Knife Construction - Stick Tang Blades I - Guards

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Just in case someone might be curious as to how I build a blade (and as a reminder to myself), what follows is a more or less step by step description of making a stick (or hidden) tang knife. The information will be broken into three sections, the guard, the handle, and the pommel and will include descriptions of the jigs, tools, etc. that I have found to be helpful. This is, by no means, the definitive way to approach the task, so if you have a better or different process, please write it up and share!

Guard:

The geometry of the tang and blade was set before the heat treat and in the final grind. Using a rotating vise (A), a file guide (B) (two hardened blocks of steel connected by pins and clamped on either side of the blade) was used to insure that filing (C) the shoulders of the tang are square to the central axis of the blade and are in alignment to each other.

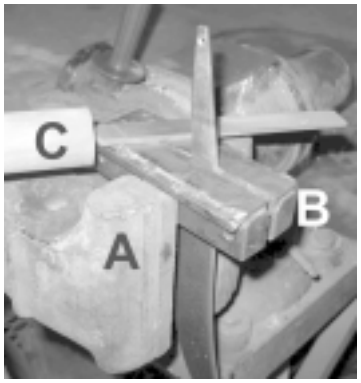

Fig.1: Filing guide

The shape of the guard is somewhat dependent on the selection of the handle material. If the handle is wood, you have a lot of freedom in determining the size and shape but if it's antler or stag (as shown here) and you want the guard to tightly conform to the shape of the handle, a bit more complexity is called for. I first trace the outline of the handle at the guard end on an old business card (they are useful for more than just an epoxy mixing platform!) and layout an approximation of the center and the tang width (Fig.2). Given that getting the tang in the dead center of a piece of stag is not guaranteed, I have found that clipping the card to allow the tang to pass through it and assembling the system (Fig.3) gives me a more accurate sense of the layout and produces a template (Fig.4).

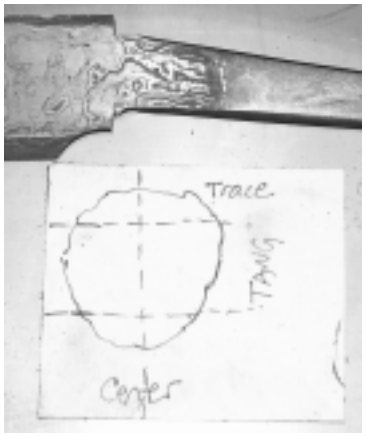

Fig.2:Initial layout

The next step is to fabricate the actual guard. The material is coated with a layer of machinists blueing (though a magic marker will do just fine), the template is used to aid scribing the shape onto the material , and the material is sawed out on my cheapie Harbor Freight bandsaw. Because I will eventually mill the slot and then crush the guard to fit, I leave a margin of 1/8" or so on the left and right sides and try to saw those sides out parallel to one another. If the guard is non-ferric (brass, bronze or nickel silver), I then anneal the material (use a propane torch to bring the piece up to a cherry red, then allow to air cool or quench in water - either works). I can then either use the slot in the template or use a set of calipers to layout the location of the slot. Typically the tangs on my blades are thicker than 0.125" at the top and less than that at the bottom due to the way I taper grind my blades. Since I have a small mill, I typically drill a 0.125" hole at the wide end of the slot and then mill out the slot with a 0.125" end mill. The milling operation is why I try to get parallel sides during the sawing phase - they make holding the guard in the milling vise a whole lot more convenient. Using the narrow end of the slot as a start point, I can change the angle of the vise on the mill (usually no more than 2 to 3 degrees) and mill back to the wide end, thus cutting off material on one side and widening the slot towards the wide end. Repeat the process on the other side and the result is a triangular slot with relatively smooth walls. A few licks with a knife file and the slot is ready for the next operation. The goal here is to make a slot wider than needed, as long as needed and with smooth surfaces. In the event that more material needs to be removed, I have found that the pneumatic micro-die-grinders (Harbor Freight - on sale less than $10.00) plus a 0.125" carbide grinding bit makes quick work of any final adjustments.

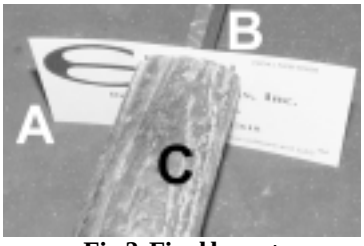

Fig.3. Final layout

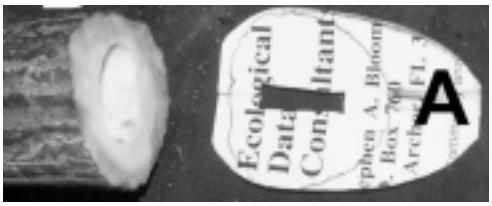

Fig.4: Guard template

The guard is slipped on the tang and held in place (see Figure 5) with a combination of steel fingers (A) and a set of vise-grips (B). I have found that a machinist's vise with oak jaws (C) is a really convenient thing to have around since it holds blades securely, doesn't mar the steel and minimizes the lacerations on the bladesmith's paws. The next step explains

