

How to Make Pens and Pencils

Subtitle: Don't ask me how I know this!

What do I need to get started?

A home workshop will already have most of the equipment needed to turn pens. A few additional inexpensive tools may be needed. You should have or have access to the following:

- Pen Kit(s)
- Mandrel with Appropriate Bushings
- Pen Blanks
- Glue
- Pen Mill or Sander
- Lathe with a Live Center
- Turning Tools
- Sandpaper (ranging from 120 to 12,000 grit)
- Micro Mesh (optional)
- Finish of your choice
- Pen press or clamp
- Drill Press
- Band Saw or Table Saw

A "blank" is a general term used to describe whatever material you choose to make your pen from. Blanks are cut to specific sizes for each individual project. Pre-dimensioned blanks in domestic and exotic woods; laminated and dyed woods, acrylic, stabilized and dyed blanks are ready available.

You may choose to make your own blanks. A band saw is indispensable for cutting your own blanks. You can use a table saw instead of a band saw, but if you are sawing blanks from expensive exotic or rare wood, the large kerf (width of the cutting path) wastes lots of precious material. And safety is a major issue when cutting small pieces on a table saw. Attached is an article by David Reed Smith on building a Pen Sled to assist you in cutting on a table saw. The band saw makes it much easier and you can also saw thicker stock into useable manageable and usable dimensions. **Again safety must be stressed, band saws are also dangerous. Don't ask me now I know this!**

Most project kits will list the exact blank length and width in the instructions for each project. When getting started, lean to the oversize rather than undersized. You can turn a little extra material off, but you can't easily add material to an undersized blank, unless you want to do segmented work.

You should match the grain in your blank, such as the upper and lower sections of a slim line pen. I lay out the tubes on the pen blank and mark where the cuts need to be made. Allow enough material for the kerf of the cuts. Maintain the blank grain orientation for the pen assembly. The matching grain should be marked to properly assemble on the mandrel.

HINT: How you orient the pen blank on the mandrel does not matter greatly but it should always be the same way every time. If you want the nib pointing toward the head stock then always put the nib end of the pen on the mandrel this way. It will reduce the number of assembly problems you have in the future. Don't ask me how I know this!

HINT: If you are preparing a number of blanks at one time and wish to keep them matched, use an old muffin pan or egg carton to keep matched pairs together. I label mine in case some one knocks over the muffin pan. Don't ask me how I know this!

Drilling the Blank

After a blank is cut to size, it must be drilled through its center for the brass tube. An oversize blank gives you more room to drill the hole. Drilling the blanks may be done on the lathe, but a drill press is faster, more flexible, and allows you to drill the hole off center if you have some feature in the wood that you wish to include in your finished pen. There are now self centering pen vises to readily aid in the drilling of pen blanks. Isn't it wonderful that as unassuming as a pen is, how much pen turning can consume your wallet? I guess that is why many called wood turning the black hole, a vortex for sucking you and your money to a place you cannot get out.

HINT: Verify your drill press table is perpendicular (90 degrees) to the drill bit. If the table is off the slightest amount it will cause the hole to not be parallel top the blank and increases the chance that you will drill through the side of small sized blanks or even cause it to split. Engineers square can accomplish this or you can chuck up a bent piece of wire to slowly rotate around the table to check level.

HINT: When drilling blanks, go slow and withdraw the bit frequently to clear the chips. More blanks are lost during drilling, than during any other operation. **HEAT** is your problem, during drilling the chips heat up and expand, clogging the flutes of the drill bit. This expansion may cause your blank to split. Other woods such as Pink Ivory, Ebony, and Snake Wood are heat sensitive and may crack. Don't ask me how I know this! Although brad point bits will do the job, Parabolic Flute Bits, specifically designed for superior chip ejection in drilling holes and will drill cleaner and faster to lessen the likelihood of ruining your blank.

Blanks, Tubes, Glue

Now you're ready to glue the brass tube into the drilled blanks. The brass tubes are the foundation of many small other turning projects besides pens. The brass tubes are glued into the wood blanks, and after turning, hold the other parts of your project by press fit. Select the proper length/size brass tubes. Some kits have two different length or diameters of tubes. The tubes can be glued in place with cyanoacrylate (CA) glue, two part epoxy or urethane glue. The proper gluing of the tube is critical to avoid a joint failure between the blank and the tube when turning. CA glue is quick but does get brittle over time and it will not flex as the wood moves. I like the medium over the thin for gluing tubes as it give you move time to properly position the tube in the blank. Two part epoxies provide great holding power and are flexible but must be mixed in the correct ratio and do require a cure time before continuing your pen making process. Urethane glues such as Gorilla glue are easy to use but require a longer curing time. They are very sticky and will not come off of you without some skin removal when dry. Don't ask me how I know this! Gorilla glue is one of my favorites for gluing larger tubes (anything bigger than a 7mm drilled hole).

You should trial fit the tube(s) in the blank before gluing. The tube should slide in without having to apply force. Different woods drill and react to the changes in stress within the blank differently. Always test fit your brass tubes before gluing. If you know you are using the correct bit, but yet the fit is too tight, re-drill or ream to slightly enlarge the hole.

