Simple Segment Project

Prompted by a Thread question by woodfarmer regarding cutting segments for bowls on UKWorkshop forum I jumped in with some images.
I've taken the liberty of cribbing some of the material from that thread to start this W.I.P. off.

Now like all workshop projects there are no hard and fast rules of "how to do" and the following is just a rough run through of how I set about my simple segmented boxes and bowls, others will use different cutting and turning methods, indeed far more accurate and intricate segment preparation and turning skills than I will ever attempt or have the patience to master.

Hopefully the following will prompt someone new to turning to have a go, if nothing else it saves a great deal of expense on wood stock and reduces the waste wood creation considerably.

For my stuff, I use a basic Chop Saw, just need to make sure everything is set up square in the vertical plane and that angles are set accurately in the horizontal.

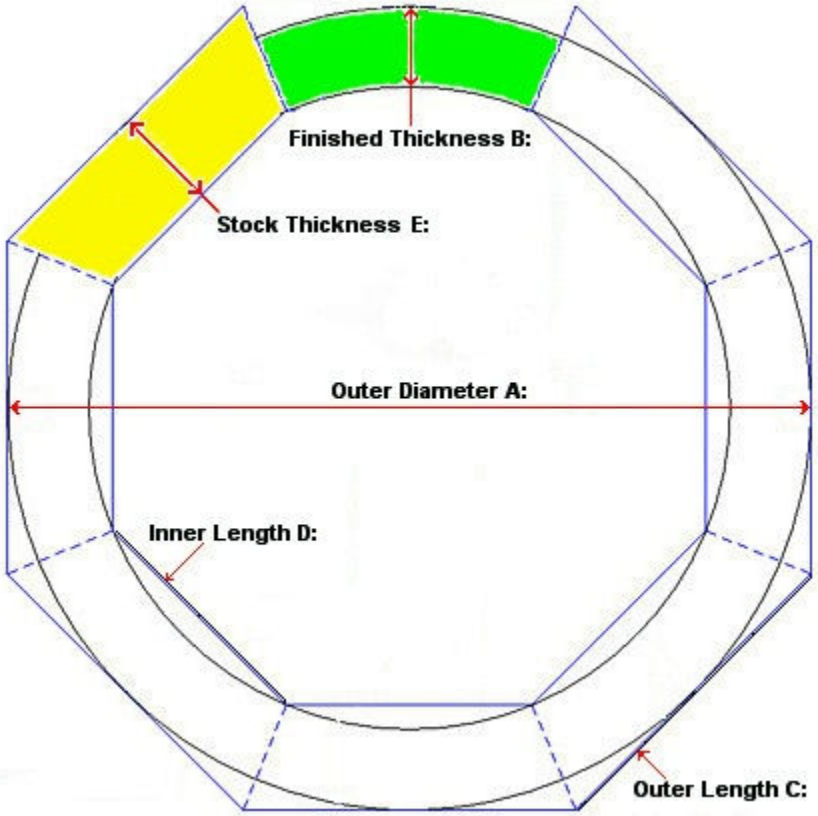
The most important of needs is to prepare your stock for even thickness & square so that it can be cut accurately by just flipping 180deg.
I personally do not use abrasives when producing segments and rely totally on accuracy of cutting, I found that trying to abrade a segment is fraught with multiple chances of creating inaccuracies and a fine abraded finish is not conducive to best mechanical key for adhesive.

The Chop saw is a basic Rexon CMS. Simple and robust is often best, only want would be similar with regenerative braking to speed things up.

There is an old run-through of a lidded segmented box on my web site.
Not the way I assemble them now but it's how I started.

Decide what nominal size you want to end up with, if you construct the way I do using up scrap wood then the available diameter of the material for the base and top rim are relevant.

I use my Calculator for anything new & I have printouts for most often used, saw stops etc. are marked up with regular options. **http://www.quest42.co.uk/woodwork/Segment/Seg-Calc.htm**



Tip:-- Don't be too critical on stock width, if you have spare then allow extra thickness in your early attempts to give yourself some error padding.
Sort out some scrap:-

Run it through the saw:-

Put it through the thicknesser to get it reasonable square and constant thickness:-

Decide if you want contrast bands and do likewise and chop them off at the thickness you want:-

Note: The use of a support media for stock that reaches over the cut path, saw plastic inserts are rarely level or rigid enough for small segment support.

Adjust Chop Saw stop to segment length (allow for contrast width if used):-
Suggest you run a scrap length through to check your sizes.
Then just keep chopping away by turning the wood stock through 180 deg. until you have enough segments and a couple of spares if you have enough wood length:-

The above sequence took 13 mins total according to the image EXIF files.

