

## Pen making

In this session I'm going to talk about and demonstrate how to make a typical ball point pen. We will look at the various bits of kit that are usually used, and also what you can do if you don't have these and just want to have a go at making one or two pens.

I know that the very idea of making pens leaves some people cold. To them I would say that you can use the same techniques to make a variety of other items, such as keyrings and letter openers.

Let's start with the pen components. These you buy, usually as a set to make one pen, and are available from the usual range of suppliers e.g. Axminster, Stiles and Bates, Turners Retreat, G&S, Just Wood etc. Incidentally, is everyone aware of these suppliers and how to get in touch with them? There are links from our website to a number of these companies' sites for your convenience. In addition if you get into pen making there are a number of companies that specialise in pen making supplies, see adverts in the wood working magazines, or search on-line.

There is huge range of kits available to make ball point pens, roller balls, felt tips, fountain pens, and propelling pencils priced from a couple of pounds to over £50 per pen. As usual, you pay per money, you take per choice. . . . .

Similarly, the barrel can be made from wood - plain, dyed or laminated; bone, antler, acrylic, alternative ivory type materials, corian, even rattlesnake skin embedded in resin, and laser cut jigsaws! If you can turn it to the size required you can make a pen out of it. Tonight we are going to stick to wood. One of the features of pen making is that you can have a go at turning a vast range of local and exotic woods at relatively reasonable cost as you only need a small piece of each.

The kit of parts will include a brass tube or tubes, depending on the design, which has to be glued into a hole drilled through the blank. The blank is then turned to size, sanded and polished. The pen is assembled by pressing the various components in to the brass tubes.

That's the general idea, now let's look at each of the steps in more detail.

### **1. Select the wood**

A pen is intended to be held in the hand and will be looked at in detail. Therefore the wood needs to be fine, hard and close grained. Coarse, open grained woods such as Ash and Oak are not really suitable. Of our local woods, yew and holly make nice pens. The fruit woods – apple, pear and plum would be good. Hawthorn and rhododendron would work OK. I recently made some pens from spalted hornbeam, which was a real challenge to get a satisfactory finish but looked stunning.

There is a huge range of exotics available. I've used padauk, sonokeling rosewood, cocobolo, African blackwood (also a rosewood), ebony, amarello, raspberry jam wood, eucalyptus burr, myrtle burr, she-oak, walnut, pink ivory wood, purpleheart and probably a few I've forgotten. These are available as ready cut pen blanks from about 40p upwards, but it is often much cheaper to buy a larger piece of wood and cut it into pen blanks yourself. Even the smallest table top bandsaw should be able to cut pen blanks.

The size of blank needed depends on the particular pen design you are making, the size of drill required, and the accuracy of your drilling method. Commercial pen blanks tend to be about 20mm square and 150mm long (3/4" by 6").

### **2. Cut accurately to length**

Check any instructions that came with the kit, or measure the length of the brass tubes. Cut the blank very slightly longer than the tube and square across e.g. for a 50mm tube, I cut the blanks to 53mm. Any shorter than this leaves very little room for error, any longer means that you have more to trim off later. I cut to length on the bandsaw by using a simple stop clamped to the mitre guide. This means that I don't have to actually measure each piece.

Label the two pieces clearly so you know which is which, and their orientation. I make pens in batches so I label the first pen as 1A, 1B, the second 2A, 2B etc.

### 3. Drill

Check the kit for the size of drill required. Most, but not all, kits use a metric drill, 7mm is a popular size for the cheaper pen kits. You need a sharp drill that will make a clean, straight, accurate hole. That ancient twist drill that has been knocking about in the bottom of the tool box for years may not be up to the job. The new Colt pen bits are excellent, but not cheap, otherwise I suggest a sharp lip and spur bit.