Roughen the outside of the tubes with sandpaper to remove any tarnish or lacquer and provide a better bonding surface for your glue. Hold the tube by one end and coat the tube with the correct amount of glue. I have found that if you insert the tube while rotating the tube ensures the inside of the blank receives glue. I insert the tube about 1/3 of the way and remove it, rotated the blank, insure there is plenty of glue on the tube and insert in the other end. Wear disposable gloves while gluing up your blanks. Set aside the glued up blanks on wax paper, so they don't adhere to your workbench and allow plenty of time for the glue to dry completely.

HINT: Purchase extra brass tubes for the type of pens or projects you are turning. They are nice to have for any failure you may have or you can turn the blank down to the brass tube if you have a bad blank, but the time wasted in trying to save a tube is not necessary when tubes are relatively inexpensive. Ask for them when you order your next kit(s).

HINT: If your pen blank is soft, porous, and punky you can add thin CA glue down the drilled hole to help stabilize the blank. Be sure and cover the entire inside surface area of the hole. Wait until cured or apply accelerator if in a hurry and then re-drill the hole. You must re-drill the hole. Don't ask me how I know this!

Square Ends

All that is left is to trim and square the ends of the blanks and you're ready for the lathe! The ends of the blanks have to be trimmed flush with the brass tube to prevent splitting the wood when press fitting parts together. This clean, square cut ensures the metal press fit parts seat flush with no gaps in the pen after it is assembled.

HINT: Exercise care when trimming your blank to length as some kits are very length sensitive and if you remove too much of the brass tube the kit could be difficult to assemble or maybe even impossible.

Squaring and trimming can be accomplished with a belt or disc sander or with a Pen Mill (barrel trimmer). The pen mill is a quick, easy way to ensure square ends tube. It also removes any glue inside the tube and this is very important for the proper fit and function of the kit. The shoulder of the mill cuts and trims the end of the blank flush with the brass tube. I have attached an article from the Pen Maker's Guild on how to sharpen your pen mill because they will get dull from use.

Warning: Make sure that there is no excess glue inside your tube. CA glue is very bad about getting inside the tubes and this will cause fit-up problems when you assemble your kit and could even cause you to split wooden barrels. A small X-Acto knife blade works great for removing excess glue. Don't ask me how I know!

When a Blank Becomes a Barrel

Most pen kits require a mandrel for turning the pen on the lathe. Determining the size of the pen barrel to turn is achieved by using bushing sets with outside diameters comparable to individual kit and mandrel to be used.

Hint: I find that applying a small amount of wax to the bushings insures that finish or CA glue does not readily stick to them.

The mandrel is available in two different diameters, the A being smaller and more widely used than the larger B mandrel. Most are equipped with a Morse Taper for lathes with Morse Taper headstock spindle. The mandrel can also be purchased without the MT adapter, so it can be held in a compression chuck or three jawed Jacob style chuck. There are even some that screw on the spindle threads for lathes that do not have a Morse taper in the headstock.

Mount your mandrel in the lathe's headstock and remove the mandrel nut and washer if equipped. Follow the instructions for the particular kit you are turning, i.e. slide the proper bushing on the mandrel, then the blank (making sure the brass tube goes over the corresponding shoulder on the bushing, if required), the second bushing and so on.

After installing the bushings and blanks, place the washer (if so equipped) on the mandrel and tighten the nut just tight enough to keep the blanks from spinning on the mandrel while turning. Do not over tighten! Over tightening may distort a brass tube and make assembly difficult and may crack the blank. It is better to leave the mandrel too loose. If the blank spins on the mandrel when you make contact with your turning tools, stop and slightly tighten the nut. Repeat this process until the blanks do not spin in place. After a few projects you will develop the "feel" for the right amount of pressure required to hold the blanks securely.

After installing the blanks and bushings on the mandrel, bring your tailstock with a live center up to the mandrel, and lock it in place. Screw the ram (the portion of the tailstock that moves out and in) out until the ball bearing center just comes in contact with the inside of the dimpled or cupped end of the mandrel shaft. Do not over tighten the tailstock, or you will bow the mandrel, resulting in oval, off center pens! If you severely over tighten the tailstock, the mandrel will stay bowed and have to be replaced. Don't ask me how I know this!

All woodworkers have their own favorite tools and techniques for turning pens. Usually a spindle roughing gouge is best for removing corners and rounding up the blank. From this point some switch to a scraper to gently scrape down to the bushings. I do not recommend a scrapper as it damages the surface of the wood too much and requires more sanding. All pen turners should learn to use a skew, it cuts smoothly down to sanding size and you can get good enough to skip a couple of course grits when sanding. If the skew is too difficult for your or it scares you then try the Spindlemaster as an alternative to the skew, it is a compromise between a skew and a scrapper and much easier to master.

HINT: If you discover a small void or tear-out in a turned barrel, coat the area with medium CA glue and add turning dust from the same wood to fill the defect, spray accelerator and sand as usual. Now you know why I recommend waxing your bushings. Because usually your tear out is next to your bushing at the end of the pen barrel. Don't ask me how I know this!

