

Notes for 2017 GCWA Retreat Ring Class

Background

These class notes describe how to make a ring with a stainless steel insert and a wood exterior band. They also include information on how to make the necessary tools and jigs that are required to turn the wood band.

A wooden ring without the ring insert can be made using many of the same techniques, however, the ring will be weak, even if the wood is stabilized, and probably crack either during construction or while wearing it. Also, with the ring insert, the ring can be made much thinner and is more attractive and comfortable to wear.

When choosing wood for the ring, spindle blanks are best because the grain will run across the ring and there will be no end grain showing on face of the ring. In the case of burls, it does not matter, since there is generally no pronounced grain direction. Also, choose a wood that has a grain pattern that is small relative to the ring size, otherwise there may only be a couple of grain lines showing on the ring. Good wood choices also have a lot of contrast in the grain lines. Examples are burls, dyed burls, cocobolo, zebra wood, some highly figured maple and spalted wood if the spalt lines are close together. Examples of rings are shown in Figure 1.



Figure 1. Dyed burl, cocobolo and spalted maple rings

Materials Needed

1. Wood for rings
2. Stainless Steel ring insert – sizes 7 to 13
3. #2 Morse taper drill chuck
4. Centering bit
5. Forstner bits – 3/4" and 7/8"
6. Dial calipers
7. Medium CA to glue the ring insert into the wood blank
8. Thin CA glue for finish
9. CA accelerator
10. Various grades of sandpaper and silicon carbide paper
11. White diamond and buffing wheel
12. Wood for mandrel
13. Small sharp spindle gouge
14. Sharp parting tool
15. Small sharp square end scraper
16. Chuck – optional if blank is threaded for your lathe spindle

What You Will Make

1. A ring mandrel that holds the ring insert with wood blank glued to the outside so it can be turned, sanded and finished.
2. A finished ring.

Mandrel Construction

The mandrel is used to hold the ring for final turning, sanding and finishing. One end is held in a chuck with a tenon (or threaded directly to your lathe spindle) and the other end has tenons turned to fit four different ring sizes. You will turn diameters that skip a ring size so there is a large enough shoulder on each tenon that the ring insert can reference against when turning. The mandrel will hold all common ring sizes by making tenons for sizes 5, 7, 9 and 11. Each will expand enough to hold the next larger ring size (6, 8, 10 and 12). Figures 2 and 3 are pictures of a typical mandrel. The mandrel is split with two cuts perpendicular to each other for about 3/4ths of its length and expanded using a 60° live center to hold the ring.



Figure 2. Ring Mandrel Side View



Figure 3. Ring Mandrel End View

Steps in Turning a Mandrel

1. Prepare a spindle blank that is thick enough to make a tenon for your chuck (or long enough to drill and thread for your lathe spindle using the appropriate sized Beall wood tap for your lathe spindle) and mark the centers on both ends. Typically 1½" X 1½" square to 2" X 2" square and 4" – 6" long is about right. The blank should have straight grain since you will be expanding the mandrel to hold the ring and do not want it to crack because of grain runout.
2. Mount the mandrel blank between centers, rough turn it round and then turn a tenon to fit your chuck on one end (or drill and tap for your lathe spindle). It is best to size the tenon so that the chuck jaws are almost closed when gripping the mandrel tenon.
3. Mount the mandrel in a chuck using the tenon. Mark jaw #1 so that when you remount the mandrel it will run true. Using a blank threaded for your spindle is a better choice to insure that it will always run true each time you mount it.
4. Using a centering bit, drill a 60° conical hole in the end of the mandrel deep enough so that the tapered part of the bit cuts a 1/4" diameter hole but do not go beyond the bit taper. Install a live center in the tapered hole.
5. Rough turn the first 2" of the right end of the blank to about 1" in diameter (headstock is to the left).
6. Use a parting tool to cut a tenon about 0.680" diameter (slightly oversize for the size 5 ring's ID of approximately 0.620") 3/8" wide on the right end to set an approximate diameter. Carefully finish turning the tenon to a diameter of 0.620". Repeat this process to turn three more 1/4" wide tenons with diameters of 0.685" (size 7 ID), 0.749" (size 9 ID) and 0.818" (size 11 ID). An accuracy of ±0.005 is fine.
7. Turn a cove with a minimum diameter of approximately 3/4" starting about 1/2" from the chuck jaws (or from the end of the threaded hole) ending 1/4" from the largest ring tenon. Also reduce the 1/4" shoulder to the left of the last tenon to about 1/8" larger than the last tenon. This is necessary so you can access both sides of the ring when it is mounted on the largest tenon of the mandrel.