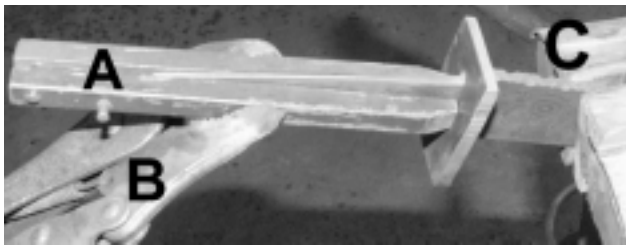

Fig.5: Holding guard in place

the margins created by the sawing mentioned above. Take a look at Fig.6. There is a decided gap at the bottom of the tang (indicated by the arrow). That gap has got to go. Take the knife with guard locked in position over to your anvil and hammer on the edges of the guard to close the gap. Since the wide part of the slot usually fits more closely than the narrow end, fewer blows are needed on the wide end. A heavy hammer and directly down blows will tend to close the gap without mushrooming the edges excessively. You want to close the gap while minimizing the distortion of the guard, i.e., we don't want wrinkles. For large guards, I sometimes clamp pieces of scrap steel on either size of the guard and left and right of the slot (we're now talking three sets of vise-grips, the steel fingers, and 4 pieces of 3/8" square stock). Once the gap is closed, I would remove the guard, quick grind off the mushroomed edges (bye-bye margins) and flatten it using a combination of my treadle hammer and a precision surface grinder (OK - sure it's overkill, but I have the tool, so why not use it?). Since I've got my 30 ton press working, I now just place the guard in a holder (which has a slight slope corresponding to the usual difference of wide to narrow dimensions) and squish it. The guard is then removed from the tang and given a squeeze on its face to flatten it, obviating the need for the surface grinder. Typically, the slot is now a touch small and will need a bit more filing to fit. I deliberately stop filing when the guard almost but doesn't seat (maybe a 1/4" to go). Using a combination of the vise with oak jaws and a driver longer than the tang (Fig.7 - A) made from a piece of pipe or a piece of square tubing hammered into a diamond, the guard can be driven into place while only marring the rear surface. Take a look at Fig. 8 - the gap is gone.

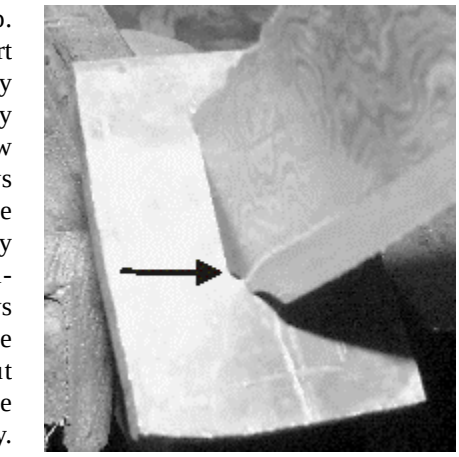

Fig.6:Guard showing gap

Fig.7:Driver for setting the guard

Fig.8: Guard ready for soldering

The next operation is to polish the front surface of the guard (Fig.9) . It is a pain to try to hold a guard while grinding and/or polishing that surface. If you use your fingers, expect flat finger tips and blisters. If you use a hand vise (C) or a machinist's screw vises, expect to pick the guard up from the floor from time to time. What I discovered recently (imagine me slapping my forehead in exasperation for being so dumb) is that a hard wood wedge (B) driven into the slot makes all these problems go away. It even prevents the polishing buffs from rounding the edges of the slot . What a great idea! -- one that I should have thought of years ago!.

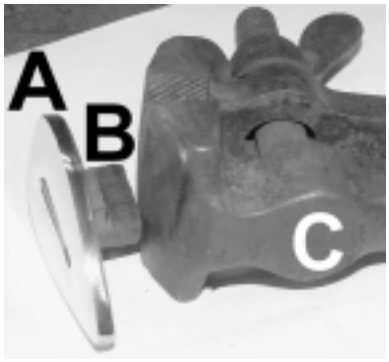

Fig.9: Ways to hold a guard

We're finally ready to talk about soldering the guard. What works for me is a MAPP gas torch (using an acetylene torch handle and a MAPP tip - either large (A) or small (B)), TIX solder and flux (from Brownell's=C & D), a laboratory screw hose clamp (E), a pair of small pilers (F), and some home-made chisels (G & H) made from 1/8" diameter brass rod stock. With the exception of the torch, all of this stuff resides in a single small drawer so I don't have to go on a scavenger hunt anytime I want to solder something.

