Norse Woodsmith

Making a Backsaw From Scratch

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The Back Saw Project

This is a project I've been contemplating for a long time, and finally was pushed over the edge when someone told me that it wasn't feasible for a home shop. "It requires a machine shop to be able to pull it off, and a sharpening service to cut the teeth..." I thought to myself, no way -I've done teeth without any fancy machine, and the old time saw makers of the 1800's surely didn't have all access to a machine shop, much less a modern one. I had to prove to myself that I could do it, and am thrilled that I can tell you here that I was successful - and that if you want to make your own back saw, I will be the last one to say you can't.

I've arranged this writing of the steps of making a backsaw into different "chapters" and created an index that would make it easier for those who want to skip over certain parts - or to come back for information on a certain portion of the process. These "chapters" can be accessed either from the main backsaw index, or from the index you see at the left. If you don't see one, try starting over from here and see if that gets you straightened out - or it may be that your browser doesn't support frames.

However - if you are looking for a set of "plans" to build a saw off of - you aren't going to find it. I will try to provide all the information I've gathered and provide some basic patterns that are free to use. The real fun in this project for me was as much in devising the method or procedure I wanted to attempt as it was in executing that method, and I encourage the reader, if you are inclined to make your own back saw, to research what it is you want to accomplish rather than pull it off of a set of cookie cutter plans.

Prototyping

I've always wanted an open-handled back saw, but have been too cheap to buy one for what they are worth, and didn't want one that was all beat to death, either. I made up my mind to give making one a try - but didn't want to commit myself until I knew for sure that I could do it. I started researching it on the web, but found woefully little in the way of helpful information. I did find some early email conversations between modern saw makers on the oldtools discussion forum archive from early in their saw-making efforts - but all of them inserted their blades into a solid chunk of brass that they had milled a slot into using a milling machine (something I will never likely have).

I wanted to make a saw like the old-timers did (before such milling machines). Old saw makers formed their backsaws by bending brass or steel over a blade rather than by milling a slot and inserting the blade into that. I did find a few who had made their own backsaws by bending brass, including one who used all found materials - i.e. used a grain shovel for the blade steel (simply too cool) and it inspired me to give it a shot.

A prototype was in order - so I made myself a makeshift small metal bending brake out of some angle iron, found myself a suitable piece of brass (a door kick plate), and

successfully bent it over a piece of saw steel that I'd cut from a larger saw:

The brass was much too thin to really be of any use, but as a proof of concept, it worked beautifully and convinced me to go ahead and try to make some. As it turns out, after catching a lucky break on a piece of brass on eBay, I had enough to do a governor's dozen (that's 11 - one short of a real dozen), so went ahead and made them. This series of articles will document what I did in the process of making those saws.
First up - what to use for materials.

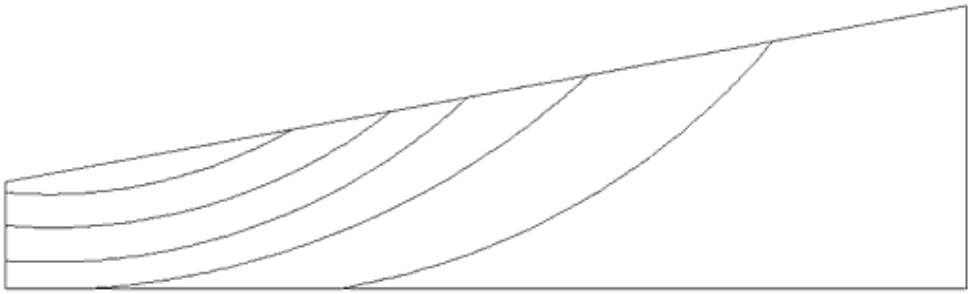
Saw Steel

All of the steel I used in these saws came from old saws that I purchased off of eBay. Don't worry, no valuable saws were in the lot, they were mostly 1960's and newer vintage, and from a variety of brands including Disston, Stanley, Bishop, Craftsman, and no-name Warranted Superior saws. All had good steel in them, from what I can tell...
Here's the first lot of saws that I bought that I used:

And the second lot:

The second lot had a few winners in it that I hung on to rather than cut up, including a WWII era D-8 and D-7 that are in excellent shape, and the top lot included a 100 year old D-7 that I also kept. The rest were cut up for use in these backsaws, at a final cost of about $1.00 a blade. I still have steel left for other saw projects I want to try.

