Reprinted with permission.
American Association of Woodturners
Spring 2008

Wood Through & Through

By Richard Kleinhenz

Penturner Richard Kleinhenz has been on a quest to maximize the wood in the pens he turns. In the last issue of American Woodturner, *Rich showed AAW members how to turn a wooden grip section on a fountain pen. He's now ready to share his technique for creating a fountain pen with a functional wooden clip having some spring in it.*

In the online groups that I am a member of (one address is penmakersguild.com), I have seen several wooden clips featured, but none was exactly what I envisioned. I wanted something a little less obtrusive, something that looked more like a traditional pen clip and less like a shop project.

An opportunity presented itself when I was working with my pen-turning friend Glenn McCullough on a collaborative project. After we completed the project, I started developing the technique that follows.

A clip with a tenon

The basic approach is to rout a slot into the pen cap down to the brass tube, and epoxy in place a clip that has a mounting tenon at its end.

One obstacle to this is that on many pen caps, the thin wood layer over the brass tube offers little glue area for a strong joint. The solution involves two different tubes: one normal cap tube to support the threads and a second smaller-diameter tube towards the top of the cap that increases the wood's wall thickness.

The clips themselves are scroll-sawn or laser-cut from a thin slab of wood. I went through several iterations to arrive at a shape that works.

Follow along for several alternative assembly methods, based on available tooling. With the basic concepts, you can adapt the methods to your own shop and tooling, thus shortening your learning curve.

Parts and tooling

This project is based on the El Grande kit. I like the El Grande because the final product is extremely light. To me, lightness in a fountain pen is a very desirable property. Several of the pens I have made this way have weighed only 21 grams.

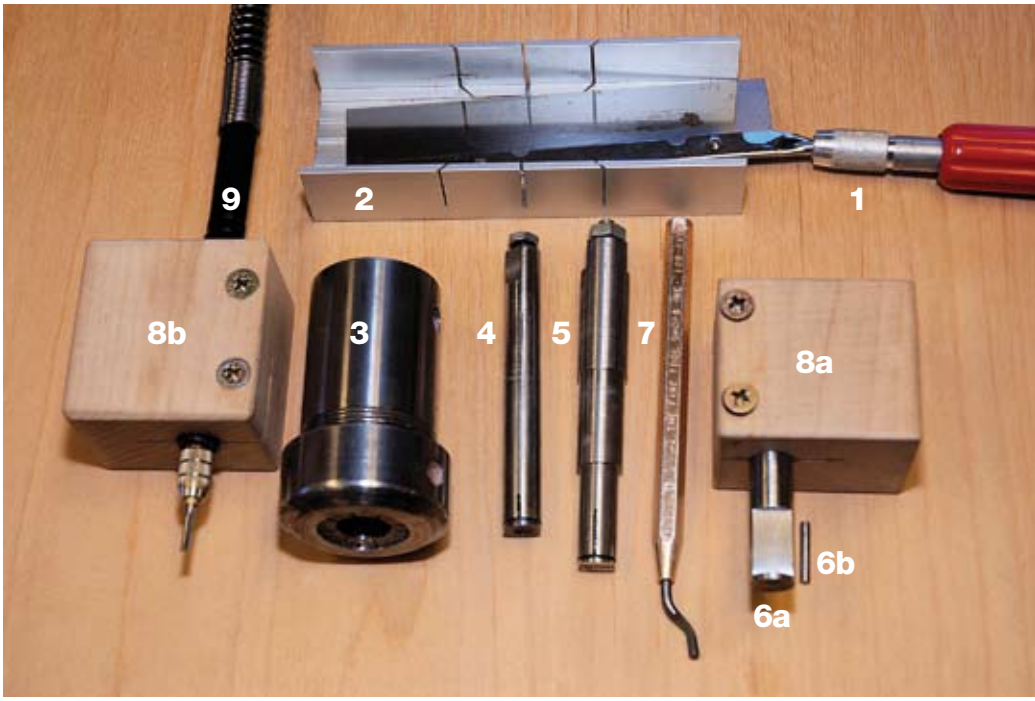
The sidebar on *page 46* provides the appropriate dimensions for turning this pen from a Gentleman's kit.