Note:-- If you want repeatability and minimum amount of aggravation and disappointments then it is essential to set up the saw correctly.
DO NOT rely on any existing graduations or stops without checking.
I use an Engineers Set Square off a dummy piece of flat stock laid across the base to set the blade vertical and check that the vertical traverses is spot on.
For the Horizontal angles I cut stock and check it against a digital angle finder on a reference surface, you can get away with a few tenths of degree in cutting errors but you need to start as true as possible.
If you look carefully at the front right hand side of my saw (in previous image) you will see a knurled knob, this is in fact a location dowel inserted in a hole I drilled through the frame and rotating table when I had the table clamped correctly so that I can come back to the setting. (The table clamp and associated notches do not return close enough for segment work without trial and error checking)

Having collected your batch of segments and associated contrast fillets, if using them, it is wise to do a test clamp just to prove that nothing has gone astray, saves a lot of frustration and wasted glue just for the sake of a few extra minutes.

Note my assembly aids:-
I use a hand drill set to screw driver mode fitted with a nut driver and use the ratchet torque limiter as a vibration aid to help agitate and seat the glued segments.
A small persuader also helps ensure any segments that slip out of line or ride up off the base plane are returned to position.

Glue up the segments, rubbing the individual joints as you go to ensure even and good spread of adhesive.

First one glued and clamped:-

And the second one assembled and both ready to be put on one side for glue to cure.

I use Cascamite adhesive, mainly because it does not have joint creep as PVA can with wood/humidity movements.

As a time indicator:-- from the shot of the test clamping to complete glue-up including adhesive measuring/mixing was according to the EXIF data 27min.

Next comes the preparation of the glued segments and the top and bottom pieces for final glue up.

The first image is a bit gratuitous to this process but it shows how I consolidate time use when machines are in use and prepare stock volume when time permits.

The glued segment sections and rough blanks selected for tops and bottoms.

First task in preparation for final glue-up.
Mount segment ring for clean -up.

Warning:- Always clamp in compression, finding out that a glue joint is not sound or wood structure weak whilst cutting when mounted in expansion is not a procedure to be encouraged.

Note:- Cascamite recommends caution when components are to be machined and allow 48 hrs or so before subjecting to heavy cutting loads, I have never had a joint fail with items cured overnight at domestic room temperature but like many of my other tasks I tend to do glue ups in batches and rough assemblies are more often than not lying around for days,weeks, or months even. So if you are gluing up in an unheated shed be cautious.

I do a lot of my roughing out turning by using tools in a boring mode, much the same as if using a pattern makers or metal lathe.

If you don't have a carbide tipped tool then a stiff sharp 1/2" scraper can be used in the same mode.

With a sharp flat scraper finish off the mating surface:-

Check for flatness across the diameter with a steel rule, if you have it near you will get a squeak if the rule is presented as the lathe slows down, you'll know when you get it perfect, the squeak is unmistakable.

Turn the piece around and complete the other side:-

Do likewise for any other segments whilst you have the chuck mounted:-

Now to sort the tops and bottoms out whilst we still have these jaws/chuck mounted.

Take a base piece and mount:-

Roughly true up the face and edge as far as possible.

Mark out for and cut a recess mounting socket to suit your jaws. (I always use my simple gauges)

And do the same for any other bases you have ready.

Mount the top piece and rough true, mark the basic joint dimensions from the segment ring:-

True up the mating surface much the same as you do the segments, note the undercut central area, more on that later:-

And repeat for any other tops:-

Swap Jaws or in my case Chucks:-

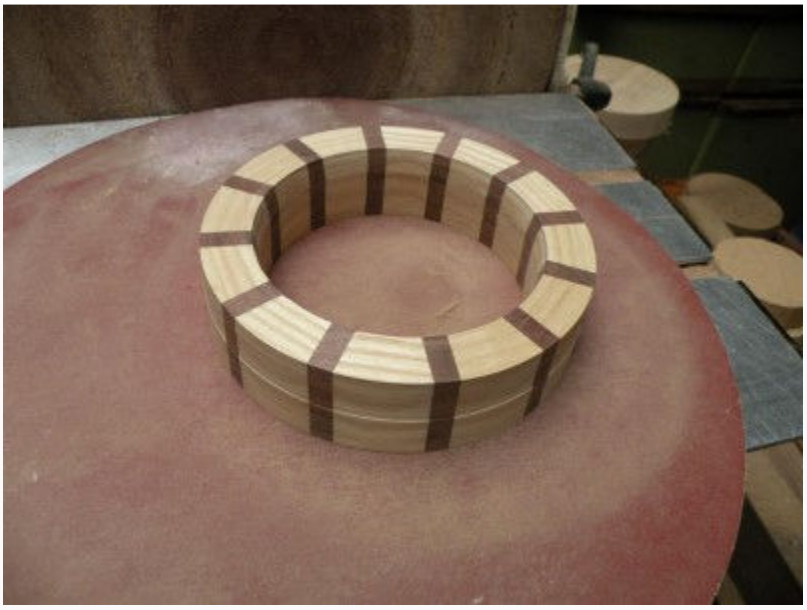
Mount the base and prepare the mating ring and clean out any base recess:-

The above turning sequences took 49 mins total according to the image EXIF files.

