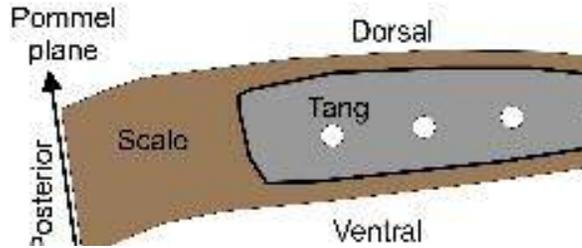


Box Tang Construction - Basics

Steve Bloom, IronFlower Forge 2017

This write-up is intended to assist folks working in my shop and act as a reminder to them (any myself) of the little niggling details of the process. There are a number of aids/jigs/crutches (depending on your viewpoint) used to simplify and/or increase the precision of the build. If I haven't generated a separate document about them, feel free to contact me and maybe I'll write it up and post it.

I'm going to use quasi-zoological nomenclature to define the orientation of the handle. The junction of the blade & handle is anterior, the pommel is posterior and the top is dorsal.



Typically, I design, forge & grind the blade as a full-tang blade. Before heat treat, approximately 1/8" of material is removed from the dorsal & ventral edges of the tang. While most of that material is quickly removed with the belt grinder, cutting parallel and quasi-square cliff faces at the intersection of the handle & the blade is tricky. The mill can be used with a mandrel and a wafer wheel or you can use a jig as shown here – carbide blocks imbedded in an aluminum frame. The blocks came from MSC and JB-Weld was used to secure them in place. A side-grinder with a wafer wheel is then used to make the cuts.



Select stabilized wood – usually 1.5" x 6" x 3/8". The dorsal & ventral surfaces must be square and parallel. If not, saw them to those standards. Rough sand what will be the outside surfaces. On the mill, place that surface down and mill off the other surface to create a flat and relatively smooth plane. Leave the mill at the last used depth & repeat for the other scale. Try to match the same depth for both scales - even if you have to go back to the first one and do it again.



Place the tang on a scale and layout the outline of the handle – this is where you will define the length of the handle. The dorsal & ventral outlines are not critical at this point but the slopes of the anterior & posterior surfaces should be carefully defined. In this example the anterior is perpendicular to the spine of the blade and the posterior is about 75 degrees (sloping towards the tip).



Go to the band saw and cut along the anterior & posterior lines. Trace that scale onto its sib (milled surfaces together) and make the same cuts. Clamp the scales together and mill the surfaces. This step is critical if you are including bolsters and/or a pommel in the design. If you have the option of using a 10" to 12" board to start, you can bookend the scales (posterior surfaces adjacent to one another, dorsal surfaces on the same line). This will produce mirror-image grain patterns on the posterior surface of the handle.



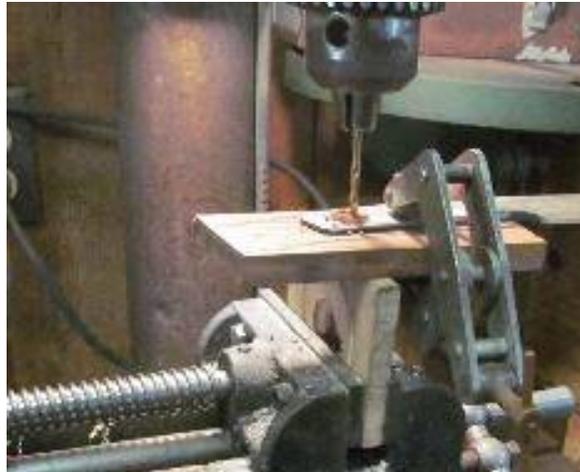
What all of this produces is shown here – two scales which can be securely held in a vise and are mirror images of each other. If the tang is short relative to the handle, you can now define where the pins will occur. In this example, there will be six pins. The diameter of the pins was set before heat treat. Typically, it will be 0.125" and the holes in the tang are 0.128" (#30 bit).. You can under-drill these to be on the safe side (#31 drill at 0.120") but then you must have temporary pins slightly smaller than that drill bit.



Position the tang on one scale and securely clamp it in place. If the tang has a significant dorsal to ventral taper, you can grind that somewhat flat back of the throat plane. When positioning the blade on the scale, make sure that there is no air gap between the back surface of the recess cut and the front surface of the block. It is better to have the wood surface slightly proud than leaving a gap.



Since the scale is flat, a wood block can be used to create a horizontal plane over the drill press vise. A relatively narrow block (0.5"-.0.75") is convenient and minimizes the number of times you have to reclamp. If you reclamp, be sure to use temporary pins and/or set another clamp before moving the first clamp. The tang cannot move relative to the scale. Drill the holes using the tang as a template.



If the tang is short, lay out auxillary holes from the tang to the pommel surface and drill the holes. A divider set can be used to transfer inter-pin distances.



Clamp the blocks together making absolutely sure the anterior and posterior planes are identical - you should not feel the break when running a finger tip over those planes. Return to the drill press and using the 1st block as a template, drill all the holes in the 2nd scale. Do not let them move relative to one another when reclamping. If you are worried about not getting the drill in the right location, clamp the pair in the vise and use the bit as a feeler with the drill press off. When satisfied, turn the drill press on and make the hole.