The pen stock and parts are shown *opposite top*. (I like olive wood because it turns easily, finishes well, and has expressive grain.) The photo *opposite middle* shows the tools I use.

Turn the closed-end body

Let's start by turning the main body. Cut a 3"-long pen blank. Because of the way the cap is constructed, don't select a cross-cut blank. You should have a total length of 5½" available. If you also want to make a wood grip section, you need a minimum of 6" (and you have to plan carefully). With a 31/64" bit, drill to the depth of 1.97" (the length of the brass tube).

The pen includes a Bethlehem olive wood blank (1) and laser-cut clips made from blood wood (2). Parts from the El Grande pen kit include center coupling (3), nib section (4), centerband fitting (5), body brass tube (6), cap brass tube (7), and converter pump (8). This is the upgrade pump I prefer. A brass cap tube (9) from a Sierra pen kit completes the inventory.



Without removing the blank from the drilling vise, drill another hole to a depth of 2.9" using a #N drill bit (0.302") or another bit slightly larger (8mm or 5⁄16" is acceptable if you don't have letter bits). Turn the main pen body on an expansion chuck held in a Beall collet chuck and appropriately sized ER32 collet. If you plan on using a CA finish, rub a little paste wax on the mandrel to prevent the barrel from sticking to it. The diameter at the open end should be 0.535".

Make sure the diameter at 2" from the open end (where the brass tube ends and the wall thickness increases) is still the full diameter, as this is a weak point. With a 1" skew or any tool you are comfortable with, finish the end of the barrel (**Photo 1**). Use a vertical arcing movement just like making one half of a V-cut. Of course you can also round over the end. For the shape at the body end, try to mirror the shape you want for the cap *opposite*.

For the pen body, try to mirror the shape of the cap. Finish to 400-grit, then apply some coats of thin cyanoacrylate (CA) glue. Polish to a high gloss.

Above: A razor saw (1) and miter box (2) allow you to make clean cuts. A Beall collet chuck (3) or similar spring-collet chuck makes it easy to grab different diameters reliably. An expansion mandrel (4) is used for the main body. A stepped expansion mandrel (5) is an option for holding the cap. A homemade pin chuck (6a) and pin (6b) is used for the cap. A machinist's deburring tool (7) eases assembly. A pair of wood blocks to hold the pin chuck and Dremel hand piece (8a, 8b) allow precise cutting of the clip slot. An old-style Dremel hand piece with a 1⁄8" cutter (9) is used to rout a slot for the clip. A centerband-fitting manipulator (10) aids in fitting the hidden threads in the centerband.

Finish the body

My favorite finish is thin CA. Since there are so many variations of this finish, and when I demo this is where I get the most questions, I will explain in some detail the method I'm using. Be aware that there are huge differences in the way different brands of CA and accelerator behave. Whatever brand works for you, stick with it! I currently use Starbond thin, odorless. The odorless CA is not exactly odorless, but it is much less irritating than regular CA. For accelerator, I rely on TMI or Starbond aerosols; both work well for me.

Specs for a Gentleman's kit

Main body: Cut blank 2.8". Drill 15⁄32" to a depth of 2.365". Drill second concentric hole to a depth of 2.57", using a #N drill bit. Glue in the standard Gentleman's body brass tube. Turn and finish, .600" at the open end.

Cap: Cut the blank to a length of 2.2". Drill with a 37⁄64" bit to a 1" depth. Drill a second concentric hole to a depth of 2" using a 31⁄64" drill bit. Cut the cap brass tube to 1" length. Cut 1" section off a body brass tube from a Ligero/El Grande kit. Glue in the brass tube sections.

If you want to economize on brass tubes: Use a 1" section off the Gentleman's body tube for the smaller cap tube. Drill the first hole in the main body only to the depth of the remaining body tube section, the second hole still goes to 2.57". Use a 15⁄32" drill for the second hole in the cap. Be aware that the grip section does not clear that smaller tube. This works if you use the stock centerband fitting, but may be marginal if you modify the fitting in some way.