The turning tools I've used so far:-

Now for the reason I suggest you have a slight recess in the top portion.
Should you have a significant delay in gluing up the assembly there is a chance that the top and bottom will move, also if you are less than sure about the flatness of the joint surfaces you can recover things:-

Using a large sheet of abrasive on a flat surface, I use a spare 250mm disc sander disc, dress the joint surfaces:-



If you run some pencil lines across before you start you will soon see if the surface is flat:-

Warning:- Do not attempt to use a disc or belt sander for the above routine, you WILL make a mess of the mating surface and not get it flat enough for a minimum joint line.
Even with hand lapping take care that the abrasive is flat and not curled away from the support at all.

Ready for glue up, the pieces do not have to be exactly the same diameter at this stage but if you have a reasonably close match near the mating surfaces it helps in alignment whilst clamping.

Apply the glue and ring the components together as you proceed to even out the glue spread, and clamp firmly:-

Check component alignment before maximum pressure is applied, they have a perverse tendency to slide sideways and once fully clamped it may be difficult to break the seal and move.

Dependant upon size of assembly and wood stiffness (i.e. using thinner stock) you may need to use multiple clamps around the periphery or a scrap spreader piece to ensure an even and close join line.

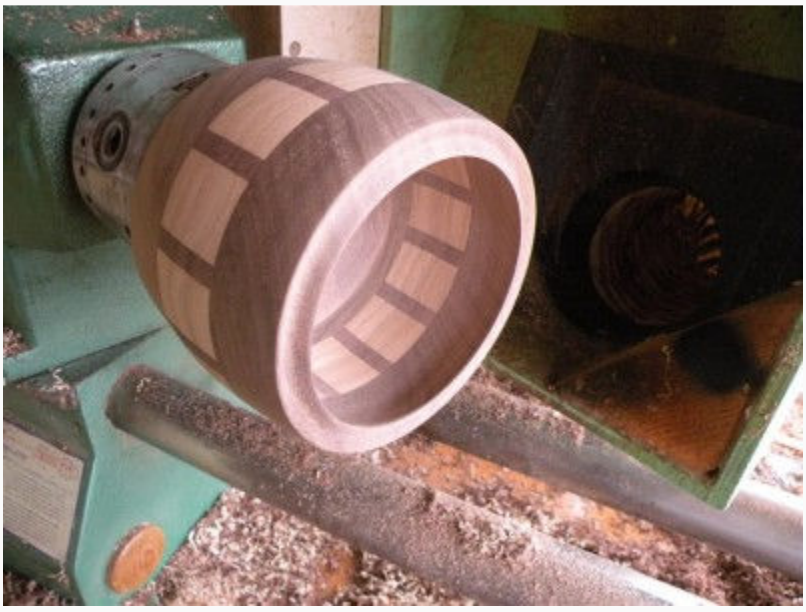
Now to turn an ugly duckling, if not into a swan, at least something presentable.

As cleaned up with a bowl gouge.

Make your mind up about choice of bowl-lid interface and part out central top waste.

Bore out internals until you reach your intended thickness, most of mine are about 6mm,

I use a round scraper bit on the inside to shear blend any gross tool marks and ridges.