I should talk about the thickness of the blades... Backsaws made today are generally made from spring steel that is about .020" thick. Older standards varied, but were also down to that thickness. The steel in these saws vary in thickness, but are all thicker than .020" - some of the steel is up to almost .040" thick in places. Yes - I said "in places". Older, high quality saws were "taper ground" - this means that after the steel was forged, they were ground down to be thinner at the top of the blade than at the bottom. This is not the case for all saws, and is even rare today than ever (I believe Pax saws are still taper ground). The tapering is not uniform across the width of the blade, though - I saw a catalog that showed how Disston saws were tapered and it resembled this:



The blade, as shown in the diagram above, would be thickest at the right and the bottom, and vary in thickness between .010" and .015" or so. The tapering is done to help keep the saw from binding in its own cut. Many newer saws that you buy today will not have this feature.

I tried to cut what I wanted from the top of the blade, to get the thinnest section possible. I do not believe, however, that the tapering has the slightest effect when you use these saws as material for the backsaws. My main goal was to spend as little as I could.

Added - 10/19 - From a book by Erv Schaffer called "Hand-Saw Makers of North America" - here is what he lists as the different types of back saws:

Type	Length	Blade Thickness	PPI
Tenon	16-20"	.032	10
Sash	14-16"	.028	11
Carcass	10-14"	.025	12
Dovetail	6-10"	.022	14-18

I think the line is a bit more blurred, myself, but still, it's nice info to have...

One other consideration you might have when choosing the steel you want to make yours from is how you are going to cut the slot in the handle for your new blade. If you don't have a saw thin enough, you will end up with a sloppy fit. Too thin (i.e. using a dozuki) and you will have trouble fitting the blade into the handle. I have 5 old backsaws - 2 Disston, 1 Jackson, and 2 "warranted superior" saws, and of them, only one had the right combination of thin enough blade and proper set to use successfully to cut the slot in the handle for the new blade, one of the "warranted superior" saws. The others were all too thick, believe it or not. I don't have a way of measuring anything that fine, so you'll just have to take my word for it, though...
If you are interested in purchasing new steel for the blades rather than mining old saws, McMaster.com offers this:

Spring Steel:
Item #9014K65
Flat Shim Stock Strip Blue Tempered Spring Steel, .020" Thick, 6" X 25"
$ 13.70 Each (at the time this was written).

That steel is tempered blue, but that could be sanded off if you prefer (I've not tried it myself, but I do have it on good authority that it is easily done). RC hardness is listed at 44-51. I wouldn't use anything thinner than that, myself. If you can find polished swedish spring steel (i.e. made by Sandvik) that is essentially what the modern makers use. Any steel you use should be hardened to at least a minimum of 44 (48 and above is preferred) on the Rockwell hardness scale and a maximum of around 54 or so - the harder the steel is, the longer is will keep its edge, but the tougher it will be to sharpen. Too hard, and you won't be able to set the teeth without breaking them.

Added 11/07: I have since made a few saws with the new spring steel mentioned above, and I have to say I like it quite a bit. I think there is an even higher quality available from McMaster, too, but it might cost a bit more:

This is text taken from mcmaster.com site:

Blue-Tempered and Polished 1095 Spring Steel
Made of hardened, tempered, and polished spring steel, this material combines maximum fatigue life with high tensile strength. Material is cold rolled. It can be

machined with carbide tools. Rockwell hardness is C48-C51. Melting point is 2500° F. Not rated for yield strength.

Item # 9075K243
Blue-Tempered and Polished 1095 Spring Steel .020" Thick, 8" X 24" Sheet
In stock at $33.38 Each

There are more sizes available than what I posted above - look at the catalog page on the web that contains that item number (it's not convenient to directly link to it because of formatting issues, otherwise I would). This might make for even better saw steel.

Once the steel is acquired, it needs to be cut to size. The brake I made for bending the back will only handle up to about 10" in length, so that determines the length of blades I needed. For height, I would recommend somewhere in the range of 2-1/2" to 3-1/2", with 3" being about optimum, as this will leave about 2" of exposed blade after the back is installed. More than 3-1/2" and you begin to lose the stiffening quality the back provides, and less than 2-1/2" and there isn't much useable blade left (the backs -at least the ones I made here - are close to 1" in depth). Also remember, that the finished size of the steel blade needs to be about 5/8" longer than the brass back you use for it - for the portion you don't see in the handle.

