

Hurshel Smith Segmented Demonstration

02/19/05

MEETING WITH HURSHEL AND TONI SMITH

For those turners interested in doing segmented work this meeting was a very special treat as well as a terrific learning experience. The thing that probably impressed me the most was the degree of precision and accuracy Hurshel was able to attain in order to get the perfect fit of his segments. Of course this is the key to a masterpiece as opposed to a mediocre piece (I can easily distinguish between the two because I have so much experience with the latter). Hurshel uses a dial indicator (measures thousandths of an inch with at least a one inch throw), a precision protractor with a vernier scale and also a magnifying lens, and a precision dial caliper. He used these instruments in ways that I was totally unfamiliar with and never realized could be used to such an advantage in segmented work. All of these techniques were demonstrated first hand in the hands on session on January 20 at Gil Russ' magnificent studio (most such places are ordinarily described as a workshop). By using these instruments he can maintain precision to less than two thousandths of an inch resulting in the perfect fit of his segments in the finished project. Hurshel is a perfectionist. A just OK fit is never good enough, it must be perfect and he showed us how to do it.

Hurshel started his demonstration from the beginning with a block of wood 4X12X12 inches. The wood must be dry. Anything under 8% moisture is OK. He uses an electronic moisture meter to measure the moisture content. This block of wood is sliced down the middle, with the band saw, into two pieces of 2X12X12 inches. Each piece is run through a drum sander. In the preparation of the stock, everything must be plumb and square. Hurshel uses mostly exotic woods (most of which I have never heard of, let alone spell). I am convinced that his mottos are square, square, square and flat, flat, flat!



PROFILING STAVES AT THE BAND SAW

Ninety-five percent of his cutting is done on the band saw (I was amazed to learn that he only has a 14 inch Delta band saw just like me. I am already encouraged; there may be hope for me!). He strongly recommended the use of a one-half inch wide, 10 hook, staggered bimetal blade made by Lennox. Hurshel called this step using the band saw---profiling. The 2X12X12 inch blocks are cut into about 2X2X12 inch pieces on the band saw. He does keep the blade fairly taught and the band saw table nicely waxed. At the meeting, Hurshel gave out to attendees a small piece of wood to be used as a jig in setting up the band saw table to the blade with a 15 degree angle (eyeballing it as close as possible). If you didn't get one of these jigs, the machinists protractor described above could be used. The band saw fence was brought up to the blade so that that one edge was cut off at a 15 degree angle. The 15 degree cut on each side will make a 12 sided bowl at glue up time. The work piece was then turned around end to end and the other side was cut at the same angle. The most important thing about this cut is that there is a small "flat" of about 3/16 on an inch (see fig 1 for a view of what the piece will look like). All of the 24 "sticks" are cut in this manner. These pieces are very gently deburred using a sheet of 220 grit drywall sandpaper (looks like screening).

FURTHER PROFILING AT THE TABLE SAW USING A SANDING DISC



These pieces are then taken to the table saw for further profiling. The table saw (unplug it first) has the blade removed and the blade is replaced with a sanding disc with a 3 or 4 degree angle (Used to be able to purchase these at Sears but apparently not any more). You should not attempt to use a flat sanding disc in this pro-

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cedure!! The wooden jig used at the band saw is now used at the table saw by placing the jig directly over the saw arbor and tilting the sanding disc to a 15 degree angle (be as precise as possible). Placing a white object behind the jig and the sanding disc while very slowly tilting the disk until you no longer see any light has been suggested as the best way to get the angle as close to 15 degrees as you can. Hurshel uses a "sled" at this juncture to get the 15 degree angle perfect. Figure 2 shows this jig. The jig can be made of aluminum or plastic or even a hard wood (the wood option may be the least desirable because its configuration may change with any environmental changes). I'm uncertain whether medium density fiberboard (spray varnished) or birch plywood would be suitable material to make such a jig. It is absolutely imperative that the sides of this aluminum or plastic "sled" be parallel. The table saw table must be lightly waxed so the "sled" can glide smoothly. One of the staves that was prepared at the band saw is now placed in the "sled" and the "sled" is placed snugly against the table saw fence. The fence is brought up to the sanding disk and the aluminum jig is slid away from you past the sanding disc and then back along the table saw fence so that a very, very thin shaving of wood is removed from one side of the stave (the side that is touching the sanding disk) that is cradled in the "sled". Now take your machinists protractor and measure the angle that was just sanded. If you are lucky it will be exactly 15 degrees. In my case I don't think I would be so lucky. But Hurshel once again comes to the rescue and tells us how to make it perfect. He places a dial indicator (with magnetic base) right over the arbor with the tip of the indicator just touching the back side of the sanding disc and with the dial set at zero (see fig. 3). Depending on how far off the shaved angle was as measured with the machinists' protractor that is how much you tilt the sanding disc. Now slide the work piece (cradled in the "sled") forward and back again past the sanding disc. It is important not to move the table saw fence it self! You may have to repeat this procedure until the angle is perfect (less than two thousandths of a degree). Now turn the work piece around (not over but just around) end for end and shave the other side. Repeat this process with all the other pieces. Deburr the pieces by gently but carefully rubbing the work piece over a sheet of "drywall" sanding