8. Remove the mandrel from the chuck and cut two slots perpendicular to each other from the 60° hole just past the center of the cove. A bandsaw is the best way to do this using a V-block to hold the mandrel. Make sure the slots are in the middle or the mandrel will expand asymmetrically.

Ring Construction

1. Chuck one end of a squared ring spindle blank diagonally in the chuck jaws and tighten. It is not necessary to hold the blank with a tenon if the blank is perfectly square.
2. With the appropriate size Forstner bit (see the Small Hole column in Table 1), drill a hole in the wood ring blank about 1/2" deep. Drill a second hole with the appropriate size Forstner bit (see the Large Hole column in Table 1) just slightly deeper than the ring insert width (all inserts are 0.25" wide). The correct sized Large Hole diameter will be slightly smaller than the ring insert OD.
3. Install a live center, and while holding the ring insert against the hole, bring the live center up to center the insert against the end face of the ring blank. Use a sharp pencil to draw a circle around the outside of the insert on the face of the blank while rotating the chuck by hand.
4. Using a small square edged scraper, widen the hole almost to the line. Measure the hole diameter with dial calipers and sneak up on the correct diameter for the ring insert to just fit in the hole with minimal slop. You can also use the special tools shown below to widen the hole. The hole should be slightly deeper than the ring insert width so that the face of the wood blank is a little proud of the ring insert. This will be turned off in Step 8. **NOTE – The sides of the hole should be straight and not angled. Also, the hole should have a slight ledge so the ring insert has something to sit against when it is glued in the hole. If the ring insert is not glued perpendicular to the hole axis, it will not be easy to part off or square the edge of the wood to the ring insert later.**
5. Rough the outside of the ring insert with silicon carbide sandpaper and clean with acetone or alcohol to remove oil from fingerprints.
6. Using Saran Wrap or a small poly baggie to protect your finger, place the cleaned ring insert on your finger and apply medium CA to the outer diameter of the ring insert and the sides of the hole. Push the ring insert into the hole, making sure it is against the ledge and does not wobble as the chuck is turned by hand. Do not worry about the CA squeeze out as it will be cleaned up later.
7. Use accelerator to cure the CA.
8. Reduce the diameter of the wood blank until it is about 1/4" thicker than the ring insert for the width of the ring insert plus about 1/8" to 1/4" so there is space on the left side of the glued ring insert to safely part it off by cutting into the Small Hole you drilled in Step 2. Then turn back the wood flush to the right side of the ring insert with a pull cut. **Note – you want the right side of the wood to be flush with the ring insert so it will be held square against the ring mandrel shoulder and will not wobble.**
9. Part off the ring assembly just beyond the left side of the ring insert.
10. Scrape the excess CA out of the inside diameter of the ring insert and polish with silicon carbide paper if necessary. If your chuck can hold the outside diameter of the ring, it can be used to polish the inner diameter.
11. Mount the ring assembly on the appropriate ring mandrel against the shoulder with the flush cut side towards the headstock and bring up the live center to expand the mandrel until the ring will not turn on

the mandrel. **Note - Make sure the ring does not wobble when the chuck is turning. If it does, remove the ring and clean up the flush side with sandpaper on a flat surface and remount on the mandrel.**

