

Pen-Turning Simplified

Pens and other spindle-turned items are simple and fun projects to turn. They normally require only a small amount of material, so save your “scraps” and off-cuts from other projects. The required tools and supplies are also minimal.

<u>“Required” Tools & Supplies</u>	<u>Recommended</u>
Lathe (I use Jet Midi) Double Mandrel Bushings for chosen project Set of 3 HSS Turning Chisels: 3/8” Spindle Gouge 1/8” Parting Tool 1/2” Oval Skew 3/4” Roughing Gouge Straight Edge (or Center Finder) Drill Press & Vise Drill bits to fit kit (Bullet or Brad-point) Pen Assembly Press Thin CA Extra Thick CA (I like Flexible)	Center Finder Universal Barrel Trimming System Pen Tube Insertion Tool Bandsaw & Shop-made Sled Disassembly Tools 1/16” Tenon Tool Magnetic Bowl for end of Lathe Spare Pen Tubes in various sizes (I use the 10” tubes & cut to size)
<u>Optional Jigs & Gadgets</u>	
Pen Blank Sizing & Cutting Jig Universal Pen Blank Squaring Jig Cornering Jig Burning Wire(s) Beading Tool(s) Micro Detailing Set Pen Blank Trimming Set	
<u>Sanding Supplies</u>	<u>Finishing Supplies</u>
Abranet Sanding Mesh (120 – 400 grit) Plastic Finishing Kit (600 – 12,000 grade) Micro-Mesh Pads (1,500 – 12,000 grade) Optional – Thin strips 80 grit sandpaper	<p style="text-align: center;"><u>Wood:</u></p> Acetone EEE-Ultra Shine PSI Gloss Sealer Shellawax Cream Renaissance Wax <p style="text-align: center;"><u>Acrylics:</u></p> Turtle Wax Polishing Compound (car) HUT Ultra Gloss Plastic Polish Renaissance Wax
<u>Required Safety Equipment</u>	
Eye Protection (Goggles or Bubble Shield) Hearing Protection Face Mask or Respirator NO loose clothing or long hair (tie it back!)	

Selecting the Turning Blanks

When turning pens use only well seasoned wood (stock which has reached equilibrium moisture content). Caution – wet wood will corrode pen components. Ask me how I know! When using acrylics or other alternate materials this is not a problem. You would, of course, want antler, horn or bone to be dry, as well. Be SURE to wear a good mask when working with these materials, as the dust can do nasty things to your lungs!

You can use material as small as ½” X ½”, but I prefer to purchase or cut my blanks at least ¾” X ¾” to allow more freedom to play with design. Most pen kits will call for a 5” blank length, but save those shorter cut-offs for key-rings, “mini” pens, etc.

I like to purchase or cut my stock into 2” X 2” X 12” blanks so that I have sufficient material to make matching pieces. (This is also helpful if you have an “oops” moment and need to replace one of the pen barrel sections.) When purchasing stabilized wood blanks I always buy at least two of each color, as it’s very hard to match pens using material from a different dye lot.

Cutting the Blanks to Length

Use the brass insert tubes to measure the proper cut length for your blanks. PSI’s Pen Sizing & Cutting Jig simplifies this step. If you do not yet have this gadget in your collection, simply place the tube against the blank and mark your cut line a bit past the tube end. I like to cut my sections about ¼” longer than the tubes, to allow for squaring the ends. Be sure to mark the blanks at the cut line so you can match grain-lines. I use a Sharpie pen to make one or two lines across the center-line before cutting. On very dark materials a pencil or chalk will show up better, or a light colored Sharpie.

Cut the blank to the proper length(s). If you have a bandsaw this is an easy operation. If not, you can use a miter box & saw. PSI has a Pen Blank Trimming Set that works nicely. Don’t forget to save those cut-off ends for key-rings or to laminate into another blank for variety.

You will need to mark the center of all blanks before inserting the blank into a vise for drilling. This can be done by simply lining up a straight-edge with opposite corners and marking the diagonals. If your blank is square, the center will be at the intersection of the two diagonal lines. Repeat the process for the other end of each blank. A far simpler method is to use a Center Finder jig. With the one shown here you simply set a perfectly squared blank flush against the inner corner of the jig and tap the end with a rubber mallet. Rotate the blank 90° and tap again to mark the other diagonal, then reverse the blank and mark the opposite end.