material as before. Do not sand aggressively as this will change the configuration of the work piece and the final fit of the staves will be imperfect. A cross section of the work piece at this stage can be seen in fig. 4.

DRY CLAMPING AND GLUING

Hurshel uses Titebond II glue for gluing up the vertical parts and epoxy for the horizontal glue joints. After deburring the staves he dry clamps the 12 pieces together. He uses two hose clamps: one at the top and the other at the bottom. If there is a visible space (greater than two thousandths of an inch) you can take one of the vertical staves and return to the sanding disk at the table saw, modify the tilt of the sanding disk by one or two thousandths of an inch (use your dial indicator) and test dry fit again. If there is still a problem, do the same thing with the stave 180 degrees on the opposite side. This procedure to correct a slight imperfection can not be done with staves that are made up in layers of different woods (as shown in figure 5). Any effort to correct one stave will result in the layered pieces not connecting. You have got to be "right" the first time for all the staves.

In the case that Hurshel described he used thin veneers (actually made up of three layers with a total thickness of about 3/16 of an inch) which he glued between every other stave. When the dry fit is OK, then the 12 staves and 6 thinner glued veneer pieces can be glued up using Titebond II or Titebond III and then apply the hose clamps and tighten. Make sure the base is on a flat surface because later it will be important that the work piece is attached to the face plate at right angles. Work quickly but carefully. When dry, the work piece can be sliced on the band saw into two or three round pieces to eventually make either two or three bowls. The work piece can be clamped to the band saw fence (make sure the fence is at right angles to the band saw blade which can be done by aligning the fence along the edge of the table) so that the work piece will not roll as you cut it. Try to make the cut at right angles to the fence as carefully as possible.

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ATTACHING A FACE PLATE

Four holes are drilled into the base of one of the pieces that was cut on the band saw and a slotted face plate is screwed (not too tightly at this time) into the base. He uses drywall screws which first go through washers, then through the face plate and then into the work piece. He uses a slotted face plate because this allows you to accurately center the work piece. These face plates (8 inches in diameter) can be purchased from Sears. You may have to purchase an adapter to connect the Sears face plate (Sears face plates have 1X8 and 3/4X16 thread.) to your head stock shaft. These can be purchased at stores that specialize in tools for wood turning.

CENTERING THE WORK PIECE ON THE FACE PLATE

To make sure the work piece is centered and perpendicular to the face plate, he uses the dial indicator with a magnetic base. (See figure 6). He places the tip of the indicator at a point near the face plate on one of the flat surfaces of a stave. He turns the work piece by hand during which time the dial on the dial indicator must hardly move. If necessary he uses paper thin shims between the work piece and the face plate and/or bumping the work piece very gently with a rubber mallet (since the screws in the face plate are not yet that tight) to insure that the work piece is perfectly centered. He then moves the dial indicator to the other end of the work piece (Hurshel had a flat metal surface in place of the tool rest whereby he could rest the magnetic dial indicator) with the tip of the dial indicator just touching the flat surface of one of the staves and again slowly turns the work piece and makes any other adjustments with paper thin shims and/or bumping to insure the piece is centered (you may have to go back to the base end again to make sure that end has not moved). When you are satisfied that the piece is centered, the screws through the face plate can be tightened. The end of the work piece toward the tail stock can then be worked with a tool of your choice to obtain a flat

surface. In addition, the inner surface must be turned to get a smooth surface because the tenon of the base or pedestal will eventually be glued into this end.

