Segmented Woodturning Overview

Version 1.0.0

This first member of *The SegMaster Series* is a quick overview of making a segmented bowl. There are many woodturners who have never made a segmented bowl and might hesitate to get started. This will give those readers some idea of what is involved. For those of you who are more experienced, you might find a couple of helpful ideas in here or you might just see how someone else approaches things.

Part of

The SegMaster Series

The SegMaster Series is a set of short articles provided for woodworkers interested in Segmented Wood Turning. They are short, concise, and filled with tips and techniques that readers may or may not have thought of themselves. They maximize photos and illustrations and can be skimmed quickly or read slowly and studied. They can be printed, taken to the shop, and used as tutorials. Please enjoy them and let me know how they can be improved.

Written By

The SegMaster

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Segmented Woodturning Overview

Here is an overview of making a segmented woodturning. There are many approaches to segmenting and much variety within those approaches. I will show you just one – with possibly a few variations. Hopefully, it will show you what you are in for if you are new to segmenting. If you are somewhat or greatly experienced, perhaps it will provide some good tips.

Before I get started, it is worth noting that I am a table saw guy. My dad had one and I have been using table saws since I was a little kid. I own a radial saw and know how to use a chop saw, but they scare me just a bit. Too much big blade spinning close to my fingers. But, if you do not have or want to use a table saw, by all means cut segments with whatever you prefer.

My approach uses mostly tools that woodturners are likely to already have. Some that you might not have are as follows:

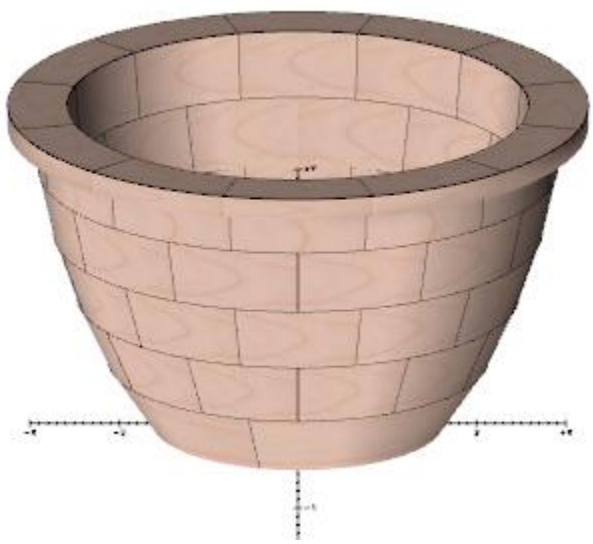
- 6” Precision Dial Calipers
- Incra V120 Miter Gauge (not strictly necessary)
- Nova ™ Chuck with Cole Jaws
- Live Tailstock or Tailstock Adapter

I do NOT have a drum sander and accomplish everything I need to do without it.

1 Design

Start with a design. Generally, you want a sketch of what your final turning will look like. You will divide the design into rings which will each be made of some number of segments. (I recommend 12 segments to start.) Your plan must include the dimensions of each segment.

To make things easy for this overview, I am including the design for a simple bowl. Here is what it will look like:

