Segmented Turning and 3D Printing

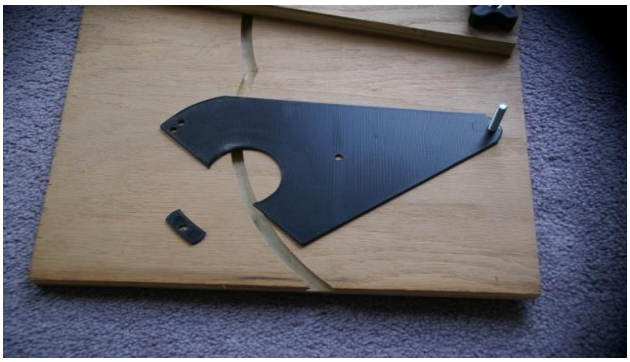
By Jared Bruckner

After watching Lynn Chastain's February demo on segmented woodturning, I just had to try it, at least once. I was aware that it would take considerable work just to get the tools that I would need to do the first, and maybe my last, segmented piece. But, I thought, "How much more work would it be than what it had taken to prepare to turn my first, and only, miniature cowboy hat?" Well, maybe a little more!

The first project I decided would be a sled for my table saw, which I would then use to cut the small segments at the correct angle. So I went to the web and looked into buying a sled to save time. Not that I have more money than time - it is just what I did. I did not find what I was looking for, but did find a kit which had parts that could be used to make a sled. Something in the kit caught my eye. It was a small wedge shaped piece of plastic attached to the end of a bolt that could be used to hold a fence on the sled in place while cutting. It would slide into a V shaped slot cut in the body of the sled. The kit also included knobs for the bolts. Well those were somethings that I could print on my 3D printer. I found a parameterized model for knobs on thingiverse.com and I designed a little plastic piece to use on the end of a bolt. The bolt had most of its head ground away. Some of the 3D printed parts can be seen in picture #1.

Picture #1 3D printed knobs and bolt with 3D printed wedge on bottom.

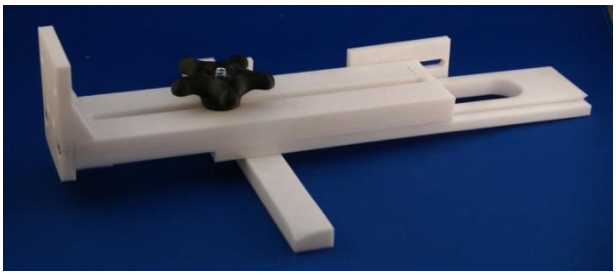
The other part from the kit, a miter bar, I could have made from wood, but a nice aluminum bar was only $15 on Amazon, and I had two in 2 days. (The second bar was for a second sled I agreed to make for Lloyd Speer.) I had a 4' by 4' piece of ¾" plywood sitting around to use. So the next job was cutting the plywood to 13" by 15" and drilling the two holes near the edge which would hold one end of the adjustable fences. Then, using an idea given to me by Tom Barksdale, I designed and 3D printed a jig to attach my router to a bolt placed in one of the holes. Then, using the jig and a ½" dovetail bit I cut the arcs 7" from the pivot bolt. (See picture #2.) The sled was completed by attaching the miter bar and the two moveable fences. (See picture #3.)



Picture #2 3D printed router jig used to cut V channels in base. Printed in 2 parts because it was too large for my printer.

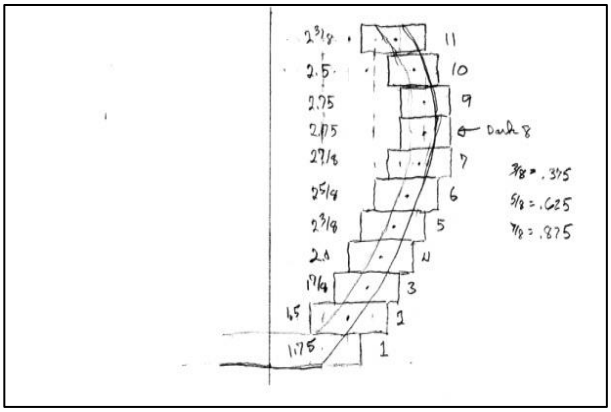
Picture #3 The completed sled.

