# Secrets of Segmented Turning

Clever tips and jigs unlock these puzzles in the round

BY ART BREESE



I t was golf that drew me to Sun City West, a huge active-retirement community outside Phoenix. But there are only so many rounds a guy can play, and I soon wandered into the woodworking club there. An amazing sight awaited me: 7,000 square feet of first-class equipment and bench space, and dozens of people working away happily.

After doing a few projects on my own, I noticed a couple of people making segmented bowls, having fun and sharing knowledge. They were extremely helpful in getting me started.

I quickly became an addict. When you make segmented

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# Design stage is critical

## START WITH A SIDE VIEW

A full-scale cutaway side view of your bowl will give the thickness and width of each ring. Then there are a number of ways to generate the length of each segment needed (see right).



turnings you are never in full control. You can sketch out a perfect plan for the segments, angles, and glue-ups, but you don't know exactly what you are going to see until the last surface is sculpted. In our shop, we think of a first attempt at any design as a prototype, knowing we can improve on it the next time. That's the fun: striving for perfection, never quite achieving it, but always showing improvement.

And you don't need a big lathe or special accessories to do it. A combination disk/belt sander is very helpful, though.

#### Start with a precise plan

Obviously, an almost infinite array of glue-ups can produce an infinite variety of patterns. But there are two main types of assemblies, rings and staves, often combined in more complex vessels. I'll stick with the ring method here. It is the most basic approach, yet very versatile.

The first step is to decide on the patterns you want in the finished turning. You can base your design on photos of other people's work, or on your own brainstorming and sketches. Then you need to make a scale drawing to sort out the rings and segments needed. The segment angles are pretty standard. You just divide the number of segments into 360. However, to get the length and width of the segment blocks, you need an accurate cutaway side view of the bowl (see above). That will show you the width and thickness of each segment, but you still need the segment lengths. The simplest way to determine that is to take the circumference of each ring ( $\pi$  times its diameter) and divide by the number of segments. That will get you close enough, but the two methods at right are a bit more precise.

I chose an understated yet elegant walnut bowl for

# TWO WAYS TO SIZE THE SEGMENTS

Centerline

### DOWNLOAD SOFTWARE

To get the size of any type of segment in any type of vessel, Breese recommends using a computer program. He and his friends use Table Saw Miter Angles (\$20 at TurnedWood.com).

#### **OR DO SOME GEOMETRY**

Here's a graphic way to create a top view of the segments in this basic bowl. Set a compass to the inside and outside diameter of a particular ring (right). Then swing arcs around a centerline (below).

1. Set compass to outside edge at top and strike an arc.

2. Set compass to inside

Centerline

edge at bottom and

strike an arc.

Now use a protractor to define the angled edges and get the segment dimensions. (Each ring has 12 segments. Divide that into 360° to get the overall segment angle.) Segment length

Segment width

# Tablesaw sled produces perfect segments

### LOCK IN THE FENCE FOR VARIOUS ANGLES

The fence on this sled has a fixed pivot point, with precise holes drilled to bolt down the other end at common segment angles. To figure out a hole location for a specific angle, clamp the fence temporarily and cut test segments until you get a perfect ring, and then drill a hole through the fence and base at the same time to lock in that angle for the future.



to avoid cutting too far into fence.

diameter with no wiggle room.

# HOW TO USE IT

#### **Cut one clean**

edge. After setting the fence at 15°. the first step on the sled is simple. Move the stop out of the way and cut a clean angle on the end of the stock.

#### Set it and forget

it. Now you can flip the workpiece and set the stop for the length of the outside of the segment. The stop stays put: You just flip the stock between cuts. Breese's clever hook-like holddown keeps the segment safely in place against the stop.

Check your work. To check the angles, dry-fit all 12 segments and pull them together with a hose clamp.







this introduction to the craft, throwing in a bit of contrasting holly to add flair: alternating segments in the lowest ring, outlined by holly veneer above and below, and more holly veneer sandwiched between the other segments, highlighting them with a fine contrasting line. So you'll need to subtract 0.030 in. from the length of each segment to account for one thickness of veneer.

### **Precise jigs produce** precise segments

Once you know the dimensions of the segments and you've chosen woods and decided how the grain should run, prepare the stock. Prep enough for a few extra segments. This is pretty standard woodworking, though you need to get everything perfectly straight and square, and be certain that all the stock for a given ring is planed to precisely the same thickness. The tricky part, as you might imagine, is getting all the angles right.