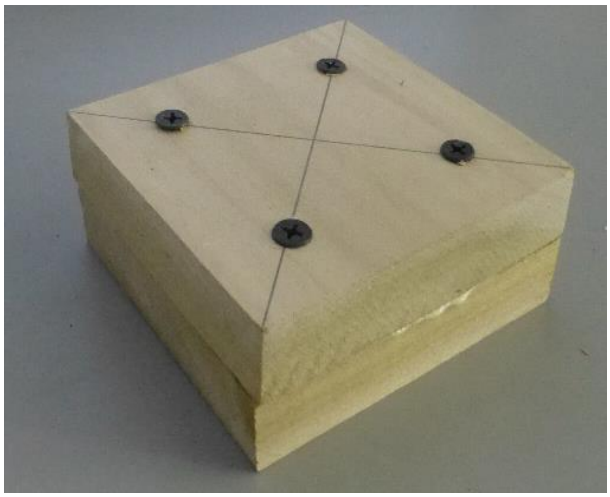


Ring Index	Ring Outer Diameter	Ring Inner Diameter	Ring Segment Thickness	Ring Segment Width	Ring Segment Length	Total Material Length
4	6.500	5.031	0.750	1.066	1.809	20.115
3	5.800	4.666	0.750	0.892	1.621	18.377
2	5.460	4.114	0.750	0.989	1.530	16.999
1	4.940	3.000	0.750	1.267	1.391	14.507
0	4.250	Base				

And here is a sheet giving all the segment dimensions:

I created this design using a design program I wrote called ***SegMaster***. It is available for free download at http://TheSegMaster.com. It is easy to use, comes with a complete tutorial and again, it is free.

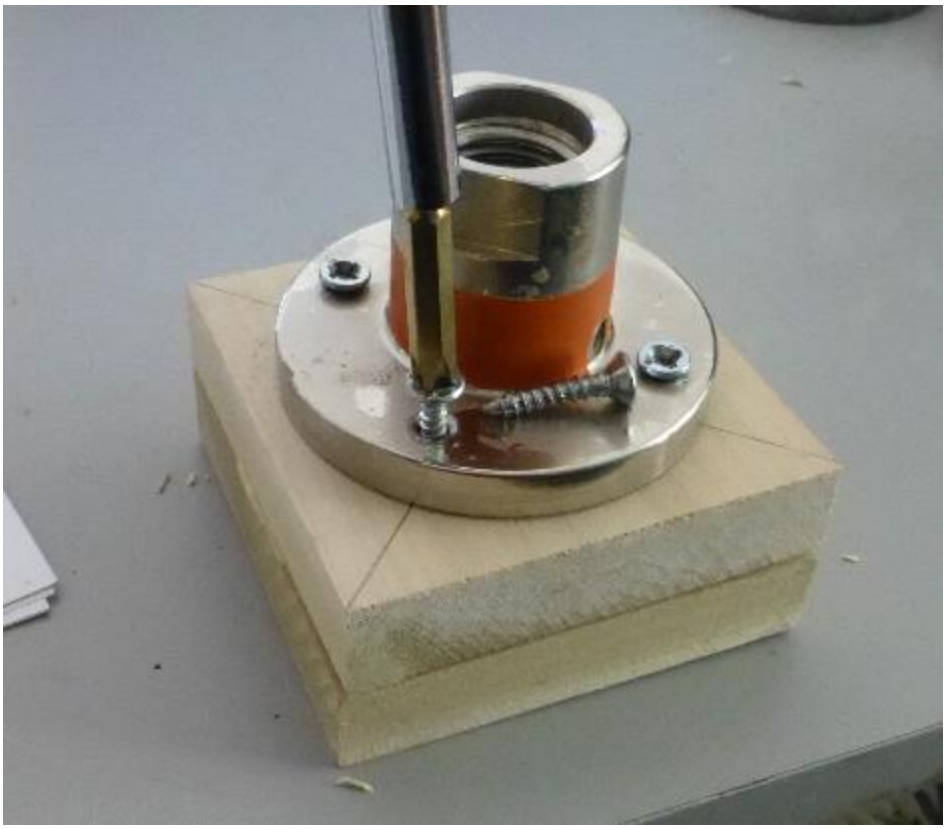
2 Prepare a Waste Block



Build a "Waste Block" to connect the base of your bowl to a flange. For small bowls, a 3" flange works well. Your Waste Block should be 1 ¼" to 1 ½" thick. Make one from two squares 4 ½" on a side cut from 3/4" hardwood or high-quality plywood.

If using hardwood, I glue them two pieces together with the grain crossed. I drill 9/64" holes in one piece and use sheetrock screws to clamp them together. I remove the sheetrock screws after the glue has set. This way I don't accidentally cut into a screw.

