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Part 3: Sources of Errors

Segmented Turning School

By Jim Rodgers

For new segmented turners, the greatest frustration is when the final quality is less than expected, including gaps, misalignments, and vessels that just fall apart. We all hate it when that happens!

In this last article in the three-part series, we explore what causes poor joints between segments or rings.

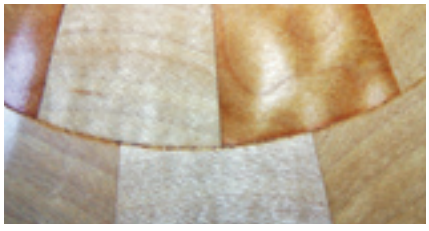
After talking with several experienced segmented turners who also teach, the consensus is best summarized by Malcolm Tibbetts, "Most errors come from students' willingness to compromise," and Wayne Cowden, "If you think it is good enough, it isn't."

At *right* are some common errors.

Here are examples of errors that I encountered in one of my first projects.

Error in cutting the segment angle accurately

Multiple errors in segment angle cutting



Poor inter-ring flattening or sanding before gluing rings together

Tenting caused by glue squeeze-out on back side

Develop a routine

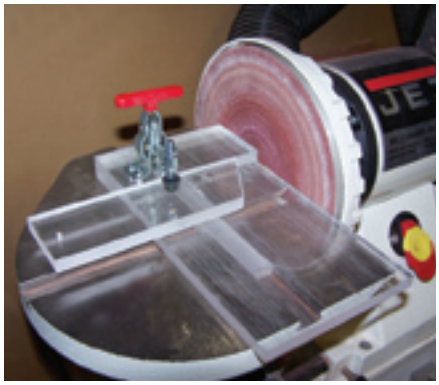
Success relies on accurately cutting the segments. If the components of your saw move or you have a sliding fixture, there must be clearance or it won't move, right? But that clearance opens a window for error.

The solution is to create a reproducible process that minimizes these errors and takes up any clearances. I've developed this routine: Push my cutting sled through the saw with my left hand and retract it with my right hand while holding the cut segment down with a hold-down tool.

Your second goal is to develop a cutting rhythm: left foot forward, push, retract, number the segment, flip the stock over, and repeat.

Prepare for glue-up

After cutting segments, start with a visual check of the cut surfaces. Look for irregular cut marks, burn marks, and wood whiskers. Sand every segment to remove extraneous marks and wood fragments.



If you cut on a bandsaw, you must sand the faces of each segment to produce the accurate angle. This requires a sanding setup and accurate fixtures.

If you sand with a belt sander, you'll have best results with a new belt, where particles stand taller than the belt's glue joint. As soon as the belt wears or loads, the glue joint in the belt introduces error by pushing the wood away from the belt and causing inaccurate sanding—not a good thing.

For more accurate results, use a disc sander with a PSA (pressure sensitive adhesive) disc no coarser than 80 grit.

Accurate sanding also requires a fixture. My version is shown *below left.* Sanding fixtures are constructed similarly to the tablesaw fixture described in the first article (Winter 2005 or on the AAW website at woodturner.org).

You'll find excellent advice on calibrating a sanding fixture in Curt Theobald's video.

Gluing segment rings

Like Goldilocks looking for porridge, there is an important balance to learn between too much, too little, and just right. This applies to glue volume and clamping pressure: Success relies on getting it just right.

Many segmented turners rely on polyvinyl acetate (PVA) glue, such as Titebond II, because it will move with the wood. Apply just enough glue that it squeezes out of all the joints when the ring is clamped.

Too much glue causes the pieces to slip and slide. The hydraulic action raises segmented pieces off the glued-up surface and causes wider rings to "tent."

Too little glue creates a starved joint, which may come apart later.

A flat glue-up surface will help you avoid problems. I use an old cabinet door that has been wiped clean and carefully waxed to prevent glue adhesion. Clean the surface between successive ring glue-up with a spatula.

Checklist for detecting sources of glue-up errors

- Glue-up not assembled on a flat surface
- Clamps not firmly tightened or are over tightened
- Ring not examined for cutting errors prior to glue-up
- Errors not corrected at the half circle (flattened to 180 degrees) before completing the 360-degree ring
- Half ring spacers not placed in the center of the open segments
- Edges of segments not sanded to remove burrs and whiskers
- Rings "tented" due to excess glue underneath the ring
- Glue press not used prior to tightening band clamps
- Segments don't fit—cutting errors (see *above*)
- Too much glue—edges not "buttered"
- Excess glue not removed before tightening

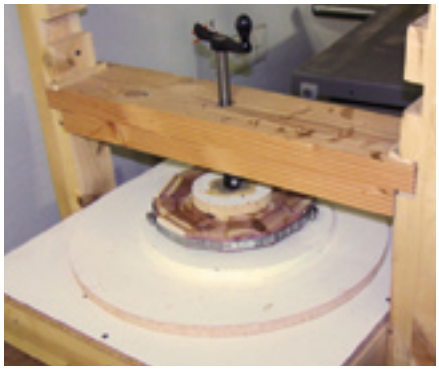
For clamping, purchase a selection of metal band clamps at the local hardware store.

Place the complete ring into the band clamp and tighten it with a screwdriver (an impact wrench or a power driver applies too much pressure). Inspect the ring for fit. If acceptable, disassemble, apply glue, and reinsert the ring into the band clamp. Use dowels to separate half rings as shown *above*.

After allowing the half rings to dry, remove the clamps, sand flat, reglue, and reclamp.

When gluing the ring, spread glue evenly on one segment edge and "butter" it with glue against its mating surface.