To make a pin chuck for the body, start with 29⁄64" drill rod and file/sand on the lathe to fit. For the cap, start with a 14mm drill rod.

Sand with 400-grit cloth-backed paper. (I prefer the 1½"-wide rolls.) If you have some marks from your lathe work, begin with a coarser grit and work up to 400. With the lathe at a slow speed (320 rpm on my variable-speed lathe), drizzle a few drops of thin CA on the barrel. Using a strip of 400-grit cloth-backed sandpaper already loaded with wood dust, rub the CA slurry into the surface, which seals the grain.

When the CA starts to set, pull away the paper and hit the barrel with a short burst of accelerator. Because the hardened slurry is cloudy and obscures the grain's beauty, sand off the CA down to bare wood.

Wipe dust off the surface with a paper towel, and spread a few drops of the thin CA across the barrel by putting a small plastic bag over your finger and applying the CA with the lathe still running at a slow rpm. (This is one way to recycle all those plastic bags shipped with pen parts.) Make sure the end of the barrel is completely covered, then hit the entire barrel again with a short burst of accelerator. Spread another few drops with the plastic bag, rotating it so an unused side faces the barrel. Repeat this process four times.

After each application, feel the surface. If it is rough, level it off with a skew laid flat on the tool rest and scrape the body gently. At the minimum, perform this scraping step after the last CA application. If I sand the surface directly, it is much harder to achieve a flat surface, because the finger follows the rough surface. Scrape until 70–80 percent of the surface is dull. (Shiny areas are low and not touched by the skew.)

Now, switch to fresh 400-grit sandpaper and sand the surface until all shiny spots disappear. Complete this step with several lengthwise strokes.

Square up the open end of the barrel with a parting tool. Then switch to Micro-Mesh in 1,500, 1,800, 2,400, 3,200 and 4,000 grits. With each grit, polish with the lathe running at high speed (3,000 rpm), using light pressure so as to not build up heat. Finish with some lengthwise strokes with Micro-Mesh.

Remove the Beall chuck from the lathe as it makes a convenient handle while you polish the pen barrel on a polishing wheel. After polishing with Tripoli compound, switch to white diamond. I used to polish pens only with white diamond, but I found that the wax that binds the polishing powder produces a temporary shine that dulls with a little handling. Using the Tripoli seems to eliminate that problem.

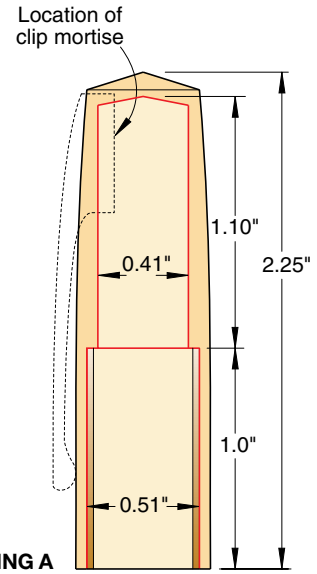
During all the polishing steps it's particularly important to pay attention to the end of the barrel to make sure it is polished to the same level as the rest of the pen.

Turn the cap

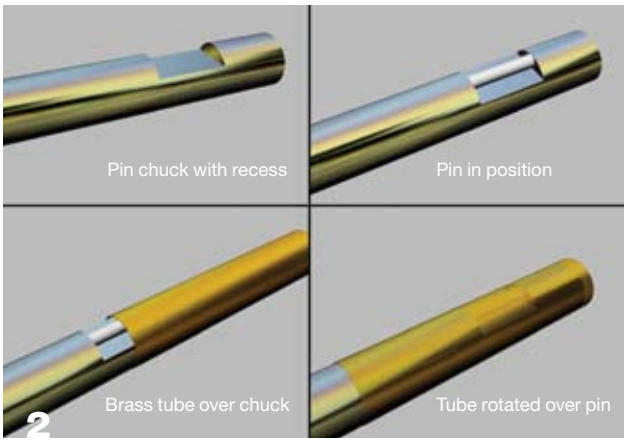
Note: *If you want to construct a wood grip section, please refer to the Winter 2007 issue of* American Woodturner.

