

4<sup>th</sup> Axis Work Holder Experience  
August 23, 2018

By way of introduction, I started woodworking when I retired 6 years ago. One of my first projects was a chest of drawers from plans I downloaded -- because I didn't know any better, I didn't realize what a 'shaker design' entailed -- it was doing that project that I fell in love with what you can do with a router. Fast forward 4 years and I'm trying to decide whether I need a lathe so I can make better table legs and I get this email about a 'Router Boss' and the 4th axis attachment and the more I look at it -- the more intrigued I become -- now I was perfectly satisfied with my Kreg router table, lift, Milwaukee 5625 router -- but this router boss looked like a better mousetrap -- and I guess the fact that I am doing this writeup tells the rest of the story .... another point I need to make is that I have only been doing this stuff for 6 years, I am completely self-taught -- save some videos from WWGOA - - which means the only way I know how to do things is how it works for me -- not the right way, not the fastest way, not the accepted way -- just the way it has worked -- for better or worse -- for me -- it is important that you keep that in mind as we go forward --

The project that set this all-in motion was a desk for my new son-in-law -- a lot of what I do is make furniture for my kids -- and I envisioned the sides and front to be raised panels with round legs / columns at the corners -- so the first thing I did was create a round leg --

But let's start at the beginning -- I think if you haven't looked at the 4th axis holder video available on the chipsfly.com website -- now would be a good time to view it -- it covers well the basics of setup and cutting a table leg -- not much hardware is needed



-- the tail stock, the bar, the rotating head stock adapter, couple of bolts, couple of spacers --

For everything I have done I have used option 2 of the 4 mounting choices -- where you attach everything directly to the sliding bar of the router boss -- the only difficult part for me is managing the weight while I try and get started 2 bolts that are 2 feet apart without dropping the bolts and/or



spacers in the process -- hence, -- a spade end fitting across the bolt

will keep

everything in place until you get the bolt started – the picture below shows all the pieces in place --



You might notice an add on to the basic router boss -- I bought a set of under counter LED lights and adapted them to hang from the corners of the baseplate



-- I find it really helps -- I've put a link to the product in the resource notes at the end --

So let's look at the stock we will start with -- for the legs of the desk -- I wanted 2 1/2" diameter finished legs 30" long -- it pushed the limits of the 4th axis on both specs -- to get around the 2 1/8" limit stated in the video -- I simply did a round off [ 1/2"] on the 4 corners of the stock -- a 2 1/8" square yields a 3" diagonal -- so if you can keep the diagonal less than 3" -- you can expand the square size -- and using a round off on the corners does just that -- you're going to cut the corners off anyway -- I also had to trim the square of the end down to fit in the head stock adapter -- getting the 30" length just meant putting the tailstock and head stock at the absolute limit of the bar -- The pictures below illustrate both points --



and the following picture shows several of the final pieces in place --



My current project is a standup armoire for my wife, Becky -- I am working from a picture of something she saw on the web -- a central case with 7 drawers, and 2 swing out side panels to hold necklaces, chains, etc -- on the front of the side panels



-- I want to attach half round columns 2" in diameter -- the length of the side panel -- 38" -- I started



again with stock rounded off

-- and mounted per the video



-- i use an up cut spiral bit, 1/2" for the cuts with the default depth of cut set to 1/16" -- I also found a CMT collet extender to be very useful



-- it spins true and often gives better visibility from above of the ongoing cut -- [link in resource notes]

-- Set the depth of cut on one of the corners and try to remember to check the alignment of the workpiece at the ends just to confirm -- I also put a digital cube level on the piece to confirm level -- finally, set a stop on the head stock end and we're ready to go



-- I continue with 1/16" cuts until almost done -- then I reduce to 1/32" cuts until I have just achieved a full round



-- a finishing cut is done at .010" -- very slowly -- you can see the tool marks -- Below picture is after the sanding technique demonstrated in the video -- it helps a lot -- but there is still more sanding needed to eliminate the rings entirely



A few thoughts on the cutting process -- I rotate the piece away from me -- clockwise looking from the head stock -- I think that is the 'normal' router cut -- rotating the wood into the rotation of the bit