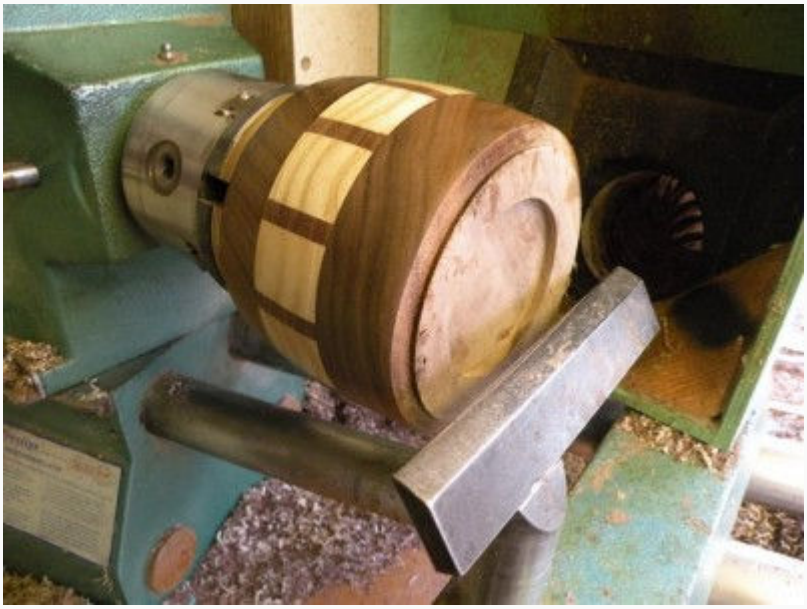


I use a slow drill driver to sand the bulk of the needs down to 240 grit, but the odd rogue grain patch as can be seen in the above image I sand by hand with the grain, and the piece stationary.

Finish off this stage by applying sanding sealer, wiping off surplus runs etc. after a few seconds.

Change Jaws/Chucks again:-

Reverse mount box to clean up base:-

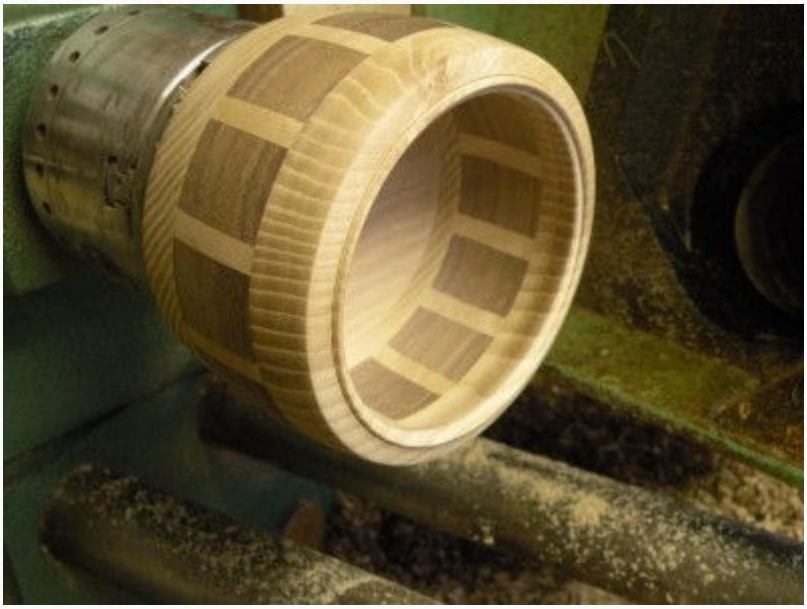


Face off to your preferred foot shape and sand to 240 grit:-

And seal:-

Put on one side ready for lid selection and fit, I leave final finishing until both components are finished to this stage:-

This is it's thread mate worked to the same level, normally I would have turned the stages whilst appropriate chuck was fitted but was not sure I had time, as it happened doing it separately only added a couple of minutes to actual work time for chuck changes.



As far as I can estimate from the EXIF files, between fending 'phone calls etc. the box turning, sanding and sealing approximates 30 mins each.

Sorted out a couple of blanks for the lids.
One needed a hot melt spigot block attached and skimmed up to aid turning access.

The other needed sorting for glue up, had not got one small enough in the store, it's design comes with an integral access spigot.

Lid turning time.

Clean up the underside:-

Mark some guide lines for the lid spigot, I use callipers to transfer the size.

Turn spigot, using box to check final sizing.

Refine fit of spigot heal to box top and start forming of lid top surface.

Sand. & seal.

As is my normal work method put to one side until jaws/chuck is changed.

Mount next Lid blank.

Clean up face and mark, in this case the box recess diameter not the spigot.

Turn down to fit, using box as size template, and mark spigot diameter.

Turn spigot and start top surface shaping.

Sand and seal.

Part off from hot glue spigot.

Change Chucks, and remount Lid, in this instant I'm using additional support because I cut the periphery rather thin and I don't want to put too much pressure on the chuck.

And finish the bulk of the top surface turning.

Remove the support and finish forming knob, sand and seal.

Likewise finish off the second Lid.

According to the camera I was working on the tops for 66mins.

Now to put a bit of shine on the creations.

After first look at the course wheel

Finishing off the last piece.

And ready to leave the shop.

About 22mins. to buff, including a bit of rework on the first one when a scratch defect was found to have crept in behind my back.

Not sure they came out as balanced as I would like but there is no accounting for taste and it never ceases to surprise me which folks select to meet their needs so they will be left 'as is' for the time being.