THE BASE OR PEDESTAL

The base or pedestal is made up of many square layers of wood of different thickness including veneers. The size of the squares will depend on the size of the piece you are making. Obviously this base must be big enough to fit into the main work piece. Hurshel recommends that each layer of wood be glued so the grain of one layer is at right angles to the layer next to it. He strongly recommends the use of epoxy glue (a two part system) for gluing horizontal layers of wood. After applying glue the pieces are clamped together. After drying, he drills four holes through the glued up base and inserts dowels. This increases the strength of the base as well as preventing any possible shifting of the layers with changes in the environment or with time. He will then glue a square piece (which may be a special design) on both ends to cover the dowels. On the band saw he cuts the base into a cylinder. Using a machinists three jaw self centering chuck, he finishes the very bottom portion of the pedestal (finishing will be described later). Small holes are then drilled into the bottom of the pedestal and a slotted face plate is attached as previously described. He later covers these holes with a round piece of felt. The base is centered and the pedestal is shaped or sculptured. The end that will be glued into the main work piece is turned (Hurshel uses a scraping tool) to a flat surface removing as little material as possible. Using the dial caliper he measures the inside diameter of the main work piece and using this measure makes a slightly larger diameter on the face that will be glued into the main piece. Using a pointed (90 degree angle) scraper he very carefully begins to reduce the diameter (about 3/16 of an inch deep) creeping up on the final fit. He aims for very snug fit. He tests at frequent intervals until he reaches this point. After finishing this "tenon" he insures that the surface (fig. 7) that will touch the bottom of the main piece is per-

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fectly flat. He uses a straight edge (metal ruler) to test for a flat surface. He uses the same scraper (described above) to perform this action. This must be perfectly flat or you will see a space between the base and the main work piece when viewing the piece from the outside. The base is glued into the main work piece. A decorative segmented ring is then glued on the top.

SHAPING AND SCULPTING THE WORK PIECE

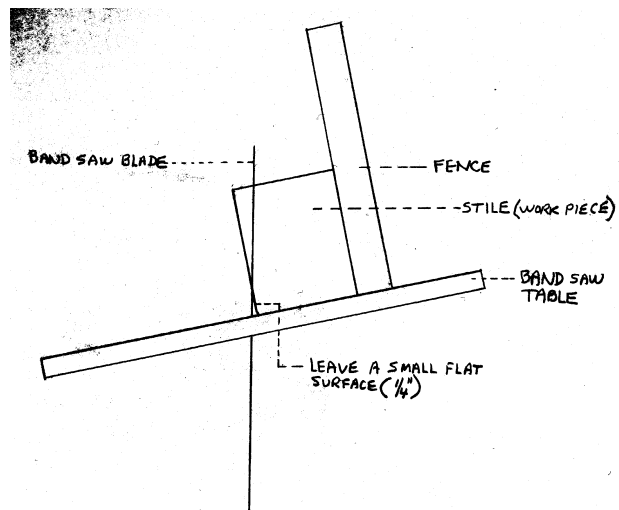
After drying, the piece is shaped to the desired form using lathe tools. Hurshel demonstrated the use of the Dyna File (a mini belt sander driven by compressed air) at the "hands on" session. The only way to describe the effect of this tool in sculpting is AMAZING!!! Hurshel does most of his shaping and sculpting with this tool. The reason for this is that in his segmented pieces the wood grain can go in many different directions. Using the usual lathe tools can result in removing small chunks of wood that can be difficult or impossible to repair. Hurshel emphasized many times throughout his demonstrations that safety precautions must be strictly observed with machinery that you use including the Dyna File!

THE FINISH

Hurshel does all of his finishing on slow turning lathe (cover the lathe with newspapers for protection). He uses a SYSTEM THREE manufacturer) filler epoxy (different from the adhesive epoxy). The two parts are mixed in a ratio of 2:1. It was surprising to learn that this epoxy is water soluble if you act quickly. One coat of the filler epoxy is applied and allowed to dry (at least about 24 hours). This is followed by sanding with 400 grit sand paper. Then another coat of the epoxy is applied, allowed to dry and sanded with 400 grit sand paper. Hurshel then applies 15 coats of TRU-OIL (Birchwood-Casey). The oil is kept as thin as possible, up to 10 % mineral spirits can be added, however, he uses it directly out of the bottle. The TRU-OIL is wiped on with a folded paper towel. Each coat is allowed to dry (at least two hours). 3M abrasive pads are used after each of the first three or four coats. After the