It's up to you how you do the drilling. If you have a pillar drill, and can hold the blank accurately at right angles, that is the obvious choice. Otherwise, you can drill on the lathe, either with the drill in a Jacobs chuck in the headstock and the blank on a table or aligned along the toolrest. Or with the drill in a Jacobs chuck in the tailstock, and the blank held at the headstock end. A special chuck for holding pen blanks was reviewed in Woodturning magazine Issue 220.

Start each hole at the end which will be in the middle of the finished pen, this will maintain the best grain match when you assemble the pen. Mark the centre using a round or square bradawl, by eye should be accurate enough. Enter the drill slowly into the blank to give a clean entry and always support the bottom of the blank with scrap and drill into the scrap to minimise break out on exit. Drill slowly and withdraw the drill from time to time to clear the waste. If you use too much force the drill can overheat and split the blank, this is especially likely with hard exotics.

It's a good idea if possible to drill a test hole using the same drill and type of wood and test fit the tube. I've found that the same drill will make a different size hole in different woods, and not all 8mm drills are the same size !!!!

### 4. Glue the tubes in place

You need a glue which will glue metal to wood and not fail if the metal or wood expands or contracts slightly. The choices are :-

Glue	Advantages	Disadvantages
cianoacrylate (superglue)	Quick cure time means you can turn almost immediately.	Quick cure time means you have no time to adjust tubes ! Not nice to use, gives off ammonia
epoxy resin	Even 5 min epoxy gives you time to insert tubes.	Need to mix two parts
polyurethane	Long open time one part gap filling	Needs time to cure

I use a polyurethane called Gorilla Glue and I've not had a failure yet. It's a good idea to wear disposable gloves when gluing for two reasons 1) it keeps glue off your fingers as it will stain skin and is difficult to remove, and 2) it keeps the grease from your fingers off the tubes which could otherwise affect the glue bond.

Clean and roughen the tubes by rubbing with 400 grit abrasive. Check the fit of the tubes in the drilled blanks. If too tight, enlarge the hole using 180 grit abrasive rolled into a tube and pushed in and out. Take care to keep the abrasive in line with the hole so that you don't over enlarge the entry hole. If a bit loose the polyurethane glue will fill small gaps.

Slip a tube onto the shaft of an old screwdriver then squeeze 3 lines of glue spaced evenly round the tube. Use a cocktail stick or similar to spread the glue over the tube right up to the end that goes in the hole first. Insert the tube into the blank at the same end the drilling was started using a twisting motion to spread the glue. Push the tube in so that it is JUST below the surface. Wipe off any excess glue then set aside to cure, I usually leave them overnight, in the house in the winter months.

## 5. Mount on lathe

The usual way to mount the blanks for turning is on a special fixture called a mandrel, we will also look at what you can do if you don't have a mandrel.

A mandrel is basically just a steel rod, machined with a Morse taper at one end to fit into your headstock, and a dimple at the other end which is supported by a revolving centre in your tailstock. The pen sections are slipped onto the mandrel and held in place by spacers and a locking nut. If the internal diameter of the tubes is larger than that of the mandrel a set of bushes is used to hold the section concentrically. The outside diameter of the bushes usually indicates the diameter of the pen components and therefore the finished diameter of the wood.

Mandrels are available from the usual suppliers. Each supplier will have bushes etc. to fit their own range of pen kits; therefore it is probably best to stick to one supplier. If you decide to try a new style of pen, then check with the suppliers that this pen can be turned on your mandrel.

Before mounting the blanks on the mandrel you need to trim the ends level and square with the brass tubes. The easiest way to do this is by using a barrel trimmer designed for just this task. I use the trimmer in a cordless drill and hold the blank by hand. You may choose to use a pillar drill or lathe. In any case, trim until the end of the blank is just level with the tube. It is very easy to take too much off which can seriously affect the fit of the pen components when you assemble the pen.

Slide the spacers and blanks onto the mandrel, screw on the locking nut just finger tight. If using bushes, make sure that they are properly located inside the tubes. Insert the mandrel into the headstock then bring up the tailstock, locate the revolving centre in the end of the mandrel and wind in the tailstock. Apply just enough pressure to support the mandrel and keep it engaged in the Morse taper. Excessive pressure can bend the mandrel which would make it useless.