The cap presents two challenges: The wood in the normal construction is thin, allowing little material for a routed slot to accept the clip. There are two possible solutions: either turn the cap fatter (not a choice I like) or use a smaller tube. However, the diameter of the brass tube at the open end is fixed to mount the threads.

The solution is a two-tube construction. The lower part is a section of the normal cap tube; the upper section requires a tube with enough room to accommodate the nib. The tube from a Sierra pen fills the bill. The length required for the lower section has to be sufficient so the grip section does not run into the step (**Drawing A**).



DRAWING A



A pin chuck is a close-fitting rod that has a machined recess. A small pin acts as a cam and locks the tube when it is rotated slightly. The recess depth matches the cam diameter.

Cut a blank 2¼" long. Using a 13.3mm drill bit, drill to a depth of 1". Without removing the blank, drill a second concentric hole to a depth of 2.1" using a 27/64" drill bit. Cut an El Grande cap tube to a length of 1" and a Sierra pen tube to a length of 1.1". By using these two tubes, you gain .050" wall thickness in the upper section. The increased wall thickness opens the door to a refined shape.

An easy way to cut brass tubes is to use a fine saw and miter box such as those favored by model railroaders. An X-Acto set is shown on *page 45*.

Epoxy the brass tubes into the blank. It is not necessary to square the end. The combined length of the brass tubes is the length of the tube plus the original El Grande metal centerband that you don't use.

An alternate way of boring the holes is to use a metal lathe and a boring bar. This assures that the two holes are perfectly concentric, and allows use of a homemade expansion mandrel as shown on *page 45*. You must bore the holes for a slip-fit so they remain concentric after the brass tubes are glued in place. However, a metal lathe is not necessary. I will use drilled holes that may not be concentric enough for such a stepped mandrel here.

To turn the cap, use a pin chuck (**Photo 2**), which you can easily make at your wood lathe. On the lathe, machine a 4"-piece of ½" steel rod to allow an El Grande cap tube to just slip on. (A file, a running lathe, and sandpaper are great tools to achieve this.) The fit should be snug, as a loose fit will result in eccentric turning. Cut the ⅛×¾" pin from a piece of a nail and remove the cutting burr (if any). Exact dimensions are not important.

Use a grinder to grind a ¾"-long flat on the mandrel, ⅛" from the end. (The ⅛" allows the entire pin to disappear inside the cap during actual use.) The depth of the slot should be slightly less than the diameter of the pin you just made.

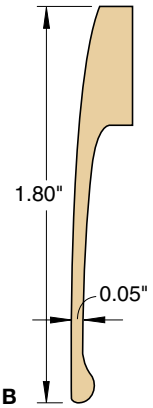
Finish the flat with a file, to a depth that just allows the brass tube to slip over. Accuracy in making this mandrel (diameter as well as depth of the slot) pays off with improved functionality. Although a slight amount of slop is tolerable for turning, a good fit is necessary so there is no slip while cutting the slot.

Insert the pin chuck in a Beall collet chuck and slip on the cap blank, covering the pin. Turn the cap to shape. If you want to taper the cap, remember that the step between the two brass tube sections is the weakest point, so keep a fat wall thickness across that internal step.

For a centerband, glue a predrilled ¼"-thick piece of wood at the end of the cap. Turn the final dimension to 0.600".

Because you will turn a wooden centerband, don't be overly concerned about the exact external diameter of the cap (I turn to approximately .61" diameter). Then part off ¼" on the left and glue on a predrilled ¼" piece of wood for the centerband (**Photo 3**).

Now turn to the final dimension of approximately 0.600". Shape the end of the cap to match the main body. Square the open end of the cap even with or a little longer than the brass tube. (This squaring is the reason we wanted the pin to disappear completely inside the cap, as described *above*.) Finish the cap with CA as described earlier.