If you are using stabilized wood, antler, or something you think may check or blow out easily, it’s a good idea to saturate both ends with thin CA before drilling the blank. You may also want to cut the blanks a bit longer than normal to allow for any problems you

may experience. After drilling the blanks can be carefully trimmed to length before squaring the ends.

Drilling the Blanks

When you drill the project blanks, use a slow speed like 580 – 650 rpm. (For fragile materials it may be necessary to go even slower.) Be sure to secure the blank in some sort of vise! You don't want your fingers anywhere near the bit. Do not make a single thrust with the drill bit. Take several penetrations and withdraw the bit to clear shavings & dust. If the bit gets too hot you can cool it with compressed air. I often use a wet kitchen sponge (turn drill OFF first!) to cool the bit. You will definitely need to cool the bit when drilling some acrylics and stabilized woods or Dymondwood!

Slow down when you near the bottom of the blank, to allow a clean exit hole. I like to use a thin piece of scrap wood under the blank in the vise to help prevent blowout, as well. Another option would be to drill about 1/4" into one end of the blank, then reverse the blank and drill all the way through. If you use this method, be sure you have the centers marked on both ends of the blank before drilling, so that your holes will align properly.

Gluing the Tubes

Before gluing the brass tubes inside the drilled blanks, you must scuff the outside of the tube with abrasive paper. A quick turn with sandpaper will remove any oxidation on the outer surface of the tube. This step also roughs up the tube and increases the subsequent adhesive bond. I use thin strips of 80-grit paper for this operation. Wipe the tube with a clean cloth (t-shirt scraps work great) to remove any metal dust residue.

If you are using an oily exotic wood, swab the drilled hole with a solvent such as Acetone (on a Q-tip) to remove any residual surface oils. When the solvent has evaporated you are ready to begin gluing the tubes inside the blanks.

I use the thickest CA I can find for my wood blanks. This gives me a bit of working time, but you still have to work quickly in this step. I like the Stick Fast CA Flexible (Woodworker's Paradise) or HUT Maxi-Cure Thick CA.

Be sure to wear gloves during this process! Nitrile gloves are great for epoxies and polyurethane glues, but I use latex gloves when working with CA, even though I'm somewhat allergic to latex. I once glued my wedding ring to my finger when the thin CA I was using ate through my nitrile glove and ran down my finger. NOT one of my better days. You may want to have some Acetone handy when working with CA – just in case.

Place your scuffed and wiped tube on the end of your Pen Tube Insertion Tool (or a dowel turned to the ID of the tube). Run three or four THIN equidistant lines of thick CA around the tube. Quickly insert the tube into the drilled blank and spin up and down in the hole to evenly distribute the CA on the inner walls of the drilled hole. Two or three strokes are usually sufficient to coat the inner walls.

Push the tube all the way in and wipe any excess adhesive from the top of the blank. A diaper wipe is great for this, or you can use a paper towel folded into a square and moistened with Acetone. You may now want to spritz both ends of the blank with an Instant Cure product to speed up the setting time of the CA. A “little dab” does the trick here – it doesn’t take much.

HELPFUL HINTS: I keep an old pair of needle-nose pliers nearby just in case I glue the tube to the Pen Insertion Tool, or need an extra “hand” in the insertion process. I also keep a T-pin (from my “other craft” supplies) handy to clear the tip of the CA bottles.

After you complete the glue-up for all project blanks you will want to clean the glue off the Pen Insertion Tool so it does not build up. Occasionally you will need to take stronger clean-up measures. If you are using the metal insertion tool a quick spin against your belt sander will clear the accumulated CA build-up. If you use dowels you may need to turn a new one periodically, as you sand it down too small to fit the tubes.

Gluing up Acrylic Blanks

When I have time to allow the adhesive to cure overnight I prefer to use a 2-part epoxy (like System Three’s T-88) or perhaps polyurethane (like Gorilla Glue) for my acrylic projects. However, the flexible CA seems to hold fairly well if speed is essential. Follow the procedures above for these adhesives.

If you select polyurethane glue, it may be a good idea to swab the interior of the blank with a Q-tip saturated with water before you insert the glued tube. This will accelerate the foaming action, although with our SE Texas humidity this step may not be necessary. You will need to periodically check the blanks after insertion to wipe away any excess glue that foams out of the ends. This will make your milling go faster and help keep the pen mill cutters sharp longer.