If you do not have a mandrel, you can turn between centres one blank at a time. If you have a dead centre you can use this in the headstock to centre and drive the blank, the other end supported and centred by a revolving centre in the tailstock. Or, mount a scrap of wood on your lathe by any convenient method and turn a slightly tapered peg which will fit inside the pen tube, centre it and drive it. As before support the other end with a revolving centre in the tailstock.

## 6. Turn

As a pen is only a small diameter it needs to be turned at high speed. The books advise speeds of 3,000 – 5,000 rpm, but I've found that not all woods respond well to these speeds, and I often turn at about 2,000 rpm. As usual, turn at a speed which YOU are comfortable with.

To turn a pen you only need a couple of tools, a spindle roughing gouge, a small skew chisel and possibly a spindle gouge. The turning is not difficult but you do have to work much more accurately than normal. Tools must be kept sharp, you cannot afford any torn grain when working at this small scale. Keep the skew razor sharp by honing it before every pen on whatever honing set up you use for a bench chisel – oilstone, water stone, diamond etc.

Take the usual precautions against shavings and dust in the form of eye and lung protection. As you may be turning woods that you are not familiar with, you may find that you react to them. If I turn rosewoods, especially Cocobolo, within seconds my nose starts to run and my eyes itch.

Turn the blanks round and to within a couple of mm of the finished size using the roughing gouge. The usual points of good practise apply here – tool on the rest, bevel on the wood, find the cut, sway to traverse. If you attempt to start the cut by coming onto the wood from space, you have to get the angle dead right or you risk splitting a chunk off the corner. It's a very small piece of wood ! I reduce this risk by initially tapering the right hand end of the blank from square to round, working from left to right; then completing the roughing from right to left.

If you don't have a mandrel, you probably don't have a barrel trimmer either, so use a small skew chisel to trim the ends of the blanks. Line up the bevel at right angles to the lathe bed, enter the wood with the long point then raise the handle to move the cut onto the edge and arc into the centre.

Turn down to final size using the skew for all the straight sections. Some people make pens with finger grips and other fancy shaped sections – which may need to be shaped with a spindle gouge. I've not seen a shaped pen that I liked yet so I just do straight barrels and let the wood be the feature. When you start a cut it is easy to chip the edge so I taper the end first in a similar way to when roughing.

Take fine cuts with the skew, cutting from end to end in a single cut. You may find that vibration is a problem, leading to ripples in the cut surface, especially when turning the harder exotics. To reduce this try to take a very fine cut with a minimum of forward pressure. Put any pressure onto the tool rest, NOT onto the wood. If you press hard onto the wood the tool will follow the ripples and make them worse. You need to cut through the crests of the ripples and not dip into the hollows.

Stop the lathe and check the diameter carefully with callipers at several points along the work. Allow a fraction of a mm oversize to allow for sanding, exactly how much will depend on the wood and how much sanding you anticipate will be necessary. If you are turning a spalted wood or a burr it may be difficult to achieve a uniform surface in which case you can use some of the usual techniques such as a coat of sanding sealer before the final cuts.

## **7. Sand and Finish**

The usual discussion about the use of abrasives is relevant here – where do I start and stop? The answer is – as coarse as you need and as fine as you want. In practise you should not need to start with anything coarser than 180grit, then 240, 320 to at least 400grit. On the fine, hard exotics you will need to go to finer grits, 600, 800, 1200 and beyond. The finer the grit, the higher the final gloss.

Your usual abrasive brand will go to 400grit, Rynogrip (my current favourite) goes to 1200 grit. Beyond that you can use Wet and Dry papers or specialist abrasives such as Micromesh.