I'd love to have a metal cutting band saw - but not having one, I put together a makeshift "table saw" using my circular saw with a metal cut-off blade installed:

The saw's base is simply screwed to a piece of particle board. A piece of plywood screwed to the "table" serves as a fence, and I just clamp the whole affair to my bench, as you can see. If you do this, you'll probably need to wear a pair of gloves while cutting the steel, both because of the sharp edges and possibly because of the heat (bigger issue when cutting the brass than the steel). Keep an open pail of water handy to dunk the steel into to keep it from getting too hot. Make sure your fence is aligned properly, and your cuts are true - if not, the blade will want to bind against the steel, which could throw it out of your control (do not stand in line of the blade!) or heat the blade up. You must avoid heating the blade up to avoid "tempering" (softening the steel) the blade. A very little bit of bluing along the very edge can be tolerated, so long as you take the time to file it off if it is on the cutting edge, but do try not to.

Another useful tool is a pneumatic cut-off tool, shown here next to one of my circular saws with a cut-off blade:

It's great for short cuts where the circular saw would be at a big disadvantage, though my air compressor can't keep up with it for longer cuts. In any case - if you use existing saw blades, they will probably need a bit of clean-up, and this would be the time to do the majority of that work as it is more difficult to do once you have the backs in place. I used a belt sander with 120 grit paper for the bad ones, then used progressively finer grit sandpaper by hand until I had a decent enough polish on them - probably stopping at around 400 grit or so at this stage. I'll put a final polish on them after they are assembled but for now, getting any rust off is the most important. Do not use any blades that have been pitted with rust - a bit of surface rust is ok, but the pits will be a detriment to your new saw both functionally and aesthetically (a few won't hurt).

Brass

There are different alloys of brass that vary in hardness - here is what I used, ordered from McMaster.com:
Brass:
Part #: 8956K42
Alloy 260 Brass Sheet (Cartridge Brass) 0.093" Thick, 12" X 12"
$ 21.37 Each (at the time of this writing).

Watch that you get Alloy 260 (or cartridge brass), as other alloys are much harder and you'll have to anneal them to get them to bend. I got 6 backs from one 12"x12" chunk of brass. If you find another source - it does not matter if you buy polished brass, as you'll be beating it silly anyway. Find the cheapest source you can. Some have used brass kick plates off of doors - this is fine, but be warned - first, the kick plate you'll find on sale at the local lumberyards are usually much too thin to use for back saws - you want your brass to be about 3/32" thick (.093") and at the very least nothing less than at least .08" or so. Also - the brass used in kick plates is often very hard, therefore difficult to bend without annealing. With the brass I used, I was able to get away without annealing it at all.
I cut the brass using the same "table saw" set up I used to cut the steel blades. To get the

most useable size out of the 12” square chunk of brass, I set the fence to cut 2-1/4” wide strips - cutting the first strip off, then rotating the brass 90 degrees and cutting the remainder, so I ended up with one 2-1/4” x 12” strip (which I later shortened to match the rest) and five 2-1/4” x 9-5/8” strips. I also had an odd sized piece of brass I got off of eBay that yielded enough for 5 more backs (two 8” long and the rest 10”).

Saw Screws

One of the benefits of using old saws as your source for saw steel is that they are also a supply of saw nuts. All of the saws I made used “recycled” saw nuts. If you want a medallion (like one that says “warranted superior” on it), or you want brass saw nuts, you really have no other choice than to use recycled saw nuts. If you aren’t concerned with using a medallion, then chrome plated “replacement saw screws” are available from acehardware.com at $7.47 for a 10 pack plus shipping.

The final option for saw nuts are split nuts. Old time saw makers used these, I believe, because they could cast them themselves (or get a local blacksmith) out of brass. Structurally, I doubt they add anything, but aesthetically they are very cool. I’ve heard (just heard - purely heresy) that while they aren’t in their catalog, you can order them from Lie-Nielsen at a cost of about $5 each plus shipping (ouch!). You could also get them from old saws - but its not always a good bet that they would still be useable in your new saw (more on this below). You could mill them yourself from brass rod if you have a lathe, or milling machine, I suppose... Or, you might even want to try casting them yourself if you have some interest in smithing.