DRAWING B

Create a wooden clip

I have my clips laser-cut, but you can cut your own at the scrollsaw. I went through several design variations of the clip to arrive at the shape I like (**Drawing B**). You can develop your own shape, of course, but keep the following pointers in mind.

Wood is fairly stiff, and if you deflect wood, it usually breaks. However, if you bend thin wood, it bends and springs back—perfect for a pen clip. If you can stay in the thickness range where wood bends rather than breaks, you can make a functional clip.

Keep the wood near the end fairly thin. As you go up toward the attachment tenon, the thickness increases. It's important to have a flexing section that will bend before it breaks at the point where it can't move, up where it curves into the tenon. If you make a thick clip, it will not flex. And if you try to use a nonflexing clip, it will break.

The other key consideration is the grain direction. You want the grain to run exactly within the clip. The slab that the clip is cut from needs to be laid out so the grain runs in its plane, and the clip needs to be aligned on the slab such that the grain runs the length of the clip. I rotate the clip slightly to make the grain (assumed parallel the long edge of the drawing) run along the clip. Wherever grain runs out to a surface, there is a weak spot and breaks can occur. Sometimes the grain direction isn't obvious. I find it beneficial to rip a thin strip and break it. The break indicates the grain direction.

Another important point is wood species. I have used blood wood and maple. Both are strong and straight-grained. I rotate the clips slightly in my layout so that the grain runs in the best orientation on both clips.

The width of the cutter determines the thickness of the starting slab of wood. (I use a ⅛" cutter.) Cut a test slot and measure it. You may find the ⅛" cutter cuts a slightly wider slot than 0.125". If so, cut the clips from a thicker wood slab. It's easier to thin down a clip to fit than to deal with a gap.

Finish the clip

If you want to try laser-cut clips, contact a local trophy/awards business. Laser equipment is fairly common today in this industry. (I get laser-cut clips from Ken Nelsen at kallenshaanwoods.com.) The clips arrive on a slab, as shown on *page 45*. The laser cutting leaves a black charred surface that must be removed. I use a combination of belt sander, small sanding drums mounted in a Dremel tool, and hand-sanding to clean up the clip and break any sharp edges. Round the end of the tenon to fit the routed slot on a belt sander or by using a small sanding block. Because I don't find a small opening right under the clip objectionable, I don't try to round the other end of the tenon.

I have tried several finishing methods for wooden clips. Gloss lacquer (I used Deft) applied with a small brush works well. Apply four or five layers in 15-minute intervals

From the top: A blood wood lasered clip with burn marks (*top*), sanded (*center*), and finished with a thin coat of CA glue (*bottom*).

followed by 24 hours or more curing time. This is done on the finished, mounted clip. I use a plastic bag under the clip to avoid major accidents.

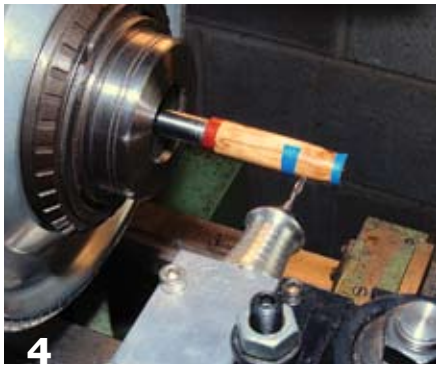
With wood species such as blood wood, the surface is not completely smooth because the grain is filled with fine sanding dust. The slight roughness is revealed once the first coat of lacquer has dried.

The second method for finishing is wiping on thin CA glue. I put a small drop of CA on the clip and spread it out with a piece of paper towel to cover all surfaces. After two or three applications, sand with 400-grit sandpaper, Micro-Mesh 1,500 through 4,000, and a buffing wheel to produce a glossy finish. The photo *above* shows a clip as received with the charred surface, sanded, and finished with thin CA.