My main jig for cutting angles is a tablesaw sled, with a fence that can be set at common segment angles. With a sharp blade and an accurate sled, you can get good glue surfaces right off the tablesaw. If you are having trouble, or if you are using a lighter wood that shows glue joints more obviously, you'll want another helpful jig for segmented turnings: an angle jig for the disk sander. I'll include that one at FineWoodworking.com/extras.

Be sure to cut a few extra segments and deburr the

Online Extra Having trouble getting perfect joints off the tablesaw sled? Go to FineWoodworking.com/ extras for another handy jig for segmented turnings: an angle jig for the disk sander.

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edges of each segment so they'll join cleanly.

### Assembly starts with the base blocks

The first assembly step is screwing the waste block to the faceplate and then doing some light turning to clean it up. Start with the outside diameter. You'll do this for all the layers, which will help you keep them concentric and the vertical gluelines aligned nicely. Now turn the critical glue surface on the face. I use a round-end scraper to turn it as flat as possible, before relieving the center about 1/8 in., leaving just a 1-in.-wide ring around the perimeter. This gives the excess glue somewhere to go when you rub the joint together and put it into the clamping press. It also makes the bowl easier to part off later. Last, I press a board covered with sandpaper against the face to ensure it is dead-flat. I do this each time I am truing up a new layer on the lathe.

Now glue on the first layer of the bowl, the solid block that will form the bottom. On this and all the rings that follow, the glue face must be dead-flat, which I take care of on a belt sander (see photo, right).

To glue on each new ring, I turn to a setup that resembles a small veneer press. These can be made pretty easily from wood or metal. You can also use clamps and cauls, but you'll have to be very careful to balance the clamping pressure.

After a half hour or so for the glue to set up, you can turn that block to get it ready for the first ring. Again, clean up the outside diameter, turn the face flat, turn a shallow depression in the middle, and then apply the sanding block to ensure flatness.

For this design, the first layer of holly veneer goes on now. I cut it to size by placing what I've turned so far on a sheet

# Rub joints make rings

These angled pieces would be difficult to clamp tightly, but rub joints work wonderfully.







**Sand the halves flat.** This removes excess glue and any unevenness. Breese does this on a stationary belt sander using a light touch. (The pencil lines are for the next step.)



**Now sand the edges.** The disk sander ensures that the final rub-joint is gap-free. Watch the pencil lines to track your progress.





# Build from the base up



**Waste block goes on first.** Screw a block of solid wood onto the faceplate and then prep its face for gluing. True up the outside diameter, and then skim the face with a round-end scraper before turning some relief (as shown) in the middle for glue squeeze-out.



#### **MAKE A SMALL PRESS**

To glue the rings together evenly and accurately, you'll need a small press like the one Breese and his friends made. Theirs is welded steel, but you can easily make one from hardwood and melamine, using a press screw.



Add the bottom of the bowl. This is a solid block of walnut, sanded flat. Always rub layers together first to create a thin glueline before clamping them in the press.



**Now a layer of holly.** Holly veneer frames the ring of alternating holly and walnut. Trace around the turning onto the veneer, cut out the disk leaving about  $\frac{1}{2}$  in. of excess, and then glue it on using the press.



Trim the veneer. A quick touch with a gouge removes the excess.

of veneer, tracing around it, and then cutting it out with scissors. Then I clamp it in the press and let the glue cure for an hour or so.

# Build the rings, segment by segment

It would be next to impossible to clamp all the angle blocks together accurately to form the rings. The solution is the humble rub joint. If your surfaces are clean, these joints are very strong, and they also leave extremely thin gluelines, which look best. These tight joints also cure quickly, reducing downtime.

The key here is keeping each little assembly flat so the glue joint will be good, and the segment corners aligned so you ultimately get a round ring. If it isn't round, it will be impossible to align the segments vertically in the various rings.

My trick for ensuring flatness and alignment is simply holding the pieces against a 12-in.by-12-in. granite plate as I rub them together. You could use any flat surface for this, such as MDF or melamine. You align the corners at the same time.