By this time I knew of two other things that I needed before starting to cut. I designed and 3D printed a deflector, to allow the cut little pieces to fall away from the saw blade (See green part in pictures #7 & #8), and a saw stop to allow getting all the pieces for a layer cut to the same size. I could have made a wooden saw stop in about a tenth the time it took to design and 3D print my saw stop. (See picture #4 and others.) But, my stop allows very precise measurement for the cut pieces.



Picture #4 My 3D printed saw stop.

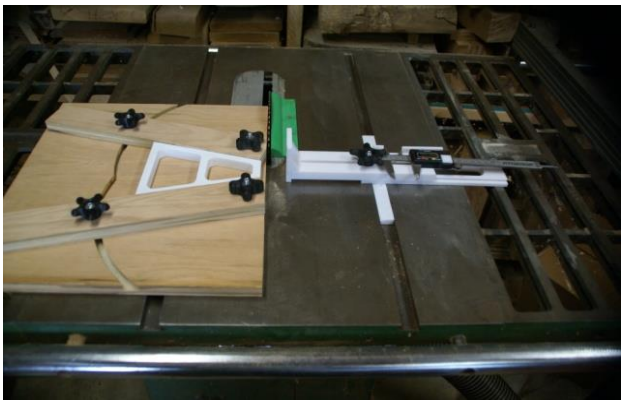
Now that I had all the tools, it was time to start making a segmented piece. I started by making a full size drawing of what I wanted to make. (See picture #5.) Then I made a spreadsheet to do the calculations I needed to start cutting. (See picture #6.) After preparing the wood, I cut the segments (See pictures #7 & #8) , and glued up the rings.



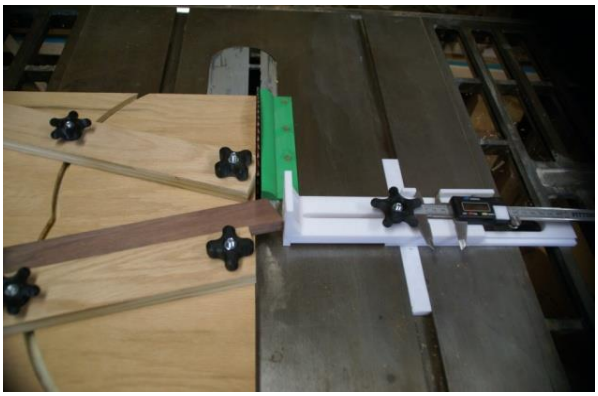
Picture #5 Full size drawing. (Graph paper did not show on picture.)

Ring #		Radius	Diameter	Width	LENGTH	STOP
1						
2	1.5	1.5	3	1.25	0.8037	0.7764
3	1+7/8	1.875	3.75	1.25	1.004625	0.9705
4	2	2	4	1.25	1.0716	1.0352
5	2+3/8	2.375	4.75	1.25	1.272525	1.2293
6	2+5/8	2.675	5.35	1.25	1.433265	1.38458
7	2+7/8	2.875	5.75	1.25	1.540425	1.4881
8	2.75	2.75	5.5	1	1.47345	1.4234
9	2.75	2.75	5.5	1	1.47345	1.4234
10	2.5	2.5	5	1	1.3395	1.294
11	2+3/8	2.375	4.75	1.25	1.272525	1.2293

Picture #6 Spreadsheet for calculations.



Picture #7 Setting up the table saw using a 3D printed “Wedgie”



Picture #8 Ready to cut a walnut segment. Note how the walnut wood touches the saw stop.

I made the piece in two parts, the bottom part, up to ring #8, and the top part, rings #11, #10, and #9, were glued on separate face plates. After turning, and finishing, with polyurethane, the inside of both parts, I glued the two parts together. I had planned to trim the join line on the inside after gluing but when sanding the top side of the bottom, I broke the tenon off. I decided to just make a reverse tenon in what was left, even if a little piece would still be missing from the bottom. With only a little reverse tenon, I was afraid to try trimming on the inside, so I left the piece with a little difference in the size of two parts between layers 8 and 9, which you can easily feel on the inside. Using the tailstock supporting the inside of the bottom, I completed turning the outside. The piece was finished using “slow turn poly.” The completed piece is shown in picture #9.

Picture #9 The finished piece.