next several coats, steel wool (0000) is gently rubbed after each of the coats has dried. The final two to three coats are rubbed with a mixture of pumice and rottenstone to which a little mineral oil is added. The mixture can be applied with a small piece of felt. You now end up with a matte finish. To get a hand rubbed effect, automotive 2000 grit paper backed by a folded paper towel. While the lathe is slowly turning he rubs with a circular motion inside and out. The finish now appears dull. Using a modified air brush gun (modified so the opening at the nozzle is enlarged, he uses the trial and error method until he gets it right) he sprays on two final coats of the TRU-Oil. The final applications involve two automotive polishes (both liquids) made by DuPont. The first is Chromabase 1000 grit followed by Chromabase 1500. Each of these liquids is applied (at least 30 minutes per grit) to a folded paper towel and applied to the work piece while the lathe is slowly turning. He does not use a circular motion during these applications. This makes all microscopic scratches go in one direction so that the light reflects in one direction. He does not apply wax!!

The final result is a work piece that looks like glass!

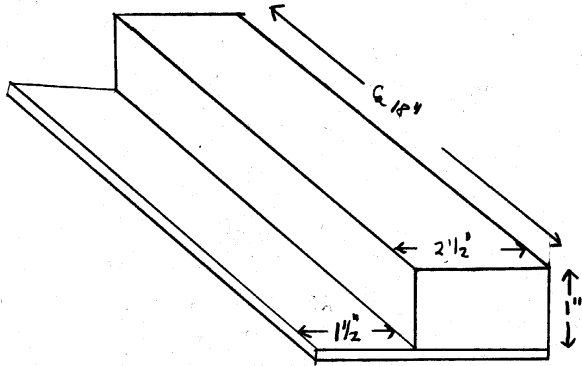


BAND SAW PROFILING

FIGURE 1

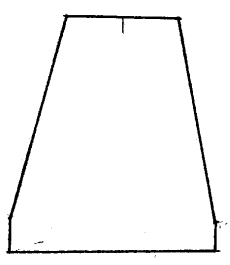
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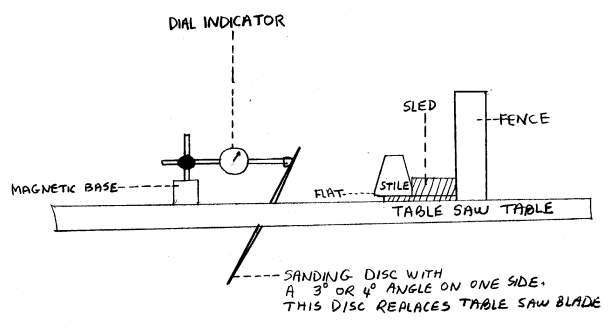
THE SLED