Finally, Final Sanding

How much do you have to sand to be finished? The \$100,000 question and the answer is; until you are happy with the finish you achieve. Most turners progress through grits starting at 180. With the tool rest removed and the lathe set to same speed you were turning or I like to go to a slight slower speed and use a strip of sandpaper, cut into approximately 1" wide strips. Gently move the strip of sandpaper against the blank continually moving the sandpaper back and forth across the blank. Keep the sand paper moving as it loads readily and will stop sanding and start burnishing your blank. Change grits progressively as the blank becomes smoother. Be careful and cautious a little sanding goes a long way and do not sand the bushings! You will change their diameter and your metal parts will not align with the next barrels you turn. Don't ask me how I know this! After using regular sand paper, many people like to switch to Micro-Mesh for a final, high gloss finish. Available in sheets or foam backed pads, Micro-Mesh has superior durability to other abrasives available in ultra fine grits. The foam also has some "give" which allows it to conform slightly to your turning. Remember to keep Micro-Mesh moving, if you don't, the heat buildup from friction will damage your Micro-Mesh and possibly the barrel you are working. Here again do not ask me how I know these things!

HINT: Ask any pen turner how they sand and finish their pen and you will get more answers than you had pen turners. Find what works for you and stick with it.

Finishing

I have seen or tried a lot of available materials to finish a pen. Natural body oils and wear on a heavily used pen will dull any finish. PPP (Perfect Pen Polish) which is a combination of synthetic waxes and inert polishing compounds gives a quick, durable finish and is applied; while the barrels are still on the lathe. Although easy to apply, it will not last but wax finishes are easily refurbished after they wear. I like Mylands High Build Friction Polish, it is easy to build multiple coats and does not contain as much wax as other products. It works very well especially when I put it over a coat of EEE Ultra Shine, a polish paste wax with Tripoli powder as a fine abrasive. I find that it burnishes the wood as well as seals pores in the wood. CA glue as a finish is becoming more popular with pen turners as it is more durable and can be polished to a high shine. Clear epoxy is sometimes used but does require a rotisserie for the barrel to be slowly turned until the epoxy dries in a dust free environment. But again, find what works for you and stick with it.

Hint: EEE Ultra Shine must be kept off your bushings. It turns black when you get it on steel and it will discolor light colored woods if you happen to get it on your blank. Don't ask me how I know this! Of course if you are making Ebony or African Blackwood pens then it will not matter much.

Sorting out the Parts

Each type of pen, pencil, perfume applicator, etc., has parts that are unique. Whichever pen kit you are using take the time to fully read the instructions and understand them before starting.

Until you are comfortable with all the particular parts for a specific project, match the parts to the exploded diagram each time. Some pens and pencils have parts which look identical, but there are subtle differences which prevent the parts from being interchanged. A micrometer or caliper is invaluable for this purpose. Be careful to select the proper set of components prior to assembly. By following the step by step instructions, and referring to the diagrams for clarification of terms and parts, you should be able to make a quality piece the first time. Of course the Vortex of woodturning (the money sucking vortex) has disassembly kits available for taking your improperly assembled pen apart. I find the transfer punch set from Harbor Freight works great for this purpose. Don't ask me how I know this!

Assembling the Pen, or Your Last Chance to Ruin Your Work!

Almost all of the small turnings are assembled by press fitting. If you find your fit-up is too loose then apply a very small tab of medium CA glue and press the parts together. Assembly order is critical. For example, if you press the twist mechanism in the lower barrel of a pen prior to the nib, the twist mechanism will most likely push in too far for the pen to operate before the nib is seated. Making this kind of error will ruin a project.

There are several methods of pressing the parts together. A woodworking bench vise or metal bench vise, which will open far enough to accommodate the parts, work well. If your vise has metal jaw faces they need to be padded with wood, plastic or any material with some give to prevent distorting or scratching the parts as pressure is applied. Quick Grip Clamps also provide an easy, controllable means of pressing parts. Regardless of what you use to press with, go slow, and keep the parts square with the jaws of your press and parallel to the pen barrel. If the parts are slightly cocked in the press they will jam, and as you add pressure, destroy your project. Again there are now pen presses available and if you are going to manufacture a large number of pens that are a must.

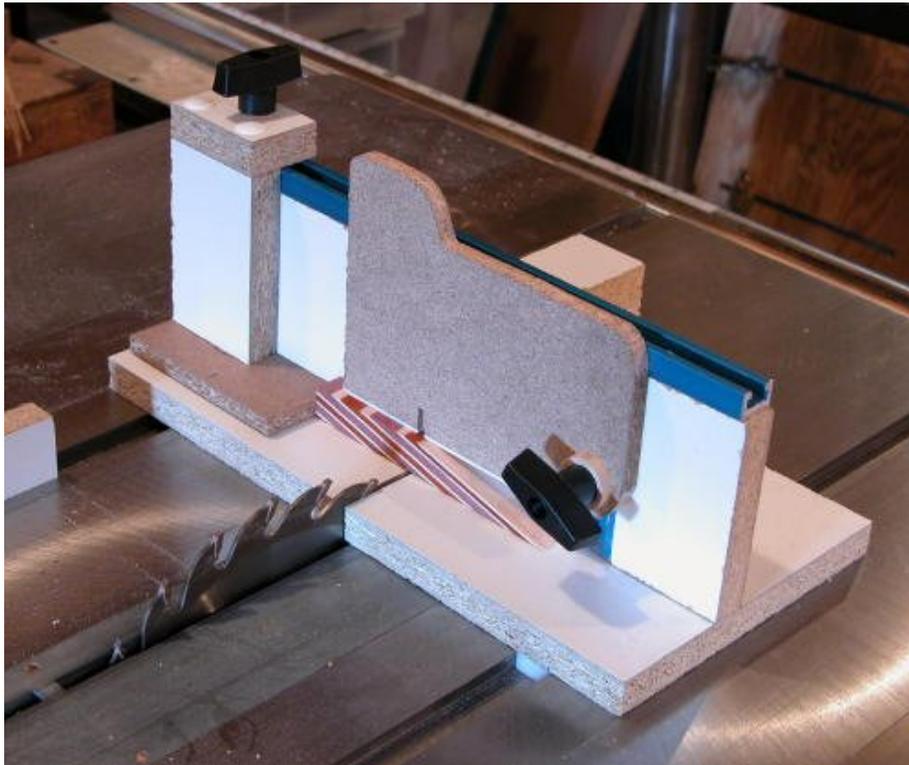
HINT: If you have "grain matched" blanks for the upper and lower tubes of a pen, be sure to align the grain before pressing the two halves together. This is especially important when assembling Parker style pens, since the top of the pen cannot be removed after assembly to re-orient the grain.

