeeze-out.

Number each segment in order on its top face as shown *above*. I recommend cutting two or three spare pieces for each ring.

Dry-clamp each ring using hose clamps. Hold the ring up to light and check for gaps. Spend the time to make them fit now, or the final vessel will never look good. If necessary, readjust your cutting sled and cut new pieces.

Glue segments into rings

Proper gluing techniques are critical to the success of your project. You'll draw on these steps: prepping the individual segments, assuring a flat glue surface, and clamping effectively. Here are the steps that you should follow:

1. Check each segment and hand-sand the faces with 220-grit sandpaper to remove any whiskers or loose fibers that might interfere with the joint.
2. Prepare a flat, glue-resistant surface. A heavily waxed, discarded cabinet door will be flat, and will be relatively easy to remove dried glue from it. Reserve this surface for your segmented projects.
3. Test-fit the ring segments with a hose clamp or rubber bands and check for good joints.
4. Butter the glue onto all contact surfaces. With your finger, remove lumps and debris from the glue.
5. Do not glue a complete ring. Instead, assemble the segments into two half circles (in this case, six segments each).
6. Place a ⅛" to ¼" dowel between the two half circles and add the band clamp. The dowels keep all glued joints tight by forcing any gaps toward the two unglued joints as shown *at left*.
7. Lightly tighten the clamp while ensuring the ring remains flat. If you don't tighten carefully, the clamping pressure will push the inside of the ring upward.
8. Wipe away the excess glue from both sides and tighten the clamp completely. I use a screwdriver and hand-tighten each clamp.
9. When the glue is dry, remove the clamp and dowels. Then flatten the half ring on a belt sander and glue the two halves together.

Assemble the vessel

Your challenge is to get each ring flat and centered when building the vessel. For solid construction, build a flattening stick from hardwood and 80-grit sandpaper as shown *below*.

I recommend building vessels with two faceplates, each with attached hardwood glue blocks.

Before you start adding rings, true up each glue block on the lathe with a scraper or skew. With a bright light and a straightedge, check that the face is absolutely

Make a flattening stick to dress the face of your rings. The stick shown *above* is made from a 3×16" strip of 80-grit sandpaper adhered to the hardwood with 3M Type 77 adhesive.

flat. Use the flattening stick to dress the face of the glue block.

Center and glue the top ring to one faceplate. Apply clamp pressure until glue squeeze-out appears. Center and glue the bottom ring (often a solid hardwood base) to the second faceplate.

After the glue dries, true up the ring face on the lathe as described *above*. Then dress the face with the flattening stick.

Glue on another ring as described *above*, but rotate the segment edge by one-half a segment. This will add a "brick-laid" pattern to your vessel.

Turn the vessel

After you assemble the two vessel halves, screw the base section to the headstock. With the tailstock, press the top section (still attached to a faceplate) against the base and turn the exterior shape.

Remove the top section and complete the interior of the base section. Repeat this step with the top section, turning its interior to match the wall thicknesses.

Glue together the two sections. After the glue has set, part the neck section from the faceplate and complete the top of the vessel. Use a scraper to clean up the interior glue line before parting the base from the lathe.

Final sand and add finish.

In the next issue, we will unfold the process for designing and laying out segmented vessels.

Jim Rodgers (JLRodgers.com), a studio turner and demonstrator, is president of the Bay Area Woodturners Association. He lives in Martinez, California.

Other Resources

Tutorials

Tutorials are also available online from Kevin Neely (turnedwood.com), who has probably taught more segmented turners than anyone, and Verified Software (verifiedsoftware.com/goodturns).

Cutting sled

In order to accurately cut segments you will need a fixture that cuts the desired angle repeatedly, allows for segment edge length measurement, and provides safety when cutting smaller pieces. For detailed information on building a cutting sled, download complete instructions for Jim Rodger's sled from the AAW or for one of the other sleds available at:

American Association of Woodturners (woodturner.org); sled shown on *page 26*

Kevin Neely's Turned Wood (turnedwood.com)

Verified Software (verifiedsoftware.com/goodturns)

Books

Recently published books provide the most complete descriptions for the segmented-turning process:

- *The Art of Segmented Wood Turning*, Malcolm Tibbetts, Linden Publishing
- *Woodturning with Ray Allen*, Ray Allen & Dale Nish, Fox Chapel Publishing

Other books available:

- *Segmented Turning, A Complete Guide,* Ron Hampton, Guild of Master Craftsmen (2003)
- *Segmented Turning, A Good Start,* Bill Kandler, Verified Software (2004)
- *Segmented Turning*, William Smith, Schiffer Publishing Ltd. (2002)
- *Laminated Designs in Wood,* Clarence Rannefeld, Lark Books (1998)
- *Southwest Pottery – Anasazi to Zuni*, Allen Hayes & John Blom, Northland Publishing (1996)
- *Fine Woodworking on Faceplate Turning*, Taunton Press (1987)

Videos

There are a limited number of videos available:

- *Introduction to Segmented Turning*, Curt Theobald, 307-245-3310, curttheobald.com
- *Segmented Patterns*, Curt Theobald, 307-245-3310, curttheobald.com

Software for segmented design and layout will accompany the next article in this series.