For the first ring, you'll be alternating holly and walnut segments. Put a layer of glue (I use Titebond II) on both mating surfaces, press them down on the plate, and rub them together until you feel the joint begin to grab. Be sure the corners are aligned before putting them aside to cure for 20 min. or so. Then join sets of pairs, wait, and so on until you have two halves of the ring.

Before joining the halves, they need some prep work. Sand their bottom face to remove the excess glue, and then bring them to the disk sander to sand both ends at once. This is another great trick from my friends at the woodworking club. Even if your segment angles were a little off, sanding the halves ensures that the final glue joints are tight. The trick here is to scribble on the ends with pencil, and then sand until the lines disappear.

Now you can rub the final joint together to complete the ring, and after one hour (to let the glue cure more fully), re-sand the bottom side of the ring to be sure it is still flat.

The only twist with the other rings is the little pieces of holly veneer that go between the other segments. You'll need to cut the pieces in advance (about <sup>1</sup>/<sub>32</sub> in. oversize is fine) to fit the glue faces of the segments, and then bond a piece between each segment as you rub them together. Don't worry, the veneer won't prevent you from eyeballing the corners of the segments to align them.





**True up each ring as you go.** Turn the outside to make it concentric, and then flatten the face with a round-end scraper again. Breese also sticks sandpaper to a board and uses that as a last flattening step.



**Keep them aligned.** It is critical that each ring stay centered and aligned properly in the press. Breese marks centerlines on the ring and then traces around the turned assembly to be sure it doesn't shift.





**Turn the inside first.** Turn until you have a smooth wall, and then check your progress with a simple template made from your drawing. You want to be sure you don't go too far and that the angle is right.

### One layer at a time

You might be tempted to glue all the rings together at once, but don't do it. The pieces will slide around as you apply pressure and you'll never get them to stay aligned. Put on the layers one at a time, as we have been doing: letting each joint set up, and then cleaning up the outside of each one to get ready for the next.

At this point, the holly veneer is flat as is, but the outside diameter still needs to be trimmed on the lathe. After doing that, the "feature" ring (alternating holly and walnut) goes on. Use the rubbing action to remove the excess



Now the outside. Just use a caliper to keep the wall thickness even, and your bowl should be perfect.

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# **Finishing touches**



Keep it on the lathe. Sand and finish the top of the bowl, outside and in, while it is still spinning on the faceplate.



**Part it off.** Breese got some help here from a white-gloved friend, who let the bowl spin in his hands and than caught it when it came free.

glue, and then put it in the press. Remember that one more layer of holly veneer goes above the feature ring.

As you add layers, pay careful attention to the vertical alignment of the segments in each successive ring. To be sure I bisect each segment, I mark centerlines. Then I position the ring properly and trace around it to be sure it doesn't shift as I am rubbing and clamping.

Each ring only needs 45 minutes or so to set up, but let the whole assembly cure fully overnight before turning the bowl.

### Turn it and see what you've got

Start with the inside when turning the bowl. I recommend using a template, made from your drawing, to make sure you are turning close to the right angle or curve. You don't want to go too far and not have enough left outside to produce an even wall thickness. Then you can turn the outside, using a caliper on the walls. As for sanding and finishing, I go from P150-grit up through 600, finishing up with 0000 steel wool. Apply your finish before separating the bowl from the faceplate and waste block. I use five or six coats of Minwax Wipe-On Poly, using the 600-grit paper or 0000 steel wool between coats.

The bottom of the bowl is still attached to the faceplate, so the last step is to part the bowl off the waste block and finish turning the bottom. There are a number of ways turners hold a bowl in the reverse position. I use a vacuum chuck at our community shop, but I'll demonstrate a lower-tech method using a shopmade plate. I hollow my bases to help prevent rocking, and add a few decorative details.

After you sand and finish the base, you are done. There are lots of steps, but none of them hard, and once you get set up to turn segmented work, you'll become as addicted to it as I am!

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**Reverse turning.** You need to flip the bowl around to finish off the bottom. A vacuum chuck will hold it nicely, or you can make a simple faceplate as shown. Breese turned a channel in MDF to fit the rim of the bowl exactly, then screwed on small wood tabs to hold it in place.



**Works like a charm.** The bowl spins true and holds fast, allowing Breese to face off the bottom, hollow its center a bit, and then turn a few nice details before sanding and finishing this last area.

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