The advantage of brass split nuts are that you can file/sand them flush with the surface of the handle, and they make for a very professional appearance, though like I said, I doubt they provide any structural benefit over standard steel saw nuts. Older saws you find will often be sanded flush - when they were made, the saws and their handles were not intended to be disassembled - so sanding them flush was a nice solution. Unfortunately, this can also mean that they have been filed or sanded to the point where it is difficult to remove without damaging the brass (and also require a special tool) - which is why restoration of some of these old saws is difficult. This obviously wouldn’t be an issue when using new brass split nuts, obviously.

Materials for the Brake

To make the metal bending brake - you’ll need:

- Three 10” long and two 18” long pieces of 1-1/2” x 1-1/2” x 1/8” angle iron;
- Two 1/8” x 1-1/2” x 18” pieces of flat steel;
- A slug of #8 to #10 sized, 1” long flat head machine screws with appropriate nuts and washers;
- Four fairly thick washers (the thickness of the brass - or you can stack thinner ones)
- A pair of door hinges.

Everything I made the brake from I either had or scrounged from scrap. The iron I used I only had because I had purchased it to make a mobile base for my band saw (still haven't done that, by the way - now I need some angle iron for that project! Oh great...)

Other Special Tools Needed

I've already mentioned the tools I used to cut the steel and the brass, so I won't again here.

Because I don't have much in the way of metal-smithing tools, I did most of the work for these saws making due with what tools I had on hand. There were a couple tools I needed to purchase, though - without which, I doubt I could have successfully made these saws.

The first two tools, and the most important in my mind, are a hammer and anvil. For the anvil, I happened to be in the local Harbor Freight when they had a sale going on, and picked up a "Made in China" 55 lb. anvil for $30. Not a fancy one, mostly because I'm not kidding myself into being any kind of a blacksmith - just need the mass that an anvil like this provides for bashing the backs over the blades.

You don't even have to spend that much. Dad has an anvil he's made from a short chunk of railroad track, mounted to an old I-beam, and it works just dandy.

I also used a 4 lb. hammer. That's right - a 4 pounder. Mine is wood handled, but here is an HF fiberglass handled one that retails for about $9.00 that would also work.

You **need** a 4 lb. hammer to make these backsaws, in my opinion. A smaller one simply won't do - or will yield unsatisfactory results. The larger hammer made bending the brass a veritable breeze in comparison with anything else that I tried. It wasn't that I was swinging that hammer in a wide arc, quite the opposite. The weight of the hammer let me get by with much smaller swings, affording me more control over them - which subsequently meant doing less damage to the brass. Of course, your experiences may differ, especially if you are practiced in blacksmithing.

Finally, if you want to stamp your name into the brass you'll need some lettering stamps. The ones I used are 1/8" tall, and cost about $5. The rest of the tools I used are all standard issue woodworking tools you should be able to find in any good woodshop.

The Choice of Wood for the Handles

Finally, there's the wood for the handles. The saws I made here all use either beech or walnut handles - mostly because that's what I had on hand. Beech is a very good choice for tool handles, as it's a tough wood that's not open pored. Walnut is more aesthetically pleasing, but is a much more fragile wood - there's a much greater chance that if you drop it the walnut will split. I think just about any close-grained hardwood that isn't open pored is a good candidate for a handle - cherry, walnut, maple.

I would avoid open pored woods such as oak, hickory, or ash - not because they aren't strong enough, but because the open pores of the wood tend to collect dirt and sweat, and get very dirty looking after a while. I would probably avoid maple too - just because I personally don't think it would look right. Classic saw makers used apple wood, beech, or for their fancier saws - rosewood, usually Brazilian rosewood. While Brazilian rosewood is in short supply, Cocobolo would be a very nice alternative. I have trouble sawing or sanding rosewoods, though - it seems I'm allergic to them and they make me sneeze very badly.

Bending Brass for the Backs

Now I have the steel and brass cut to rough size… It's time to get to it - and start making some saws!
OK - not quite yet. There's one more step I must complete before I can actually start making saws. I need a way to make the initial bend of the back.