Closing thoughts:

There are unlimited numbers of things that can be made into pen blanks; money, rattlesnake skins, denim, cactus, cartridge shell casings, bowling balls, and sunflower hulls just to name a few. Most are encapsulated into a cast polyester resin. There are also stabilized wood blanks that eliminates the shrink swell problem with wood. I treat all such cast or stabilized items like an acrylic blank (plastic); they should be sanded through the finest Micro-Mesh grades and then polished with any polish that you like. The acrylics have vivid colors and make great gifts for college students and graduates because it is easy to match the school colors. They look great as a pen but the acrylics do smell when turning. Don't ask me how I know!

Pen Sled

by David Reed Smith



Introduction

Making your own pen center bands, or making segmented pens, can open up a lot of creative territory to explore. However cutting small parts on the table saw can put your fingers in harm's way. A band saw is safer, but doesn't cut as precisely or leave anywhere near a glue ready surface. This article describes a dedicated Pen Sled with a hold down that holds the stock securely, even for small segments, and keeps your fingers well away from the blade.

The body is just a small scale sled. But there are two additions that make it great to use on small pen parts. The hold-down pivots from an adjustable height. The Adjustable stop has a "foot" that doesn't interfere with the hold down.

Construction

Base

I have a considerable amount $\frac{3}{4}$ " melamine lying about right now because of the "shelving incident", a major violation of the "measure twice, cut once" rule. So I used it to build this sled, but any stable sheet good would do as well. All the dimensions I used are arbitrary; please feel free to change almost anything as long as you leave the hold-down long enough to work and keep your hands away from the blade, and a long enough foot to get under the hold-down.

I started by cutting a 7" by 14" piece of melamine for the base. I laid it down on the table saw, centered on the blade, and marked about where the miter-gauge slots were. I cut two 7" pieces of 3/8 x 3/4 UHMW for runners, then drilled and countersunk two holes for attaching them. You can use wood (or aluminum) but UHMW works nicer. I drew a line perpendicular to the back edge on the bottom of the base where I wanted it to ride in the miter-gauge slot. I attached one of the UHMW runners. Then I put a thin piece of cardboard (about 1/16") in the other miter-gauge slot, and put the other runner on top of that. I put a couple of drops of CA glue on the UHMW runner, then set the sled down on it. This is an easy way to get the spacing right. I gave the glue a few minutes to cure, then screwed the runner to the base. Then I put the base on the saw and cut about two thirds of the way through the sled to give myself a line to mount the fence perpendicular to.

Fence

I started making the fence by cutting a 4 by 14 piece melamine. I cut a dado big enough for the aluminum track (3/4" x 1/2") 2 1/4 inches from the left hand end. Next I cut two pieces of track, one 4" long for the height adjustment, and one 14" long for the adjustable stop. I had to drill and countersink extra mounting holes. I used flat head machine screws and nuts to mount the height adjusting track, but I could just as easily have added a scrap of melamine to give some thickness for the threads to gain purchase. I used 1" wood screws to mount the track on top. You'll be much happier with the results if you drill pilot holes for the screws.

To mount the fence I started by drawing a line perpendicular to the saw cut, 2 1/4 inches from the front edge. I put a T-bolt in the height adjustment track, lined the fence up with the line and temporarily clamped the fence to the base. Then I mounted one end of the fence with a screw (McFeeley's has a really wonderful kit for joining sheet goods, I suggest you try it). I removed the clamps and checked to make sure the fence was perpendicular to the blade slot. After making any adjustments, I reclamped the free end and mounted it with another screw.

I added some blocks on the back to cover the saw blade. I just cut four blocks 2 inches by 4 inches, then glued them in place with a few drops of CA glue, clamped them temporarily, then screwed them in place from the bottom. The melamine is a trifle thicker than 3/4 inch, just enough to jam into a miter slot. Keep a small piece to put in a miter slot to keep from exposing the blade on the back side.

Hold-down

I made the hold down from 3/8 inch particle board, about 7 by 5 inches. I drilled a 3/4 inch hole centered 3/4 inch from the left side and 1 inch from the bottom. Cut all but the rightmost two inches down an inch on top. Round the top and left bottom corners. Make sure when placing the hole that you don't build a cam clamp that will keep you from cutting from long squares. I used the hold down to trace its thickness on some self-stick play foam, and then cut the strip out and stuck it to the bottom.