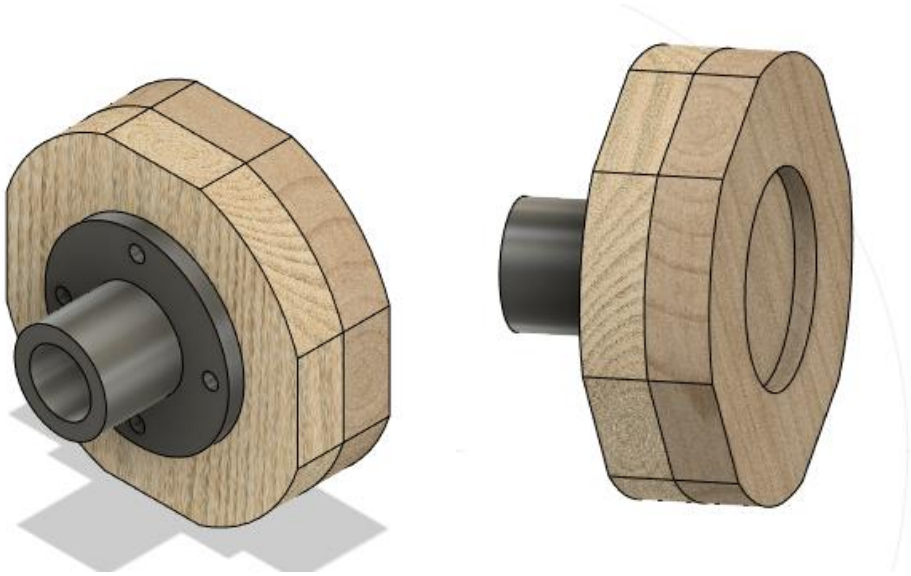
I often use high quality plywood, but still cross the grains. Much of the literature says not to use plywood for this. I often do. I have always found plywood to be exceptionally flat and less likely to warp. I often use a single ¾" thickness of plywood and then use a *waste ring* on top of that. I have run into trouble only once. That was with plywood that had a venire.



Mount the block to the flange after the glue is dry. For this I use 1” oval head sheet metal screws. Do NOT use sheetrock screws. They are notoriously brittle and break easily.

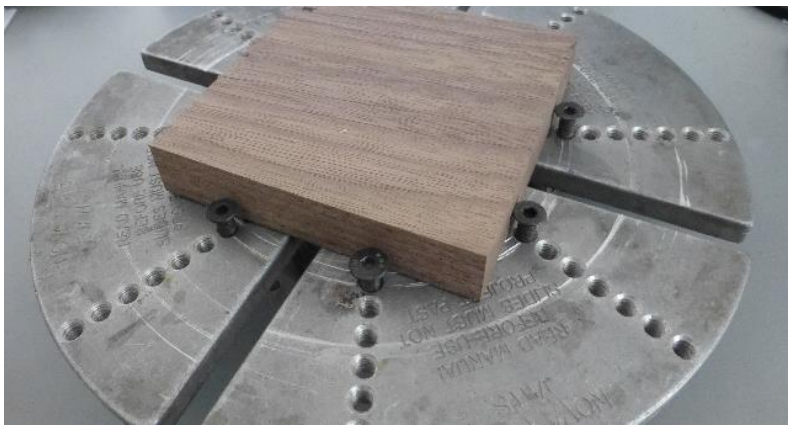
Put the flange onto the lathe and round the corners. This gets rid of spinning corners that hurt if you touch them while the lathe is spinning (which I always do if I don’t round them).

Cut a 2” diameter hole a quarter inch deep into the waste block. This makes it much easier to cut the final bowl from the waste block when the bowl is done. You do not have to cut all the way to the center of the waste block to release the bowl. It is faster, easier, and safer.