HELPFUL HINTS: I like to use a “potato plug” in one end of my brass tubes when using epoxy or polyurethane. This helps keep the glue out of the insertion end of the tube. Just twist the tube into a slice of fresh potato (about ¼” thick) before glue-up. Don’t try this with CA, though – it will accelerate the set-up time too much. You may end up with your tube stuck half-way into the blank. If this should happen to you, just cut a section of tubing and insert from the opposite end of the blank, then carefully trim off the excess tubes on each end. This is where the spare 10” brass tubes come in really handy!

Another method of clearing most of the excess glue from the interior of the tube would be to push a dowel, sized to just fit into the tube, through the glued-up blank and out the other end. The dowel could then be wiped off and set aside for future use.

Squaring the Blank Ends

After the adhesive sets up you will need to square the ends of the blank to ensure a perfect fit when assembling the project. If you are using a pen mill (Universal Barrel Trimming System) this step will also clear any residual glue from the interior of the brass tube. If you have more than about 3mm of material beyond the end of the tube, carefully trim the excess before using the pen mill to extend the life of the mill blades and speed up the milling process. You can either use the Pen Blank Trimming Set for this or, as I do, use the Universal Pen Blank Squaring Jig with your disk or belt sander.

Squaring the ends of the blank is a very important step before mounting the blanks on the mandrel. Any irregularities between the ends of the blank and the sizing bushings will result in a poor component fit when the project is assembled. The pen mill can be used with a standard hand held drill, but I prefer to use it in my drill press. The pen mill can also be used in a Jacobs chuck which is inserted into the headstock of your lathe. This latter option may be a real time-saver if you are preparing a number of blanks at the same time.

To use the mill, securely clamp the blank in a vise or drilling jig. Do NOT hold it in your hands! Insert the clearing rod into the end of the tube, turn on the drill (or lathe) and continue inserting the rod until the cutter head contacts the top of the blank. Continue milling until the blank is square to the brass tube and the tube appears uniformly bright.

If a small portion of the brass tube remains dull, continue milling until the top of the brass tube is uniformly bright. Take care to remove only the absolute minimum amount of material necessary to square the tube and blank. Excessive milling can cause fitting problems during assembly. Once the end is squared, reverse the blank and square the opposite ends of the blanks.

If you do not have a pen mill, a sanding station can also be used to square the ends of the tube and blank. Set your station base to 90° and securely tighten the retaining bolt. Use a fine grade of abrasive on your sanding belt or disk and carefully pass the end across the abrasive. Periodically check the end and stop when the tube is uniformly bright and level with the surrounding material. The Universal Pen Blank Squaring Jig is quite helpful in this operation. HINT: Use old bushings or other spacers on the spindle to hold the blank stable and extending past the end of the jig spindle.

After squaring the blanks I like to mark the INSIDE of the brass tubes on the “cut” ends with a Sharpie. This enables me to tell which ends to match up during assembly, as the marks I made when cutting the blanks will be removed during turning. If you forget to mark the tubes at this stage, you have a second chance when you remove them from the mandrel after turning and finishing. (I like to keep the grain or any patterns (acrylics) lined up when I assemble the final product.)

You will occasionally need to sharpen the blades of your pen mill. Excessive pressure needed during milling is a sure sign that the cutter head needs to be sharpened. I use a

fine diamond hone to sharpen the cutter head teeth – the flat one from PSI’s 4-pc Diamond Sharpening Set works nicely.

Endeavor to maintain the original angle of each cutter tooth during honing. A few strokes of the diamond hone are usually sufficient to renew the cutting edge. Be sure to use the same number of strokes on each tooth.

Mounting the Blanks

If you are working with a fairly fragile material, such as Dymondwood or some of the acrylics, it may be helpful to “cut the corners” on your blanks before mounting them. I use a jig that can be clamped to the bandsaw table for this (from HUT). I find this extra step especially helpful with Mica Swirl (PSI) or Mica Pearl (HUT). It helps prevent blowout during roughing out, speeds up the process, and is also easier on my gouges (less frequent sharpening). This will, however, slow you down a bit in production mode. This jig could quickly be made in the home shop with a piece of angle iron (notched for the bandsaw blade) and a couple of pieces of scrap plywood.