There are probably twenty ways to turn the hold-down bushing. I've made two, and made them both differently. However you make it is fine; but one of the ways I did it is to mount a piece of scrap maple in my collet chuck. I roughed it to round, then drilled a 5/16 inch through hole. I cut the end down to just under $\frac{3}{4}$ inch diameter, a little longer than $\frac{3}{8}$ inch. I tested to make sure the hold-down could pivot on it, and that it was a little bit longer than the thickness of the hold-down. Then I cut it off, leaving a shoulder about $\frac{1}{4}$ inch long.

To mount the hold-down, put the bushing in the hole, with the shoulder on the front side. Thread through the 5/16 inch bolt and screw on the knob.

Adjustable Stop

To make the adjustable stop I first cut a piece of melamine 2 $\frac{1}{2}$ inches wide as long as the height of the top of the track above the base minus the thickness of the particle board foot (~ 4 inches). I cut another piece of melamine 2 $\frac{1}{2}$ inches wide by 1 $\frac{1}{2}$ inches long for the top of the stop. I cut a foot of $\frac{3}{8}$ inch particle board 2 inches wide by 4 $\frac{1}{2}$ inches long. I screwed the foot to one end of the stop and the top to the other. Last I drilled a 5/16 inch hole lined up with the center of the fence track and mounted it to the fence with a T-bolt and knob.

Use

To use the Pen Sled, first set the Adjustable Stop for the length of cut. If you always use the same blade you'll be able to measure from the slot cut by it in the base. Set a piece of the stock you'll be cutting up against the fence, loosen the height adjustment knob, and set the hold-down against the stock. Then tighten the knob. The foam will automatically

adjust for any minor bumps and variations in stock size. Pivot the right side of the hold-down up and slide the stock into position. Then lower the hold-down, holding it in place by the tab. Advance the sled through the blade until the stock is cut, then return it to the original position. Pivot the hold-down up and remove the stock. Repeat and reset as needed.

Sources

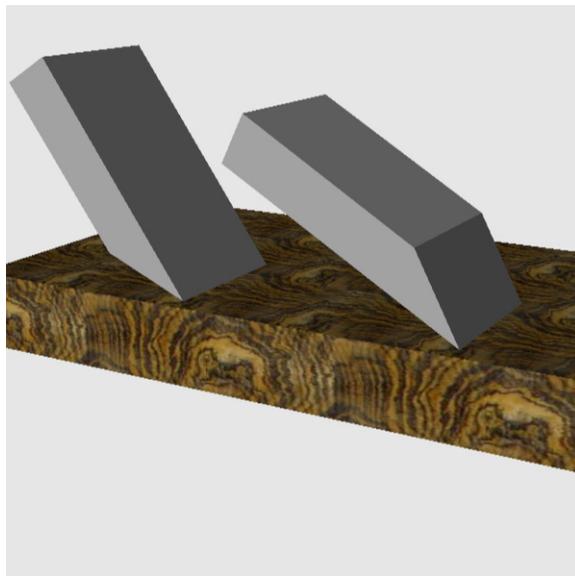
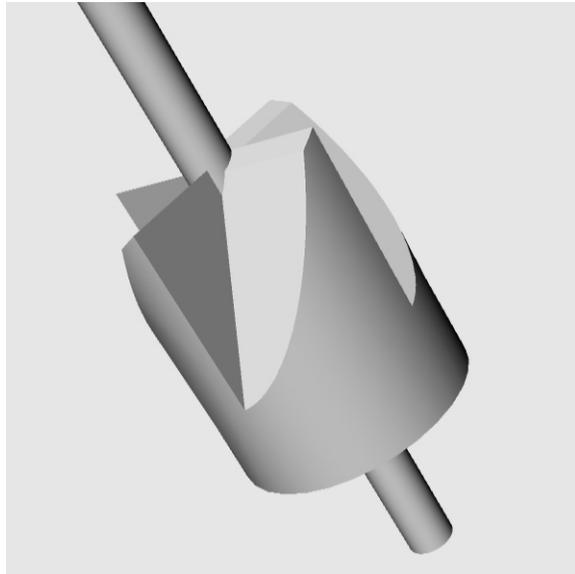
Item	Source
3/4" sheet goods	Any home improvement store
3/8" sheet goods	Any home improvement store
Knob and track set	Rockler # 24672, www.rockler.com
Connecting Screw Starter Set	McFeely's # 7050-CSP-A, www.McFeelys.com
Self-Stick Play Foam	Wal-Mart craft section

Sharpening The Pen Mill

Pen mills (a.k.a. barrel trimmers) are used by many people to square pen blanks before turning. They are usually held in a wooden handle, in a drill press, or in a portable drill.