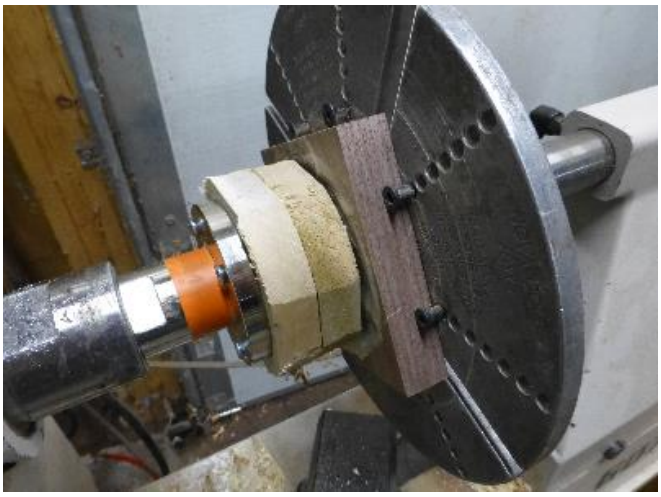


3 Prepare and Attach the Base

For bowls with a small (<5”) base, I use a solid piece of wood. In this case it will be 4.5” x 4.5” x 0.75”.



Mount Cole Jaws onto your Nova Chuck and mount the base onto the Cole Jaws. Even though the soft rubber bumpers that come with the Cole Jaws work fine for this, I prefer using M6 Flat Head screws 20 mm long. They are lower profile and they hold better.



Apply glue to the Waste Block and to the Base piece. Mount the Nova Chuck onto the Live Tailstock or Tailstock Adapter. Put these onto the lathe and use the lathe to clamp them together for an hour or so until the glue hardens. Doing this on the lathe makes it easy to get the base centered.

After the glue sets, remove the Cole Jaws. Let the glue harden for several hours and round the base. When rounding the base, I often use a cut off tool and go into the base from one side. If you do this, place your body well to the sided of your work. Those pieces go flying when they come off the base,

4 Cut the Segments

Use a Segment Cutting Jig to cut your segments. For detailed instructions on how to build a segment cutting jig or sled, refer to the document in this series named *Segment Cutting Sled* which you can download from the SegMaster web site: http://www.TheSegmaster.com.

Hint: I use a 7 ¼" carbide tipped blade on my 10" table saw preferably with 40 teeth. They are inexpensive, waste less material because they are thinner and give smooth cuts that require no sanding.

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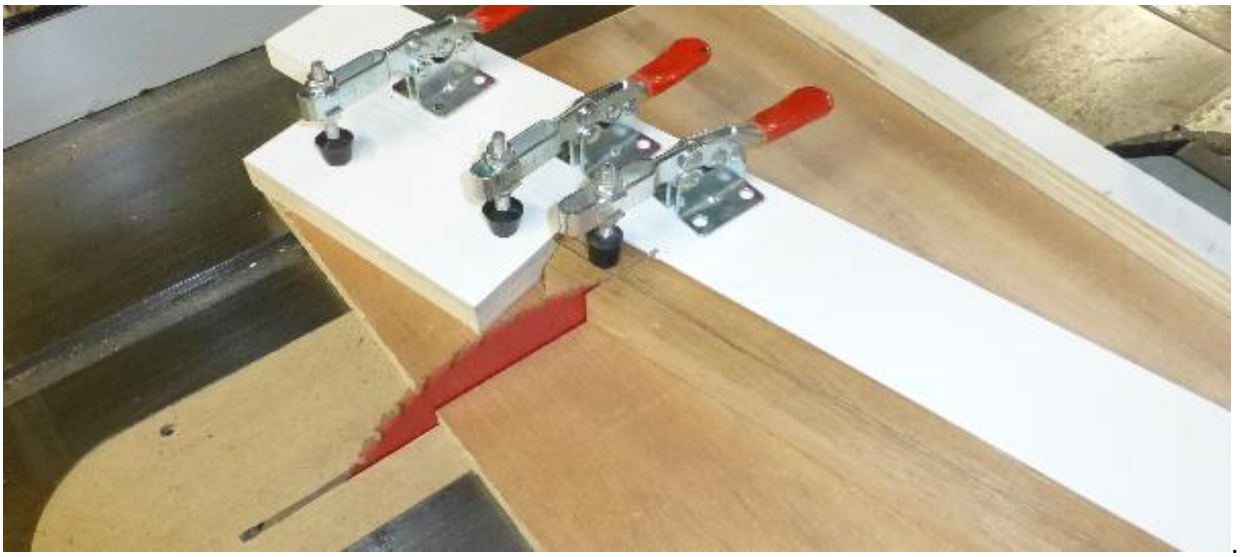
1	4.940	3.000	0.750	1.267	1.391	14.507
0	4.250	Base				