You will need to use the appropriate bushings for your chosen kit to stabilize the blank on your mandrel. The bushings will also serve as a guide for sizing the ends of each blank to fit the components during assembly.

When you mount the blanks on the mandrel, be careful not to tighten the knurled brass nut too much, as this could bend/bow the mandrel. Use just enough pressure to keep the blank from spinning freely. I like to put the nut on the mandrel fairly loosely, and then bring up the tail stock, bringing the tip of the revolving center into the mating dimple on the mandrel until it just touches. Then advance the revolving center the last few millimeters with the hand-wheel to snug it up. At this point I check the knurled brass nut to tighten it up just enough that the blank does not slip during turning. You may need to adjust the nut after rounding off the blank (lathe OFF) if it loosens up.

Turning the Blanks

At this point you should go back to the project instructions to check for any special instructions for your specific kit, especially if it is a new style for you. I’ve messed up a few pens by skipping this step!

The lathe speed you use will be determined by the material selected. I use a fairly high speed for most woods, but a lower one for stabilized woods and acrylics. I usually sand and finish at a higher speed for all materials.

Round off the blank (if necessary) using a Roughing Gouge. I use a ¾” or 1” gouge here. Make sure you attack the blank at an angle, either toward the headstock or the tailstock. Never approach the middle of the blank during the rounding over phase. Light cuts are preferable here and in all successive stages of turning. After rounding the blank,

stop and adjust the tension on the retaining (brass knurled) nut. It may need to be tightened (or perhaps loosened) at this stage.

I use a 3/8" Spindle Gouge for most of the shaping of my pens, following up with the 1/2" Oval Skew for final smoothing. I also use the 1/8" Parting Tool to turn tenons, as required. Most of your turning can be accomplished with this 3-piece set, but it's also nice to have other gadgets for additional detailing. I love my Mini Detailing Set (Sorby), Burning Wires, Beading Tools, etc. for this. (In case you haven't figured it out yet, I'm a gadget freak!)

If you are turning a fragile material such as antler or stabilized, or punky woods you may want to stop once or twice during turning to saturate the blanks with thin CA. I do this after roughing out on Dymondwood (I have a hard time with this material) or stabilized box elder and antler. I then repeat the process just before I get to the final shaping phase. Let the CA dry naturally at the last treatment, as the Insta-Cure products can leave a cloudy white film in crevices that may be hard to remove completely in the final stages of turning.

Be careful not to glue your blanks to the bushings! I usually take them off the mandrel just to be sure. Carefully remount them the same way they came off the mandrel, though. Marking the inside of the tubes on the "cut" ends helps with this.

Sanding the Blanks

Once all sections of the project have been turned to the desired profile, you are ready to begin perfecting the surface with abrasives and cutting compounds. Most buyers seem to prefer a high luster on their pens (in my experience). The finish needs to be very durable and highlight the grain well.

I sand all project blanks using Abranet Sanding Mesh, cut into strips. It's a good idea to label each strip with the grit for easy identification. I use a Sharpie for this. You want to progress sequentially through the grits (don't skip!) from 120 to 400. If I have a really rough blank (this is NOT supposed to happen, but does occasionally) I'll start with a strip of 80 grit paper, then progress to the Abranet. I love the Abranet because it lasts longer than sandpaper, doesn't load up as much, and can be cleaned quickly with a small brush.

For many projects this may be sufficient, but perfectionist that I am, I take the sanding process all the way to 12,000 grade for most projects. For wood I usually use Micro-Mesh Pads (1,500 – 12,000 grades) dry. I have also used the Micro-Mesh Fine Sanding Kit – sheets with a foam sanding block. The sheets are sometimes easier to use on finely detailed pieces.

Be sure to wipe down the blanks with a clean cloth or paper towel (lathe OFF) or clean with a burst of compressed air between grades of abrasive. This removes loose grit and dust from the surface, which could cause inadvertent scratching when using a higher grit abrasive.

For my acrylic projects I use the Plastic Finishing Kit pads (600 – 12,000 grade) wet, although the Micro-Mesh Pads can also be used wet here. I just like to avoid contamination by using separate sets of abrasives for the final sanding stages. I don't want acrylic dust embedded in my wood-grain!