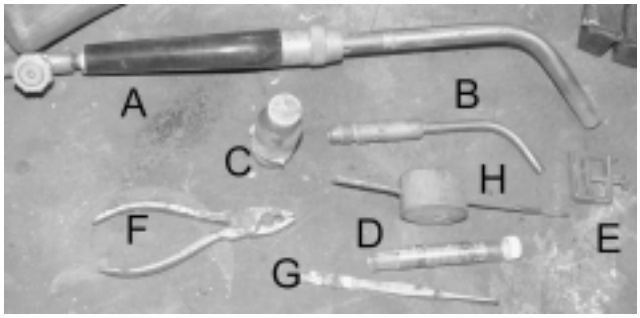

Fig. 10: Soldering tools

The first and most important rule about soldering is KEEP IT CLEAN. Any oil, dirt, etc. can mess up your day in a heart

beat. I usually do a touch of hand sanding using a 15 micron belt piece (leftovers after the glue joint failed) on the shoulder area of the blade and then wipe the area down with acetone. The guard is also wiped down with acetone and a Q-tip makes cleaning the slot a bit easier. Once wiped, don't touch the soldering area with your bare fingers.

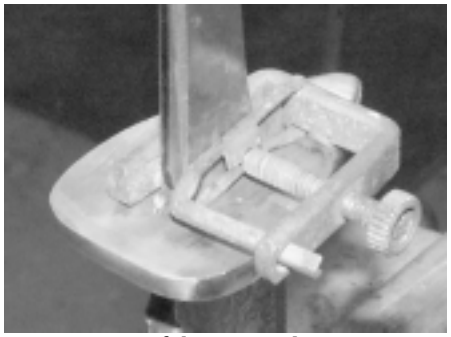

Fig. 11: Use of the screw clamp

The guard is set onto the tang in the final position (Fig. 7 & 8) and is clamped in the vise (using those oak jaws again) with the tang straight up. A small amount of flux is brushed onto the junction of the rear of the guard and the tang. The torch is fired up (usually with the small tip) and the flame is played over the tang/guard interface. I like the TIX solder because it is strong and melts at a low temperature - why go through the hassle of doing a great heat-treat and then ruining it while soldering. The process consists of plying the flame on the interface, then touching the joint with the stick of solder (those small pilers come in handy when the sticks get too short to hold in your fingers). Eventually (usually a couple of minutes but that's a function of the size of the guard, tang and torch output), the solder begins to melt when touched to the interface. I run a very small bead on that side of the system and switch over to the other side of the tang to repeat the process. A touch of the stick at the top and bottom of the tang completes the solder application. By now, there is a bead of solder completely around the tang on the backside of the guard. For most blades (with a tang approximately 3/4" wide, I might use a quarter stick of solder.

Now comes the moment of truth unless you've got something like the clamp shown in Fig. 11. The blade needs to be flipped over, point up, tang in the vise. If the fit of the guard to the tang isn't tight enough, the guard may slip back down the tang when flipped. The clamp prevents that slippage. Once the blade is flipped, the torch can be applied to the interface of the blade and the front surface of the guard. The heat will draw the solder upwards and fill the space between the guard and the blade. If necessary, a careful touch with the stick and/or a bit to pushing the solder around with the brass chisel will fill in any gaps or pinholes. When you're happy with the results, you can cool the blade by pouring some water on it. I usually just grab the blade with the pilers and suspend it under the running faucet in the nearby sink. The brass chisel can then be used to remove any excess solder without scratching the guard or blade (See Fig. 12).

I've tried using a line of superglue and anti-solder coating just above the solder line to control wicking of solder up onto the blade but haven't been particularly impressed with results. A careful and light application of solder seems to be a better way to go.

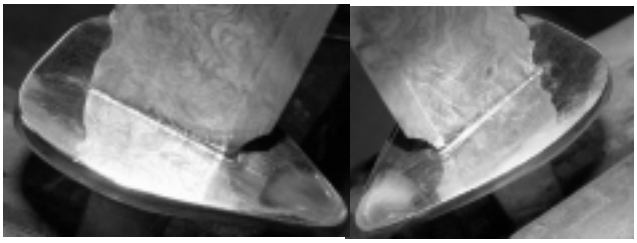

Fig.12: Solder joint

Handle:

Handles have to comply with several constaints - they have to enclose the tang, they have to fit the hand, they have to have a decent interface with the guard and pommel, and they ought to look and feel good. A lot of these constraints are value judgements - what fits one hand may not fit another - but the general concept holds. The handle may be a single block or be a composite of multiple pieces. I'll primarily talk about the block approach but good examples of the composite approach can be seen in any Japanese hilt (tsuka). Not only are there two pieces of wood making up the handle, the cavity for the tang is typically confined to one piece and the other piece acts as a 'lid' - a non-symmetrical arrangement that combines superior resistance to shearing the glue bond with simplifying the construction.

Next time I discuss the handle, the pommel and the final finish.

FABA October Conference

One if the activites we're attempting to organize is a Friday - after registration - get together & jam session. My better half says....

Anybody know any songs about blacksmiths? Kimmy knows only three - one is a ballad (1), one is suggestive (2) and one is so graphically allusive she wouldn't sing it in polite company(3)! If you do, please send copies to the Editor.

(1) "A Blacksmith Courted Me"
(2) "The Tow Magicians"
(3) "A Lusty Young Smith"

Future Articles:

Stick Tang conclusion
Hardness testers