Measure the tang thickness at several spots along the tang. The thickest must be at the throat plane. If not - grind the tang until it is. The next step is to trace the tang onto the scale in such a way that you can easily see the outline.



Use temporary pins to locate the tang correctly with the pins inserted through the tang and into the scale. Typically the pins will extend 1/2..3/4". Use a drill-press vise to clamp the pins and lock the complex together. Use a carbide scribe and trace the outline of the tang onto the scale. Repeat with a sharp pencil.



Go to the mill & etch-a-sketch out the recess by touching off the surface and then lifting the table 1/2 of the thickness at the throat plus 0.005". When milling the recess, go up to but not beyond the lines. It is better to leave a whisker inboard of the scribe line than going over the line. Remember - the closer the recess wall is to the tang, the better the probability of not seeing a cavity appear when grinding the handle.



Use an air die grinder and a square-end burr to fine tune the recess. Try to fit the tang - locate any problem areas and then remove the wood at that spot. Make absolutely sure that once the tang fits into the recess that a pin can still pass through the tang & the corresponding hole. It doesn't, the problem is usually at the throat area. Align with pins and scribe that area - you will typically see what needs to go away.



At this point, the tang will be recessed into the scale and half of the width of the spine is within the scale. If there is a dorsal-ventral taper, there will be air at the ventral aspect of the recess. That is what epoxy is for.



Repeat the process on the other scale. Place them around the tang and verify that there are no air gaps. If there are, you may have to deepen a recess or grind the tang a bit more.

Trace the handle outline on a scale and band saw it (stay just outside of the lines). Clamp the two scales together, trace the outline onto the uncut scale and saw it out.



Tape the blade (leave $\sim 1/16$ " at the throat exposed) and adjust 3 C-clamps to just slip over the assembled handle. Position the two temporary pins, the clamps, epoxy, colorant, acetone, paper towel, a scrap of paper and a tongue depressor (or popsicle stick). Mix up the epoxy and paint the inside of one scale completely - recess and all the surrounding 'highlands'. Add a bit extra to the throat plane and insert the two pins from the non-epoxy side. Place it on the table, pins up. Butter the recess of the other scale and paint the throat surface. Place that scale onto the alignment pins and apply the clamps at the pommel, the mid point and the throat.



I like to have the center clamp on the opposite side of the handle from the other two clamps. Remove and wipe off the pins. Use a paper towel wetted with acetone and wipe off the throat area. Wait until the epoxy sets.



Grind off the epoxy splatter so that the handle will lay flat when drilling. Drill out the pin holes - if using undersized bits, now use 1/8" bit to match pin stock. Layout the length of pins needed - deliberately oversize them - wasting an 1/8" or .a 1/4" of stock is far better than coming up short. If using a mosaic pin, make n-1 pins where n is the number of holes.



Shear the pins using a modified fence tool. Both ends are now distorted by the shear. Go to the grinder and grind a taper on one end of all pins.



Lightly insert the tapered ends in the appropriate pin holes. Unless you have taper-ground the handle, the pins should all be essentially the same.



Butter the pins with epoxy and shove some epoxy into the holes on the other side of the handle. Go to the machinist vise and place the pins against the front jaw after positioning a backing board against the rear jaw. Use the vise to drive the pins - go slow and careful - do not bend the pins. You can drive all pins at once or each pin individually.



When done - make sure that all pins are proud on both sides. Let it set. When ready, grind off the protruding pins and epoxy splatter. Rough grind the edges of the handle to create 45 degree slopes but leave the pin area flat and hopefully parallel'



If using mosaic pins, assemble tools - the pin stock, a caliper set, a depth indicator, the saw aid & the correct Allen wrench. Verify the exterior diameter of the pin stock and find the matching drill bit.



Use the drill press vise - clamp the handle parallel to the drill plane - align the bit over the hole (use an 1/8" as feeler gauge if unsure) and drill into the handle 0.25 to 0.375" deep - do NOT hit the tang. Flip it over and repeat on the other side.



Use the depth gauge and determine the maximum depth you drilled. Lay out the distance on the pin stock (which should have beveled ends). Use the saw tool and cut off the two sections needed. Bevel-grind the ends of the remaining stock for next time.



Gently insert a pin into the handle - just enough so it doesn't fall out. Flip the handle over and do the same for the other pin. A block of wood with a hole larger than any pin stock you use makes a convenient way not to mess up one side while working on the other.



Butter both pins with epoxy and use the machinist vise to seat them. Wipe off excess epoxy and let set. When set, grind off anything that is proud. Using the slack belt setting - walk the handle from 38 - 120 - 320 - 800 grit (J-Flex Hermes). Shape as you like. I typically narrow the end at the blade, let the handle gradually widen until near the pommel and then narrow slightly. I like a taper from dorsal to ventral. The idea is to fit a handle with a gentle bulge in the palm and a secure grip with the last two fingers. Your mileage may vary.



Buff with white rouge. Remove the tape and sharpen the blade. For a patterned blade, you can use gun bluing and a wet 2000 grit sandpaper to pop the pattern. Dry and then apply hot beeswax to finish.