After sanding thoroughly with each grit to remove scratches from the previous grit, turn off the lathe and rub the abrasive lengthwise over the blanks while rotating the mandrel by hand. This will help even out the scratches left by the abrasive.

When working with wood blanks, I have learned to follow the sanding phase with a quick rub-down of Acetone on a soft cloth. This removes dust that can settle into the grain and cause discoloration during the finishing stages. Allow the Acetone to evaporate before proceeding to the next step – it doesn't take long.

Perfecting the Surface with Cutting Compounds

Secondary surface perfection is accomplished by using cutting compounds. For all wood projects I use EEE-Ultra Shine. On Acrylics I like to use Turtle Wax Polishing Compound (like I'd use if I ever washed my truck). This step removes any remaining scratches, although if you sand all the way to 12,000 these should not be visible to the naked eye.

Stop the lathe and apply the compound to the blanks using either your finger or a soft cloth or folded paper towel. With the lathe running, run the cloth or paper towel over the surface of the blanks using a slight amount of pressure. Be careful not to use too much pressure or you may damage the mandrel.

Be SURE that you are holding the cloth/towel in such a way that you can let go quickly if it wraps around the mandrel – fingers don't wrap well! If this happens, just turn the lathe off and untangle your cloth before continuing the process.

Use a folded corner of the cloth/towel to get into bead details. A second application may be necessary to bring the surface to the desired level of luster. Once the entire surface has been buffed thoroughly, use a clean cloth to remove any compound remaining on edgings, bushings, etc. (lathe OFF).

Finishing the Blanks

For wooden blanks (and stabilized wood) I use a lacquer-based sealer such as PSI Gloss Sealer after the EEE-Ultra Shine compound. Apply a small amount of the sealer to your cloth (I use folded paper towels for all stages of finishing) and use as a friction polish by applying to the blanks with the lathe turning. About 30 – 60 seconds should be sufficient for this and all successive steps.

The next step in finishing is to apply an ultra high surface perfection product to further enhance and develop a mirror gloss luster. I use Shellawax Paste here, applied in the same manner as the compound pastes above. I usually turn off the lathe and apply the Shellawax to the blanks with my finger, then buff with the lathe running. As a final protective step for my wooden projects I apply a microcrystalline wax (Renaissance Wax). This leaves a museum quality wax finish over the project to protect it from moisture and the oils on my hands as I use my pens. The Renaissance Wax can be reapplied later to all parts of the pen (hardware included) and buffed if necessary to restore the glossy finish.

For acrylic project blanks I follow the Turtle Wax Polishing Compound with an application of plastic polish such as HUT Ultra Gloss Plastic Polish. Apply as above with the lacquer-based sealer.

Although not really necessary on acrylics, I usually give all projects a quick final polish with Renaissance Wax (see above), just to be sure I have all the bases covered.

Assembling the Project

Before assembling your project you may need to deburr the inside of the barrel (both ends). I use a round file, but I've seen a small countersink recommended, as well. Be careful, use only the slightest amount of pressure or you will take off too much of the brass tube. Then you will be left wondering why your pen doesn't hold together during assembly.

On your workbench, lay out the kit components and newly turned blanks following the diagrams provided in the instruction sheet. Carefully assemble your project following the instruction sheet. There are several ways to press the components together, but I've found that the Pen Assembly Press is by far the simplest and most reliable. This gadget is definitely worth the investment.

Enjoy your lovely new pens!

Supply Sources

To download instructions for Penn State pens and other project kits sold at Woodworker's Paradise, go to: <http://www.pennstateind.com/library.php> Read the instruction sheets carefully BEFORE starting to turn your project, and watch for typos or things that don't make sense.

Most of the "gadgets" and supplies mentioned here and in my presentations are available at Woodworker's Paradise. Go to: <http://www.woodworkersparadise.com/>

The PSI products mentioned above may also be ordered online at: <http://www.pennstateind.com/library.php> . The HUT products can be found at: <https://www.hutproducts.com/>

For a great DVD on pen turning, check out "Woodturning with Steven D. Russell, Vol. I & II" at <http://www.woodturningvideosplus.com/dvd-videos.html>

If you have any questions please feel free to email me at kmoffatt@gt.rr.com

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