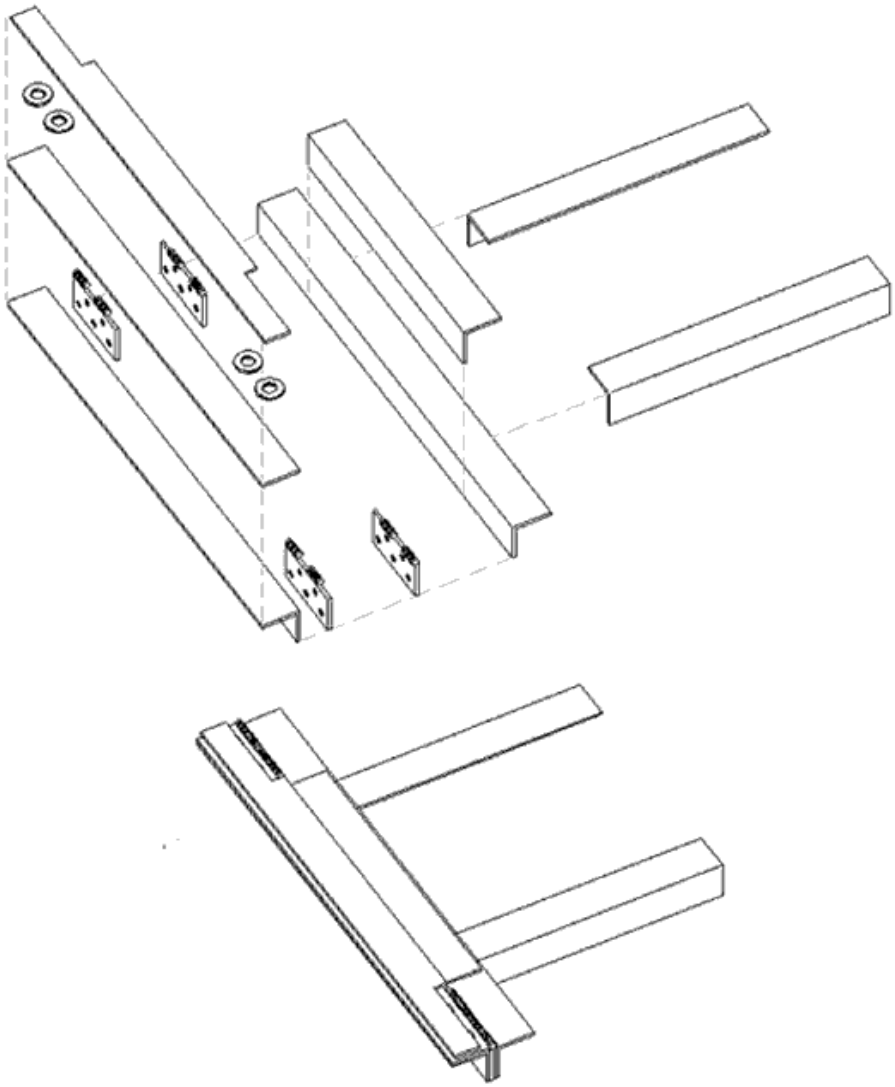
Building a Metal Brake

One of the most obvious requirements of making a back saw is having a way to bend the back over. With patience, and more than a little skill, it could be done with a simple hammer - I've not found this skill, myself. Every time I've tried something similar, the results have been poor - besides, I wanted to make more than a couple saws. The solution is a metal brake made specifically for bending the backs.

I should point out that a brake is not the only solution to bending the brass. You can bend brass simply by mounting it in a vise, and bending it over with a hammer - a piece of angle iron mounted beside it in the vise would be helpful. However - for doing multiple backs (why not?) this brake is very handy, and I believe it also aids in producing