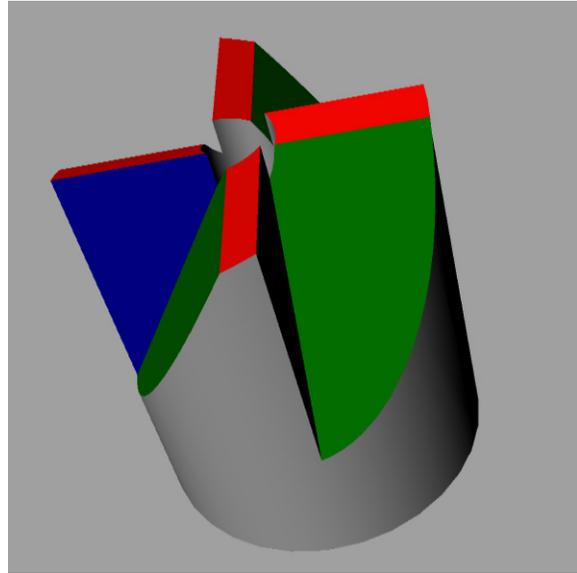
Their primary purpose is to square the ends of a pen barrel, but they are often used to remove excess wood to get the barrel to the right length. They are typically made from hardened steel, but depending on their use and the quality of the cutter, they can dull fairly quickly. Many people have a problem sharpening them, and because there is no standard nomenclature, describing what surface needs to be sharpened appears to be difficult, at least in an understandable way. So a couple of pictures should be helpful, I hope.

Wood cutting of any sort is simply the interaction of some cutting edge with wood. The cutting edge is harder and wins. But, to cut, it does have to be an edge! Picture a plane iron. The steel approaches the wood at an angle. On the left is a block plane, on the right a standard plane. Note in both cases there is a relief angle on the backside of the iron.



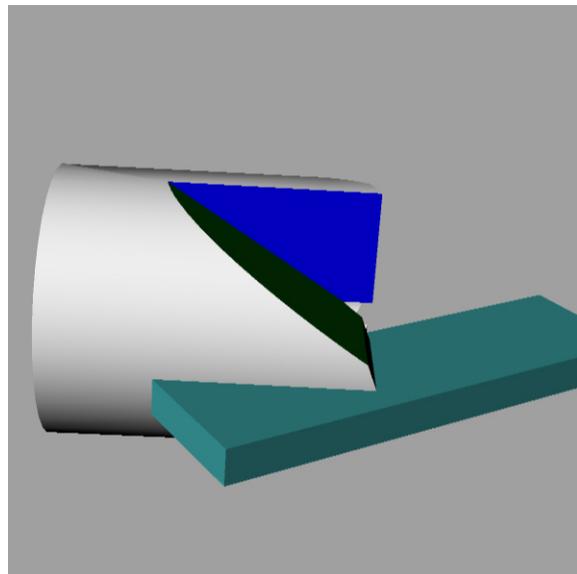
It's no different with the pen mill! Here is the pen mill with relevant surface colored so they are easier to refer to. The center shaft was removed – it either unscrews, or simply slides out after some setscrews are loosened.

Each cutting edge is formed by 2 intersecting planes, the blue one and the red one. The 4 edges lie in 1 plane, it's fairly important that they be in 1 plane so they can share the work, and prevent digging.

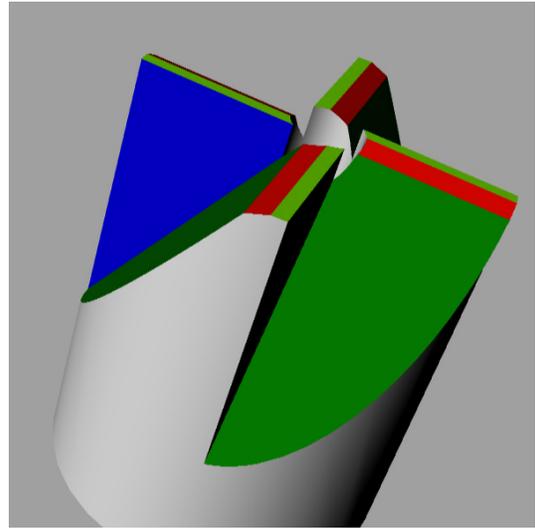
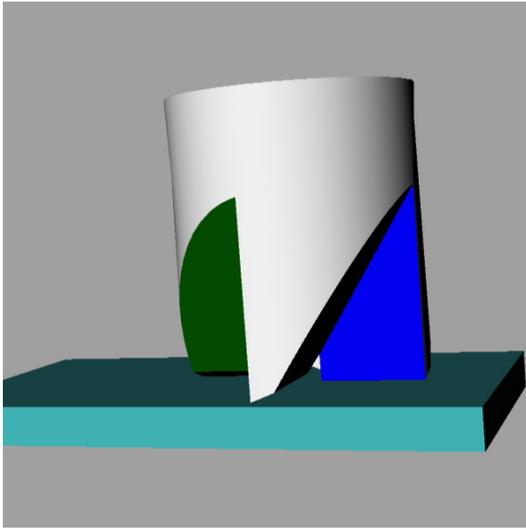


So rather than attempt to sharpen the 4 red surfaces evenly (which can be done, but is more difficult), stone or use a diamond file on the blue surfaces! First remove crud that's caked on the surface (this is important!!!), then take a few strokes with a stone or a fine diamond file. Because of the angle against the red surface, a slight change of the blue surface has a minimal effect in terms of moving the cutting edge, so this is pretty forgiving. If you attempt to sharpen the red surfaces, it's much harder to keep them even, and each surface is very small, so it does not support the stone, and it is easy to change the angle.

It's fairly easy to set the mill on the corner a stone and move it back and forth a few times.