12. Turn the right side of the ring until the wood is flush with the ring insert.
13. Turn the outside diameter to 1/8" thickness or less and the desired profile. **Note – This is not the time to get a catch given all the effort that has gone into the ring so far. It may be best to turn thicker and sand to the desired thickness. You can embellish the ring further at this point by cutting a groove and back filling with colored epoxy or ground plastic beads.**
14. Sand to 600 or 800 grit.
15. With the lathe running slow, wipe the sanded surface with a paper towel moistened with accelerator.
16. With a separate folded paper towel, apply thin CA with a quick wipe across the ring surface. **DO NOT** go back over it or make multiple passes as this will create ridges in the finish that must be sanded off.
17. When dry, repeat Steps 15 and 16 until you have applied at least four coats.
18. Remove the ring from the mandrel and hand sand the ring with 600 or 800 grit sandpaper until the entire surface is uniformly frosty looking and there are no shiny grooves. Take care not to sand through the CA finish. If you think you have done so, apply a couple of more coats of thin CA and resand.
19. Replace the ring on the mandrel and finish sand (gently) with 1200 grit and then 2000 and 4000 Abralon or comparable sandpaper. Burnish with brown paper bag until a shine is achieved.
20. Buff with white diamond if you want a high gloss finish.

**Table 1.
Ring Insert and Drill Sizes**

	Small Hole		Large Hole	
Insert Size	Insert I.D.	Drill Size	Insert O.D.	Drill Size
5	0.620	3/4"	0.778	*
6	0.650	3/4"	0.812	*
7	0.684	3/4"	0.845	*
8	0.719	3/4"	0.876	7/8"
9	0.751	3/4"	0.904	7/8"
10	0.786	7/8"	0.937	7/8"
11	0.817	7/8"	0.972	7/8"
12	0.847	7/8"	1.003	1"
13	0.879	7/8"	1.036	1"

* No need to drill a large hole, the small hole is just widened 1/4" deep to the correct insert OD.

Note – The small hole is drilled about 1/2" deep and the large hole is drilled slightly more than 1/4" deep (the width of the ring blank).

Special Tools

To widen the hole in the wood blank to fit the ring insert, you can make a special tool. The first option is a 3/16" square tool steel cutter ground as a square end scraper mounted in a 1/2" diameter rod holder that can be held in a handle adapter. Figure 4 shows the 3/16" square bit grind and the 1/2" tool holder. This type of tool is more flexible because several different cutter profiles can be used in the same 1/2" rod holder. However, it requires some machining. The second option is a 3/8" or 1/2" wood chisel that is reground with the same grind as the first option. The reground chisel is a single purpose tool, but only requires grinding to make it. Figure 5 is the unground chisel, Figure 6 is a top view of the reground chisel and Figure 7 is a left side view of the reground chisel. The grind profile is the same scraper shape for both tools. It has a 70° bevel ground on the end and the left side so it can cut in both places. This is necessary to produce the required flat sided hole with a square bottom shoulder. You can sharpen either tool by honing the top surface.

To make the cut, position the tool parallel, both vertically and horizontally, to the centerline of the hole you are going to widen. Start with the tool about 1/16" into the hole and slowly move to the left to start scraping. Widen this first 1/16" until the ring blank fits with a very small amount of movement. Then widen the hole to a little more than 1/4" deep to the same width. Be sure to slowly sneak up on the correct diameter so you do not accidentally make it too large and create a sloppy fit. When widening, it is easiest to watch your progress at the 4 o' clock position of the hole instead of where the tool is making contact. The best fit allows the ring blank to easily fit into the hole just a little deeper than the width of the ring blank, but can also easily be removed. If it is hard to remove, the fit is too tight and the CA will take longer to cure.



Figure 4. Specially Ground Tool



Figure 5. Wood Chisel



Figure 6. Top View of Chisel Regrind



Figure 7. Bottom/Left Side View of Chisel Regrind