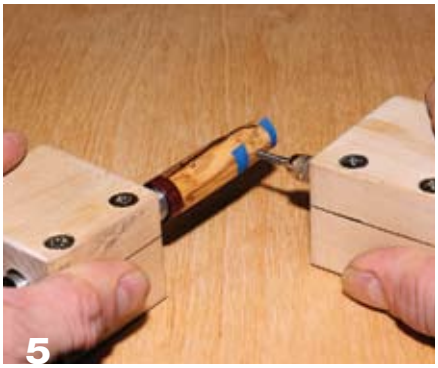
Rout the clip-mounting slot

The simplest way to cut a slot is on a metal lathe (**Photo 4**). Hold a Foredom-type hand piece in an adapter that's secured in the tool post. This makes it easy to cut a slot. The length of the slot is matched to the length of the clip tenon. I use a ⅛" down-cutting spiral router bit with ¼" shank to minimize tear-out.

If you don't have access to a metal lathe, you can cut an accurate slot with the setup shown in **Photo 5**. Cut two blocks to hold both the cap



At a metal lathe, cut a slot from the pen clip with a Foredom-type hand piece and a ⅛" down-cutting spiral router bit.



Homemade blocks hold the pen cap (*left*) and a Dremel flex-drive hand piece (*right*). Keep the blocks in contact with the table.

The finished pen-clip mortise on the cap is routed to the brass tube. Check the fit with the clip before adhering with epoxy.

mandrel as well as a Dremel flex-drive hand piece above the table. With tape, mark the desired slot length. Making sure the bases of the blocks stay in firm contact with the table, make shallow passes back and forth until you reach the brass tube. Practice first on scrap, as you don't want to tilt the block even slightly while cutting.

Photo 6 shows the finished slot routed down to the brass tube. You can blend the clip so it flows into the cap barrel, but I don't normally bother with that. I prefer a noticeable step.

For another design option, move the attachment point up and let the slot run out the end of the barrel.

Assemble your pen

With two-part epoxy, glue the clip in place, making sure you coat the side walls of the slot. Remove any squeeze-out as it appears. Do not use CA at this step.

I recommend a slip-fit and glue for the center-fitting rather than a press-fit. Screw the center coupling into a centerband fitting by holding the fitting in the Beall collet chuck.

Scrape the brass to let the main body slip on. If you use sandpaper, the brass will get warm and the glue holding the plastic threads will weaken. You don't need to be careful of the plastic rim of the centerband fitting because it will be removed.

I prefer a glue-fit to a press-fit because the wood body has to transmit the pressure during assembly. Experience has taught me that not only can you mar the end of the body, it is also possible to collapse or damage the wood.

Modify the centerband fitting to slip completely into the cap tube. It's held in the collet chuck, and the stepped-up front sections of all the large-diameter front steps are turned down to the same diameter as the rear section.

After you get close to the final diameter, screw in the center coupling, which adds rigidity.

At this point, be careful of the metal rim of the coupling. Make sure you reduce the diameter of the plastic so it will slip into the brass tube without compression, which would result in a tight thread. Then glue in the centerband fitting.

A simple assembly tool Angelo Iafrate developed works great; it's a spare center coupling glued into a wooden handle. His centerband-fitting manipulator (see *page 45*) allows easy positioning of the centerband fitting in the tube so that it is flush with the front surface.

Final assembly is trivial, but it pays to adhere to the following steps:

- Epoxy the center coupling into the body.
- Before the epoxy sets, screw the section into the coupling and rotate the whole affair so the nib lines up with the best grain.
- Wait until the epoxy sets, then epoxy the centerband fitting into the cap tube.
- Screw the cap onto the pen and again rotate the cap wood for the best grain alignment.

Penturner Richard Kleinhenz

What happens if the clip breaks?

If the clip ever breaks, you can fashion some internal chuck that will let you hold the cap rigid in the wood block. A hardwood dowel turned to the right diameter might do the trick, as might an expansion chuck that can pass through the cap threads and hold the upper tube. You can then form a new slot, removing the clip remnants, and epoxy a new clip in. Of course I hope you will never have to do that!