The first ring will be 4.94 inches in diameter. Each segment will have to be 1.267 inches wide and 1.391 inches long.

Create a piece of stock by setting your table saw fence to 1.27 inches wide and ripping a piece that is about 15 inches long from a ¾" thick board. It does not matter if your stock is a bit wider than 1.27".

Place this stock on the sled and cut an angle on one end.

Adjust the stop block on your sled for pieces 1.381 inches long. One way is to set the 6" calipers to the desired size (1.391") and put a pencil mark on my stock. Adjust the stop block to provide a cut at this point and cut one segment. Measure the segment. If it is off, I adjust the stop and repeat this until the cut segment is within +/- 0.02" of the desired size. When it is, cut the rest of the segments for this ring. Obviously, you will have to flip the stock over between cuts to get trapezoids instead of parallelograms.

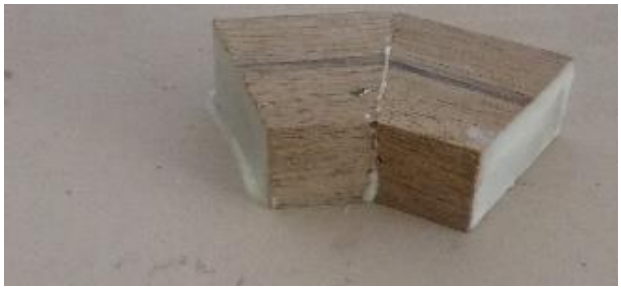


5 Assemble the Rings

Find a very flat surface to which glue will not stick well. Best is a 12” x 12” scrap of old Formica topped kitchen counter. Lately, I have been placing a piece of computer paper onto the flat surface and gluing the segments together on this paper. The segments stick to the paper and help everything stay in place until I clamp the ring. After one use, I fold the sheet onto itself to hide leftover glue and throw each sheet away. This makes cleanup much easier.

Apply glue to both ends of one segment. Place this segment with the long edge facing away from you at the 12 o’clock position on the mounting board.

Apply glue to the ends of a second segment and glue the second segment to the right side of the first. (1 o’clock position). When joining segments, rub the glued sides against each other. This ensures that the glue is well spread and forces any excess glue from the joint.



Then apply glue to the ends of a third segment and glue that to the left side. (11 o'clock position).

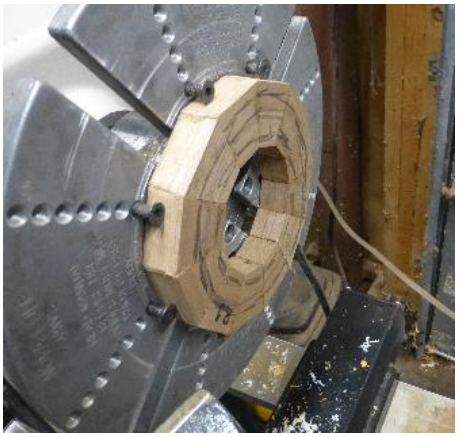
Continue, alternating side to side until all segments have been assembled.

When all the segments have been glued, use a hose clamp to secure the ring. Tighten the clamp. This will often correct what initially appear to be errors. I use a 5/16" drive in a variable speed drill to tighten the clamp.