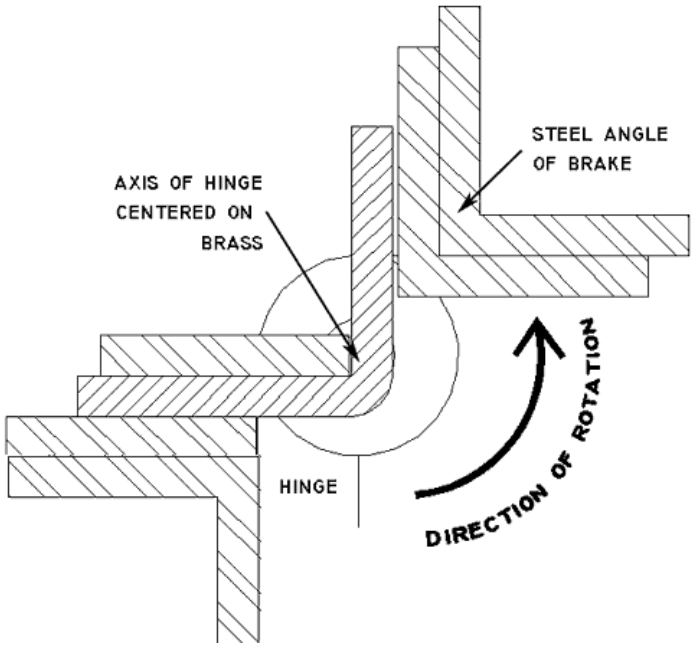
a better quality back - less hammer marks, a more consistent bend, and less chance of producing stress cracks in the brass as it's bent over.

It's a bit of a specialized tool as it's really only good for one purpose, but certainly not a complicated one, saves tons of time, doesn't cost much to make, and produces much higher quality results than a hammer alone. To make one that is effective, there are a couple things you need to realize about a brake that might not seem obvious to someone who has not dealt with one before.
The challenge for me was to build one using only materials I had on hand... I did not want to spend any money (mostly because I didn't have any) - especially for building such a specialized item. I looked at what I had on hand, and lo, it was the iron I had purchased to make a mobile stand for my band saw - a project I hadn't gotten around to yet. Here's a schematic of what I came up with:



The entire affair is bolted together using #10 flat head machine screws, where the head of the bolt was made flush through using a countersinking bit. You'll notice the screws I used are much longer than necessary - that's because that's the size I had on hand. The two sets of two washers you see are to make a space for the brass to fit, with the flat bar above the washers being the piece of steel that the brass is actually bent over. It probably helps to actually see what I'm talking about, so here's a photo of the brake with one of the brass blanks inserted into it, ready to bend (sans the 2 handles, added later):

It might seem to you to be a rather complicated affair just to bend brass - but trust me, there is a method to the madness. You see, the trick to successfully bending is to make sure the bending point of the brass will be centered on the turning axis of the hinge, such as shown in this diagram:



This configuration allows one to bend the brass easier, with more consistency, with less damage to the brass itself, and allow me to bend the brass a full 180 degrees, leaving only the thickness of the steel it is bent over. I can later use a hammer to close the brass completely over the saw blade. Many bending brakes cannot achieve this - getting you only about 120 degrees of bend, leaving too much hammer work, which means more potential for damaging the brass (at least for me).

OK - this next part is tough - I don't know if I can explain the building process for the brake adequately, but want to explain some of the reasoning behind it at the same time, so I hope it doesn't come off sounding like gibberish.... Please refer to the schematics and photos above (and also some of the photos that follow where I'm explaining the bending process) for help in clarifying some of the rambling that's about to happen.

The finished length of the brake is about 18", and it has the capacity to bend a back of about 11 inches in length. I can't recommend making one with a longer capacity without beefing up the steel quite a bit. This one, working at it's own full capacity, is probably at more than it can handle without damaging itself.

The angle iron is 1/8" x 1-1/2" x 1-1/2", the flat iron is all 1/8" x 1-1/2". I started by installing a pair of standard 3-1/2" door hinges onto two lengths of angle iron, letting the hinged portion protrude past the iron the same as it would on a door. I added 3 screws through the hinge and iron to help stiffen the hinge a bit; you'll notice it in subsequent photos.

A second 11" angle iron is added on the right angle iron, between the two hinges to raise the "bed" of the brake so the brass can be positioned where it is bending on the axis of the hinges. This has the added benefit of stiffening this portion of the brake - and thusly will make a good place to install the handles. Without stiffening this angle, the brake will not be strong enough for it's own good. The handles are just 2 lengths of the same angle iron, and are attached with a minimum of 3 machine screws, through both angles and the "handles".