If you were to simply set the mill face down on a stone and mill the front face you'd lose all cutting relief. All you would do is burnish or burn the end grain.



The chartreuse edge is the new bevel. Nobody would dream of using a plane iron with a 90 deg. edge.

An alternate method of sharpening a pen mill on the small edge (red) edge using a metal lathe and Dremel can be found in the [files area](#) .

Berea Hardwoods Co., Inc.
Pen Instructions

Berea Hardwoods Sierra Pen (Berea #0502/B-xxx)



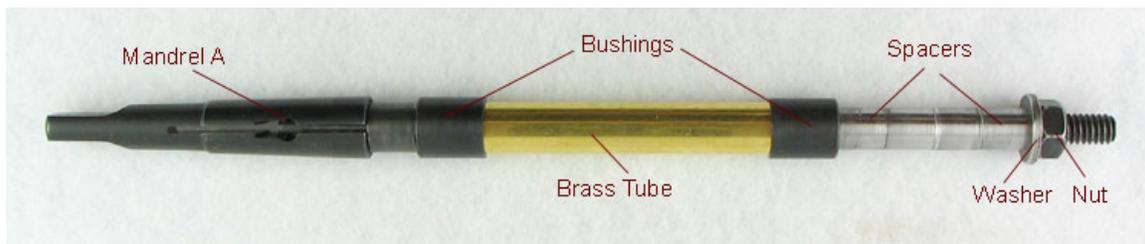
Needed: Mandrel A
Bushings 20A
Drill 27/64"
Wood Size 3/4" x 3/4"

Preparing the Material Blanks

1. Only 1 material blank is required for this pen. Cut the material blank slightly longer than the brass tube.
2. Drill the blank through the center, lengthwise, with a 27/64" bit.
3. Polish the brass tube with sandpaper. This can be done by hand or on a power machine such as a belt sander. The purpose of the sanding is to clean off the oxidation and roughen the tube so that the glue will have a better adhesion surface.
4. Plug the ends of the tube with the material of your choice. Some use base wax, a dental product, or Play Dough, or even a slice of potato. Just push the ends of the tubes into a thin section of the material. This will form a plug to keep the glue from getting into the tube.
5. Clean the tube, after plugging, with acetone or alcohol on a rag.
6. Prepare your glue. We recommend two-part epoxy glue that is available in all hardware stores. Use a fast drying type, one hour or less. Be sure to mix it thoroughly. (A Post-it Note Pad makes an excellent mixing place. When you are finished just tear it off and throw it away.) Polyurethanes and thick flexible CA's can be used, but they each have their drawbacks.
7. Place some epoxy into the blank using a small piece of dowel or other small stick.
8. Roll the tube in the epoxy.
9. Insert the tube with a twisting motion until it is almost in the material blank. Then use the dowel to push it in until the end is flush with the blank. Use the stick to rake off the excess glue even with the blank and the tube.

10. Push the brass tube through the blank until the other end is flush with the blank. Then rake the glue flush with that end. Now push the tube back into the blank until the tube is equidistant between both ends of the blank.
11. Move it aside for 60 minutes until the epoxy has had time to reach its maximum strength.
12. If you are using CA glue, the wait is only about 60 seconds. When using polyurethane the wait will be about 24 hours.
13. When the glue has cured use a hobby knife to remove the plugs from the ends. It is also a good idea to clean the tube with a brass gun cleaning brush to remove any glue that may have gotten into the tubes.
14. Not cleaning out all glue from the tubes is the most common cause of pen failure. BE CERTAIN that all dried glue is removed from inside the tubes before proceeding.
15. Using a barrel trimmer of the proper size, face off the ends of the blanks until you can just see the bright brass end of the tube. STOP facing at this point. Your pen's proper operation is dependent on having the proper length tubes. This facing operation can also be done with the proper jig and a disk or belt sander.
16. Not having the proper tube length is the #2 cause of pen failure. Sanding, on a disk sander, using a jig to hold the tube square with the disk, is a more sure way of getting the proper length. It should be tried if you have any doubt as to your abilities to square the material with the barrel trimmer.
17. Another good method of squaring the ends of the blank is to turn the blank until it is just round. Using a miter gauge to maintain the blank perpendicular to the sanding disk, just touch the ends to the disk. Once the blanks are square and you can see the ends of the tubes brighten, then return the blanks to the mandrel and finish the turning until the desired contour is accomplished.