You want the ring to be as flat as possible. Tighten the clamps and let the glue harden. I like to let the glue set for several hours.

6 Smooth the Rings

Once the glue on the rings has set you are ready to smooth them. I like to wait 4 hours or overnight, but a couple hours would probably suffice.



I use Cole Jaws on my Nova Chuck to hold the rings while I flatten them. I prefer using M6 Flat Head screws 16 or 20 mm long rather than the soft rubber bumpers that come with the Cole Jaws. They are lower profile and I think they hold better. I put the ring in the jaws such that the side with the mark is exposed.

I use a bowl gouge on the side until that side is as flat as I can get it. Often, I put marks on this side. When all the marks are gone, I have cut far enough. I then use a skew chisel as a scraper to flatten it even more. I finish it with a sanding board with 100 grit sandpaper. Sometimes I draw three lines on pencil on the ring. I sand until all three rings are gone. This is shown in great detail in the Tutorial Book: *Gluing Segments into Rings* which can be found at: http://www.thesegmaster.com/tutorials.htm.

Once the first side is smooth, I usually turn the ring over and repeat the process. However, another approach is to smooth only one side at this time and glue it to the bowl. You can use the same technique to smooth the ring after it has been assembled onto the bowl.

7 Assemble the Rings

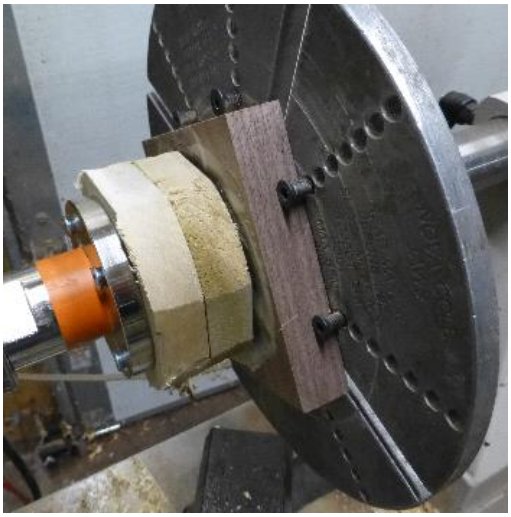
I use my lathe to center the rings on the bowl while I am assembling the bowl. This requires either a Live Tailstock or a Tailstock Adapter as well as Cole Jaws.

The photo shows a Live Tailstock Adapter (available from PSI Woodworking) on the top. The bottom images are fixed tail stock adapters. I made the smaller one (1” x 8tpi) with a 3D printer. The larger one (1 ¼” s 8tpi) is available from Amazon.

I install the ring to be added into Cole Jaws on my Nova Chuck. Instead of using the rubber bumpers that came with the Cole Jaws, I prefer using 8mm x 20mm (or 16mm) flat head screws because they are lower profile and they grip better.

Put glue onto the faces to be glued.

Put the bowl and the ring to be glued onto the lathe. Bring the faces together.



As the faces come together, I manually rotate the lathe spindle to let the surfaces rub against each other. Make sure that when everything is set, the segments are aligned properly between the two topmost rings.

The lathe can also work as a clamp for the 30 or more minutes of clamping recommended by Titebond™. Alternatively, you can let the glue settle for 10 minutes and then move the bowl to another clamping system to free up your lathe while the glue hardens. Or, if you are in a hurry, you can mount another ring.

If you do not have Cole Jaws, you can assemble the rings “by eye” but it is tricky to get all the rings perfectly centered. The glue is very slippery (like grease) and the rings tend to slide as the workpiece is clamped. If you do align the rings “by eye”, I suggest doing them one at a time, letting them dry fully before adding the next ring. That way, you can turn the top of the ring to get it perfectly centered on the axis before gluing the next ring onto it. This will prevent error accumulation. If you are planning to assemble the rings “by eye”, I suggest leaving larger margins in your ring design and then turning each ring after it has dried onto the bowl and before you glue the next ring. This will prevent errors from accumulating.