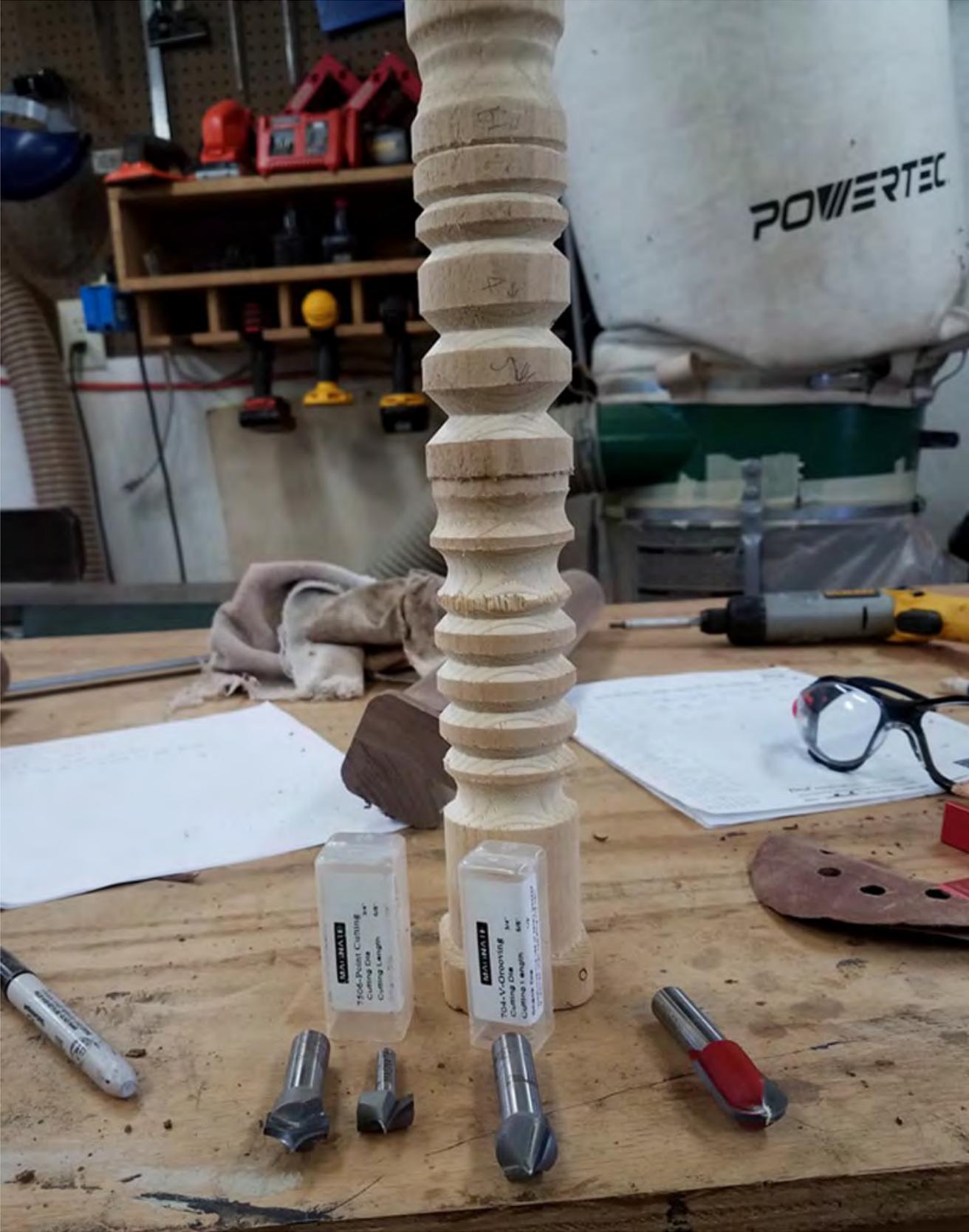
-- I think reversing the rotation -- a climb cut -- leaves more tool marks -- for the 1/16" cuts -- I do one rotation of the transverse handle every 15 sec or so -- I call that fast -- leaves big tool marks -- rings around the workpiece -- when I shift to 1/32" -- I slow down considerably -- 45 sec for 1 rotation -- I think it is a pay me now, pay me later situation -- faster cuts leaves bigger tool marks, takes longer to sand them all out -- if I slow down now -- I sand less later -- I set the successive cuts using the brass gauge bars I bought with the router boss -- easy, quick, reproducible -- I always try to look at the progress of the cuts every so often -- the 'cut' and 'uncut' stripes should be straight, uniform, symmetrical -- however you want to phrase it -- any asymmetry in the width of either from one end of the stock to the other tells me I have a mis-alignment somewhere --

When I did these, I worried that the rounded off corners [piece A] might compromise the secure fit in the head stock adapter -- it looks like it wants square corners -- so on 1 piece -- I modified the end so the last 1/2" had sharp corners [piece C] -- on another -- I stopped the round off short of the end of the piece -- it was 2 9/16" on 1 side so I had to also cut it down a little to fit in the adapter [piece D]