Say we start at 180grit. Sand with the lathe running, at about 1,000rpm. Keep the abrasive moving working right to each end but being careful NOT to sand the bushes or spacers ! Be careful not to overheat the wood, it is very thin and many woods are sensitive to heat and will crack, especially the exotics. Stop the lathe, check the surface and dust off before moving to the next grit. Repeat for 240 and 320 grits.

For 400 grit and above, I suggest that you sand with the lathe stopped, always working along the grain.

The final finishing product used is up to you but bear in mind that the pen will be handled a lot and probably kept in a pocket or handbag. This means that products like standard friction polish or wax will not be suitable. Some pen turners swear by a mixture of superglue and boiled linseed oil but I've not tried it yet.

I now use cellulose sanding sealer then two applications of PPP, Perfect Pen Polish, an American product. This gives a good gloss finish designed for the job.

Apply a coat of cellulose sanding sealer, allow to dry then start to cut back with 400grit with the lathe stopped, working along the grain. Dust off then work back up to the finest grit used during sanding.

Start the lathe at about 3,000rpm then hold the brown PPP bar against the work and move along the length to melt the bar onto the pen. Polish with a soft lint free cloth using sufficient pressure to warm and spread the PPP but not overheating the wood. Repeat using the white PPP bar. Turn the lathe off but keep polishing along the grain as the lathe slows to a stop.

Unload the finished pen barrels, being careful to keep them correctly orientated.

## **8. Assemble**

As mentioned above the various pen components are usually a press fit into the brass tubes. It is critical that the component is kept aligned when you apply pressure otherwise there is a very real risk of splitting the brass tube and the wood. Woodturning suppliers can supply various types of special presses to do the job, but you already have a device which can apply pressure between two points in a straight line – it's called a lathe !

A couple of bits of scrap hardwood and a few minutes turning will produce a pair of 'pads' to fit in your headstock and tailstock. When making them, mark a series of concentric circles on each to help you align components.

Each pen kit will come with assembly instructions, so lay out the components in order and make sure that you understand the assembly sequence. If you get it wrong it can be very difficult or impossible to disassemble a pen.

To assemble the example pen I always lay out the bits with the ball to the left. Examine the pen barrels carefully for any faults, especially at the ends. Decide which end is to go at the ball end and reverse end to end if necessary. If you have a surface fault it may be possible to hide it under the pocket clip!

Place some 400 grit abrasive on a flat surface, hold one of the pen barrels close to the lower end and rub it on the abrasive in small circles keeping the barrel at right angles to the abrasive. Remove the dust. This cleans up the end of the tube and wood so that it fits closely with the pen component. Repeat for the other end of the barrel.

Insert the pen bottom section into the barrel, line it up between the jaws, lock the tailstock to the bed, and wind in the tailstock to press the component home. Repeat for the component at the other end of this barrel.

If the wood has a strong grain pattern it looks best if the grain matches at the join in the middle of the pen. It took a while to work out how – this is my method. Take the lower half of the pen just assembled and screw the other jointing component on to it taking care to get it the correct way round.

Face off both ends of the upper barrel. Place the matching end of the upper barrel onto the joiner, hold the lower barrel still in one hand and rotate the upper barrel clockwise looking for the grain match. If you turn a barrel the other way you can start to unscrew the joiner which will destroy the grain match – I've done it ! When you find the grain match, hold both barrels in one hand, put them in the lathe and carefully press the joiner part way in taking care to maintain alignment. Take out of the lathe, unscrew, then put the upper barrel back in the lathe and press the joiner fully home.

Insert the click mechanism into the upper barrel and press on the pocket clip and end cap. Insert the ink cartridge and screw the two barrels together.

Job done !!

## **9. Package**

If you are giving the pen as a present you can buy a wide variety of pouches and boxes to display your masterpiece.

There are a number of books and DVD's available about pen making e.g.

Turning Pens and Pencils by Kip Christensen and Rex Burningham, published by Guild of Master Craftsman Publications Ltd, ISBN 1-86108-100-6

Phil Howard, Galloway Woodturners, November 2010