Sometimes it is a good idea to start turning the workpiece before all the rings are applied. It is easier to turn the inside of a bowl before all the rings are in place. I make sure the glue has set for several hours before doing this.

8 Turn the Workpiece

Use your normal techniques to complete the turning. Nothing new here.

Use progressively finer sandpaper to smooth the inside and outside of the piece.

I like to apply the finish while the workpiece is still on the lathe. True, I cannot do the bottom of the turning, but I can do everything else and do the bottom later. My variable speed lathe will move slowly, so I leave the lather running while the finish dries to prevent drips. This works particularly well with lacquer. Be careful that the lathe is not spinning too fast or you will get drips toward the outside of the bowl rather than due to gravity. If you get the lathe going fast enough, you will get lacquer all over yourself.

9 Cut the Workpiece from the Waste Block

I use the Cole Jaws again with the live end. For this, I prefer the rubber bumpers (rather than the flat head screws which would mar the work. This prevents my having to hold the piece while it parts from the lathe. It also prevents the work from taking off across the room or bopping me in the head when it separates.

Once it has been cut off, I turn the piece around on the lathe. I mount the Cole Jaws and the turning to the headstock so that I can clean up and finish the bottom. I like to keep pressure on the base foremost of this because the Cole Jaws do not always hold perfectly. I use the live end to apply this pressure. Often, I use a pointed live tailstock center. Of course, I have to remove the live end to do the middle of the base, but that is only a small part of the job and the point where a catch is least likely to pop the turning from the lathe.

10 Hints:

- Before cutting the segments, use a “Sharpie” or equivalent to draw a line on one side of the stock. When you cut the segments, the line will be on top half the time and on the bottom for the other cuts. When you assemble the segments into a ring, put all the marks on top. This will tend to cancel any slight errors that might have occurred during the cutting.
- Mount a small precision metric metal ruler to the sled. Secure it using a fender washer. I use Metric because decimal positioning is easier than estimating fractions.
- Use the calipers to convert from inches to centimeters. The design gives the length using inches. Set the calipers to this length. Then change the scale to CM. I use this measurement to set the stop block.
- Cut the segments one ring at a time and then glue those segments into a ring. Then label the ring on the top, bottom, and the edge. This can become an issue for large projects where there are rings of similar diameter.
- I have very recently placed a piece of white computer paper under the segments while I am gluing them. The paper helps the segments stay in position as I am gluing them and the last segment tends to fit more precisely when I use the paper.
- I position one segment at the top with glue on the left and right sides. I apply glue to another segment and glue that segment to the right of the first one. I then glue the third segment to the left of the first one. I alternate back and forth so I am always dealing with relatively fresh glue on both sides. If you do not alternate sides when gluing segments, the glue on the end of the first segment will stiffen before you get all the way around.
- I wear thin rubber gloves when gluing. I first tried this to keep my fingers from turning yellow, but soon realize that the glue spread faster and more evenly if I had the gloves on. I smooth the glue with the side of my index finger. It is flat there is works better than round pad at the end of my finger.
- I put glue on both sides of the joint then rub the joint together, preferably until it seems to hold. Rubbing not only improves the bond, but also removes excess glue. Excess glue has thickness that might not be even and can introduce errors.
- Sometimes my stock is not all the same thickness. I try to get the bottoms even; it is easy to flatten the top once the ring is formed. The “top” is side with the pencil marks on it. When smoothing rings, I always please the smoother side down and flatten the rougher upper side (with the marks on it) first.
- It can be a good idea to cut the widest segments first. That way you can use the left-over piece on the segments that follow. You can rip this scrap that is too wide down to the desired width. OR, you can just cut it to the correct length ignoring the fact that it is too wide. Glue the ring. There will be segments that protrude into the center of the ring. You can trim these out at the same time you flatted the ring.