An 1-1/2" piece of flat iron is installed on the top of the left angle iron to raise the "bed' on that side of the brake, then another 1-1/2" piece of steel on the top of that again. This last one separated from the previous with a stack of washers that add up to the thickness of the brass I am using, and this is where the brass is inserted for bending as you can see in the photo above. This top bar is centered vertically on the hinges axis, but held back

from the center horizontally about ½ the thickness of the brass, so the brass that is being bent is actually centered on the axis see the last diagram, and the photo below:

Here you can see the handles are installed with two screws. Wait - didn't I say to use a minimum of three screws to attach the handles? Yup. I did. I know why I said that, too. I also cut a couple notches in this last flat bar, so I could center the bending edge on the axis of the hinge - you can see those notches in the photo above by the hinges, and you can also see how it is centered on the hinge fairly well.

Just for clarity - here's a shot of the brake opened up from the other side:

Notice the added screws in the hinge to stiffen them. On to bending some brass!

Bending the Brass

Finally!
Let's try this thing out...

Mounting a brass blank in the brake, I place the whole affair into a machinist's vise. The vise will allow me to make the initial bend, and strengthen the brake so the steel flat I'm bending the brass over doesn't bend itself. I had to make sure the brass was centered so the edges would meet when the blank is bent - and remember to allow for the slight radius of the center.

You'll notice in these photos that I hadn't mounted the handles yet, and was just levering them against the screws that stuck out the back... A few broken screws later, I mounted the handles permanently. Wait - didn't I say to use three... Oh, yeah. Covered that already. USE THREE SCREWS!!! You know, if I say it enough times...

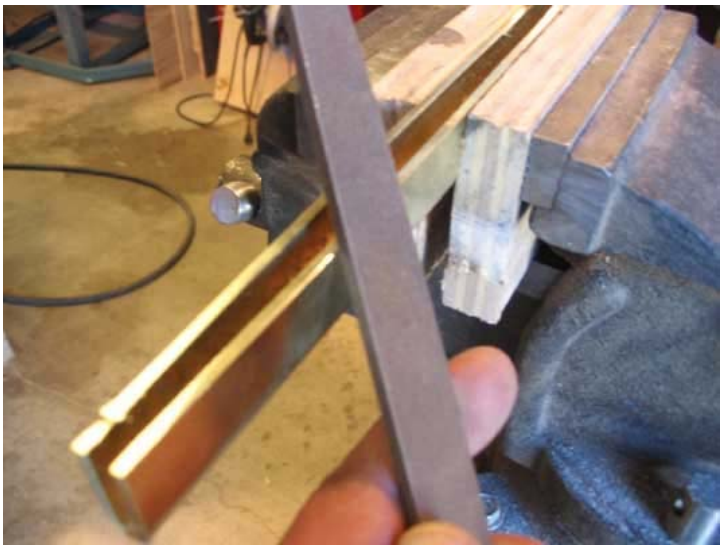
This first bend will only get the brass to about 90 degrees, as shown in the photo above:

I then take the whole affair out and remount it, turning it 90 degrees in the vise so I can finish the bend. Because I've got the initial 90 degree bend in the brass, the flat steel bar I'm bending it over is now in a position where it is strong enough to withstand the bend without bending itself, whereas before I was depending on the vise to keep it from bending.

The final bend gets the brass to a full 180 degrees.

Tapping the freshly bent back out of the brake, here is what I end up with (on left):

I hadn't gotten all of the edges quite even, but not to worry - it can be fixed. The ones that were really bad I could run through that make shift table saw I cut the brass with initially. A bit tough going, being I now had to cut through



two thicknesses of brass, but thankfully it was only one that came out poorly enough to require it. On about half of the remaining, I used a disk sander to even up the edges:

Of the ones that remained after that - only a little straightening up was required, which was done easily enough with a large file. I also took this time to clean up all of the backs, filing away the sharp edges and burrs left behind from cutting it (including the inside of the bend). In reality - if the edges are just a little off from each other, it isn't too big of a deal, it just looks a little nicer, and makes mounting the blade into the handle a bit easier.

The backs are now ready for the blades to be mounted into them. About time, huh?

Inserting the Blade Into the Back

Here is the meat of most of what is needed to make backsaws - and what I found the least information on. With hindsight - I guess that could be because it really is a very simple concept, and I was thinking entirely too hard about it. That happens to me a lot...
In any case, I think it will interest some if I explain some of what I did to arrive at my final, chosen method. It might not, either....