-- Can't say I noticed any difference during the cut or in the appearance of the final piece after -- don't think it mattered -- however, one aspect was consistent across the 4 round legs -- the diameter of the tail stock end was 3/128" smaller than the diameter of the head stock end -- using an igaging caliper tool [aside: fantastic calipers -- big numbers -- fractional and decimal inches] -- my best guess is that the head stock end must have had some give in the plastic cup -- the pressure of the cut pushed the stock down as the bit approached the head stock end causing the larger diameter -- so maybe the rounding off of the corners needs to be re-visited -- also, piece D was slightly rectangular in size -- by 1/4" -- the plastic cup looks like it wants square ends -- agreed -- 3/128" is not a deal breaker -- sometimes all this digital input can make one crazy -- another option would be to use a standard chuck from Sherline in the head stock.

Next step is to cut these exactly in half and mount them on the front of the side panel doors -- my wife didn't want any 'dust collectors' i.e. profiles cut into the pieces -- I was able to talk her into a collar around the top , bottom and middle to hide the junction between the 2 pieces -- so I have only played with cutting profiles -- the below picture shows my total experience



-- The profile bits were bought from Magnate -- there's a point cutting, a v groove and a cove bit -- I remember it was hard to figure out what I needed -- what the profile from each bit would look like -- note that the CMT collet extender is necessary to get the bits down to the stock -- the overall lengths are less than 3" -- maybe next time ....

I think that about wraps it up -- I hope you found my ramblings useful -- my fervent hope is that stuff like this will spur conversations among Router Boss users -- opportunities to share experiences, tips and techniques -- I firmly believe that: 1) it is a fantastic tool and 2) I am only scratching the surface of how it can help me to be a better woodworker.

many thanks  
larry

resource links:

light kit

[https://www.amazon.com/Cabinet-Lighting-Accessories-Included-Kitchen/dp/B00YMNS4YA/ref=sr\\_1\\_3?ie=UTF8&qid=1535239092&sr=8-3&keywords=le+led+under+cabinet+lighting+kit](https://www.amazon.com/Cabinet-Lighting-Accessories-Included-Kitchen/dp/B00YMNS4YA/ref=sr_1_3?ie=UTF8&qid=1535239092&sr=8-3&keywords=le+led+under+cabinet+lighting+kit)

collet extender

[https://www.amazon.com/CMT-796-001-00-Router-Extension-Collets/dp/B000P4NQCK/ref=sr\\_1\\_2?ie=UTF8&qid=1535238979&sr=8-2&keywords=cmt+router+collet](https://www.amazon.com/CMT-796-001-00-Router-Extension-Collets/dp/B000P4NQCK/ref=sr_1_2?ie=UTF8&qid=1535238979&sr=8-2&keywords=cmt+router+collet)

Addendum

September 6, 2018

Not necessarily related to the blog post -- more in the category of what you can do with a router boss that you can't do with anything else -- rephrase -- what i do with a router boss because i can't figure out any other way to do it --

I took the columns made in the blog post and cut them in half -- i have to join 2 together so the half column can then be mounted to the front face of the side panels of the armoire -- don't have a band saw so i had to do the half cut on my table saw -- didn't think i could manage a 38" long pieces thru the table saw so i did the half



cut on each of the 22" pieces -- the columns were turned to 2" (+/- 1/128) so they would match -- the half cuts were done to maintain the 1" radius -- side panels are 2.5" wide

-- now that i have them cut -- how do i join the two pieces together so they match and won't fall apart --

I decided to cut a mortice in each of the half pieces -- 1/4" wide, 1/2" long, 3/8" deep -- and make a floating tenon -- this will register the two together and give the joint a little strength -- so i clamped the two pieces side by side -- registered to the top, and perfectly parallel to the plane of the bit -- registered the bit to the flat side and moved it 1/2" toward the inside using the spacers -- moved L/R until I had what I thought was center and dropped the bit to just touch



-- moved + 1/8" -- to cut one side of the mortice -- moved to - 1/8" using the DRO -- to cut the other side of the mortice -- back to "0" -- cleaned out the center and the sides -- moved to the second piece and repeated the process -- final result shown above -- you can see the clamping -- i simply don't know how i could have done this activity with the precision i needed on any other device -- not counting cutting, moving, checking, moving back, and final cutting -- all without any loss of precision.



-- the above pictures show the tenon in place and the joint put together -- to my eye, there is no discernible difference across the joint -- they fit perfectly -- the key is the ability to secure a setup, the ability to confirm the setup as often as necessary, the ability to control the cuts, and the ability to see everything as you do it -- all with a final precision of better than 1/64"

You say it in one of the videos -- if you can imagine it -- you can do it with a router boss -- it is just so much fun proving that that is true -- larry