Carefully wipe away squeeze-out before completely tightening the band clamp. Wipe the underside of the ring as well as the topside to prevent the tenting effect. When assembling a 1" or wider segment-edged ring, place the ring in a glue press prior to the final tightening of the band clamp as shown in the photo *below*.

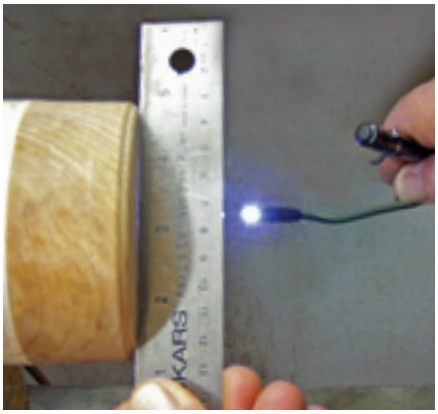


The wider the segments, the more the glue squeezes out the bottom side, causing the tenting effect. Glue, loosely clamp, wipe off extra glue, and place the ring in a glue press before fully tightening the clamp.

Assemble rings into vessels

In assembly, the most common error is inter-ring gaps—due to inadequate flattening of the glued-up ring and trueing the assembly to the lathe axis after each ring is glued into place.

During assembly, one face of a ring *must* be flat prior to it being added to the vessel assembly. After it is glued into place, mount the assembly on the lathe and true up.



A scraper, skew, or gouge is ideal for this task.

After squaring up the assembly, use a straightedge and a bright light to check for flatness. Placing the bright light on the opposite side of the straightedge is ideal for spotting errors, as shown in the photos *above*. Once the edge is true and square, apply the flattening stick as a final action before adding the next ring.

If you add a veneer between rings, you must apply additional pressure while the glue dries to prevent the veneer from swelling or puckering and thus separating the rings.

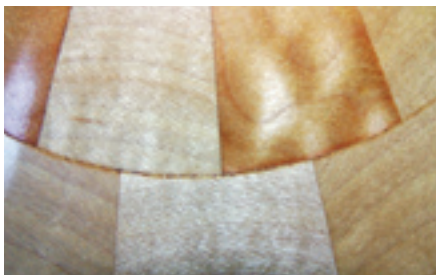
After centering the next added ring, transfer the assembly to a glue press until the glue is completely dry.

Work-arounds

There may be a way to save a ring or fix it. Most of the time it's not worth the time or trouble; however, sometimes it works.

•One or two bad joints in a ring. At the bandsaw, cut the bad ring in half through the defective joint. Then, resand the two half rings and reglue them. This normally corrects the problem if only one or two joints are involved. Remember that this process also changes the dimensions of the cut and resanded segments.

•Can't accurately cut a ring with long segment-edge lengths or widths. Wider segments magnify errors; hold-downs become more problematic, and stock is harder to control. What's the solution? Cut smaller segments, thus reducing the lengths and thicknesses and minimizing the errors. Where you initially planned 12 segments in a ring, try 24 segments.



•"Gaposis" in glued up rings. The solution that always works is to use the half-ring technique described on *page 45*. Place two small dowels between the halves during the initial ring glue-up. Be sure you place the dowels in the centers of the segment edges. If you don't center the dowels, you will introduce additional distortions in the glue-up.

•Minimizing visible errors and gaps. One trick is to select dark hardwoods, which makes errors less evident. Dark wood to dark wood and dark wood to light wood tend to hide small errors. However, joints between two light species heighten the visibility of errors.

Troubleshooting Errors in Segmented Turning

Tablesaw	Set-up Errors	• Tablesaw arbor not aligned with miter slot • Tablesaw blade not set to a perfect vertical 90 degrees • Blade dull or dirty • Thin-kerf blade • Not using a finish-cut blade (60–80 TPI)
	Fixture Errors	• Cutting-sled guides running loosely in the miter slots, causing shift in the sled • Stops slipping due to being clamped too loosely
Mitersaw	Set-up Errors	• Saw blade not set to a perfect vertical 90 degrees • Cutting angle not locked securely • Set-up angle not checked carefully • Blade dull or dirty • Thin-kerf blade • Not using a finish cut blade (60–80 TPI)
	Fixture Errors	• Solid hold-down not used • Stops slipping due to being clamped too loosely
Bandsaw	Set-up Errors	• Saw table not set to a perfect 90 degrees to blade • Miter angle not checked carefully • Blade dull or dirty • Blade not properly tensioned and blade guides not adjusted • Sled not adjusted to account for tracking error
Sander		• Inaccurate angle on sanding fixture, or fixture not calibrated • Sanding table not square to sanding surface • Old/worn sanding disc • Worn sander belt, introducing a seam “thump”
Operational Errors		• Lumber not dried and acclimated • Lumber not trued and squared before cutting • Lumber not held tightly against fence and stop during cuts • Accumulated sawdust at fence, causing inaccurate cuts • Inconsistent cutting process • Pieces not numbered, becoming “out of sequence” • Cut hurried, creating fuzzy edges

Keep at it!

Don’t throw in the towel! Just like any skill, segmented turning requires practice. Try building several segmented vessels and explore the new possibilities that this process opens up for you. Revisit the same design again with corrections to the errors encountered. After you are satisfied with this project, then proceed to more complex work.

Segmented turning requires patience, precision, accuracy, attention to detail, and an understanding of the wood you incorporate into the design.

The payoff is having the ability to express yourself in additional ways using design, color, texture, and lumber previously not considered for turning.

Happy segmented turning!

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