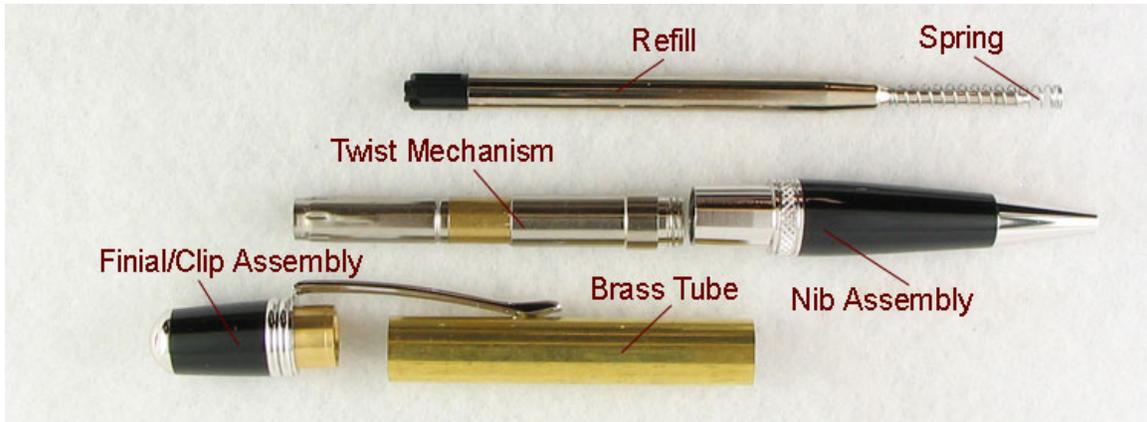
Turning the Material Blanks



1. Assemble the blank on the mandrel using the 20A bushings. Selection of the bushings is easy since they are all the same size. Put any bushing in any position.
2. Since there is only 1 blank to place on the mandrel, you will have to place spacers on the mandrel in order to tighten the tube for turning. You can drill a 7mm hole in a piece of wood for a spacer or 7mm bushings make excellent spacers.
3. Tighten the tailstock before tightening the blanks on the mandrel. This will center the mandrel first. Then tighten the nut that holds the blanks.
4. Turn the blank to the desired contour making sure that the area next to the bushing is turned to the size of the adjacent bushing.
5. After turning the blank, sand the surface in progressive steps until you get to 400 or 500 grit.
6. If a higher polish finish is desired continue sanding with Micro Mesh through 12000 grit.
7. Apply the finish of your choice and polish.

8. Remove the blanks from the mandrel.

Assemble the Pen



1. Press the finial/clip assembly into one end of your finished blank.
2. Insert the refill into the nib assembly making sure that the spring is in place.
3. Screw the twist mechanism over the refill and into the nib assembly.
4. Slide the blank/finial/clip assembly over the twist mechanism.
5. Your pen is finished.

It should be noted that this is a single twist pen.

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Turning an Apprentice Classica Pen

Supplies Needed

- 27/64" Drill Bit
- 3/4" x 3/4" x 5 1/8" Pen Blank
- Pen Mandrel
- Apprentice classica bushings
- Glue (Thick CA or Epoxy)
- Sandpaper
- Drill or Drill Press
- Barrel Trimmer
- Pen Press or Clamp
- Eye and Ear Protection

Cutting and Drilling the Pen Blank

1. Cut the blank 1/4" longer than the brass tube.
2. Using a drill press with the blank secured in a vise or clamp, drill a hole through the center of the blank stopping an 1/8" short of the bit exiting the blank. Drill at 2,000–3,000 rpm backing the drill bit partially out of the hole every 1/2" to clear chips. When using larger bits or drilling plastics drill at 250–500 rpm.
3. Trim away the small amount of wood from the end of the blank to expose the hole. The blank should remain slightly longer than the brass tube. This technique prevents cracking caused when the bit exits the blank.

Gluing the Brass Tube Into the Blank

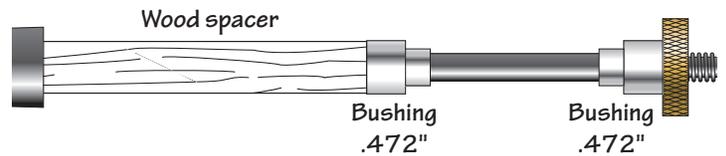
1. Lightly scuff the exterior of the brass tube with 220 grit sand paper to prepare it for gluing.
2. For a fast bond, use thick cyanoacrylate adhesive (super glue) or 5 minute epoxy. For additional working time and more thorough bond, use expanding polyurethane (Gorilla or Sumo Glue). Apply a thin layer of glue to the tube and inside the wood blank. Insert the tube into the blank rotating it as you go to spread the glue evenly. Position the brass tube in the blank so that the wood extends beyond the tube on both ends to allow for trimming.

Trimming/Truing the Blank

1. Square the ends of the wood blank with the tube using either a barrel trimmer or disc sander. This step is critical for the pen components to fit together properly. **Do Not** trim the brass tube as this may result in an improper fit when the pen is assembled.

Mandrel Setup and Turning

1. Place the bushings and blank (not shown) on the pen mandrel, using a wooden spacer for proper fit.



2. Advance a 60° revolving cone center into the dimpled end of the mandrel and tighten using light pressure. **Do Not** over tighten the tailstock or mandrel nut as this may cause the mandrel to flex resulting in an off-center barrel.
3. Turn the blank to the desired shape leaving the blank slightly larger than the bushings.
4. Sand the blank using progressively finer grits of sand paper, then apply your favorite finish.

Assemble the Parts

Layout the parts as shown. Use a vise or clamp with wood or plastic jaws to prevent damaging parts during assembly.

1. Slide the spring onto the end of the ink refill and insert it spring end first into the writing tip.
2. Slide the twist mechanism threaded end first over the ink refill, and screw the twist mechanism into the writing tip.
3. Press the Cap/Clip assembly into the top of the turned blank.
4. Slide the open end of the pen body over the Twist Mechanism and onto the shoulder of the writing tip assembly.
5. To advance the ink refill turn the body clockwise, to retract the ink refill turn the body counter clockwise.