FIGURE 2

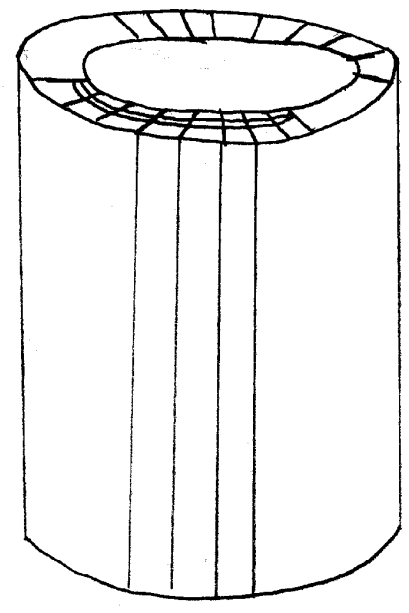


CROSS SECTION OF STILE AFTER
PROFILING

FIGURE 4



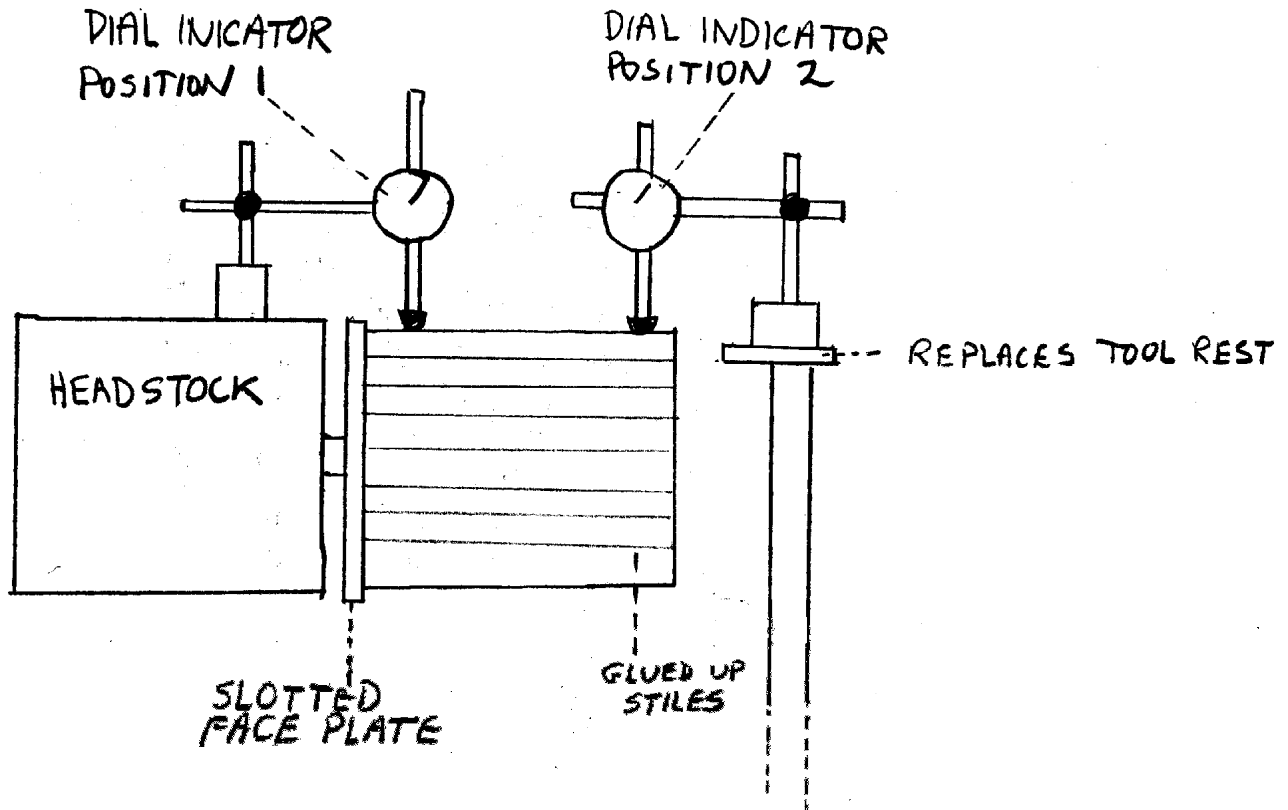
DIAL INDICATOR, SANDING DISC
AND SLED
FIGURE 3



LAYERED STILES

FIGURE 5

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CENTERING THE WORK PIECE
ON THE SLOTTED FACE PLATE

FIGURES 6 AND 7

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Supply List

Precision Jointer/Edge Sander can be found in the Winter Issue 2004 of Woodworker Supply Catalog 208 on page 33. Item #95-430 price \$33.99 +ship/handling. Glue On Discs from 40 to 220 grit self-adhesive paper that will stay, on the same page. www.woodworker.com toll free# 1-800-645-9292

Band Saw Blade can be ordered from Industrial Tool Co. in Canton, OH. www.itc1usa.com email: sales@itc1usa.com toll free# 1-800-328-7297 ask for Brian, he is the one I usually talk to and order from. The blade is a Lenox Diemaster 2 Band; part# DM8912025610

This particular blade is 8'9" x 1/2 .025 6/10. The blade can be ordered in the length needed to fit your band saws. Blades cut a little slower, but they are accurate and seem to last forever. My blade has been on my bandsaw over a year, with no problems.

They will ship the blades one at a time, if only a few of the members would like to try them.

Adhesives & Finishes

SystemThree T-88Adhesive for horizontal gluing.

General Purpose Epoxy w/#1 hardener for filler coats before oil application.

Quick Cure Epoxy A&B for a 5 minute glue—General purpose.

We order direct from SystemThree out of Washington state.

www.systemthree.com Toll-free# 800-333-5514

I use Titebond II & III for vertical gluing.

Birchwood/Casey Tru Oil Gun Stock Finishing; must be found at local gun shops/or suppliers.

Final polish job: Presta Strata 1000; this is used for roughing out before final polish

Presta Chroma 1500 is used for final polish.

These 2 polishes can be found at an automotive paint supplier where DuPont automotive paint products are found.