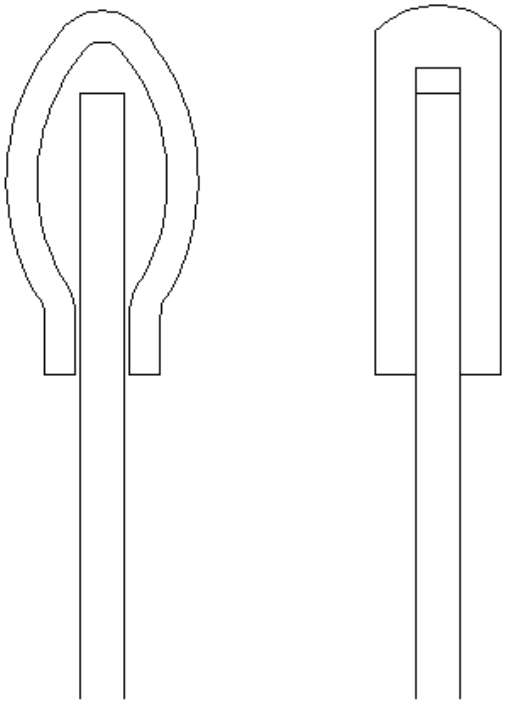
Different Methods to Choose From

I did a **lot** of looking for info on attaching brass backs. The only real information I could come up with came from two camps... The first information I found was a series of discussions archived on the web between some modern saw makers when they were first looking into making backsaws and seeking advice from other modern saw makers. These makers mostly have one thing in common - they make the backs for their saws by milling a slot out of a single chunk of brass using a slitting saw in a milling machine of some sort. Most epoxy their blades into place, and some even pin together separate pieces of brass to make the back.
The other information I found was the folding the back over "camp". This was the philosophy I decided to follow, but by making a brake first to aid in bending the brass (see previous section on bending brass).
Digging out my out my old back saws - I confirmed this was the way they had done it:

Top row - a 10" Jackson, then a 12" and a 10" Disston. The bottom row is two "Warranted Superior" nameless saws. They are all steel-backed saws, not brass - but all are folded over the blade, not machined. My guess is that you'll find most 100 year old back saws you find will be of the folded variety. I've known others who have repaired bent old backsaws by removing the spine to straighten it - so it stands to reason none of them glued or pinned into place.

Experimenting With Methods

Even having decided on which basic philosophy to follow, there were still questions on how to proceed. Looking at my backsaws - I could see differences with how they were done. Some were done by pinching the blade by forming the back into an "ankh" or elliptical shape, such as with the 2nd Disston above, or as I show in the first diagram below (slightly exaggerated for clarity):.



The second method, shown at right, is to flatten the entire back over the blade. There was also the question of whether to flatten the back over the blade, or to flatten the back first and insert the blade into it. While the real reason for the back is to stiffen the blade so it stays straight - there's no reason that either wouldn't work, so long as it adhered itself to the blade well. It was about this time that I was contacted by another woodworker who was tackling the same project (Andy S.), and we discussed our different experiences in attaching the backs. It was great to have someone to talk it over with, and he had some great ideas on how to proceed. He was considering the following method (I'm taking these segments straight from our e-mail conversation, as I think he explained it much better than I could):

- File a small chamfer on the inside edges of the back-to-be. As in, the two edges that will be closest to the saw blade.
- Bend the back
- Crimp it shut sans blade. As in all the way shut, as in gee, there's no gap left.
- Mount blade in saw vise with ~3/4" of blade exposed.
- Tap back onto exposed ¾" of blade (this is where that chamfer from Step #1 comes into play) using small ball peen hammer."

Then, when I questioned him further about how he hammered the blade into place: "We're talking about a **gentle** installation of the back onto the blade. I used a 4 oz ball peen and couldn't see any damage when the blade was installed. Furthermore, I filed the top of my back square after the installation. As far as the "pry open" concern, I found

that when the crimped back was forced open 0.020-0.040" (the blade thickness) it served more as a spring to hold the blade. My assumption here is that the bending of the back cold works the brass, thus increasing its stiffness and strength. Prying the back open a mere 0.020" sets up a residual stress that serves to hold the blade more tightly. If you do it this way try removing the back along with a back that you hammered onto a blade for comparison. I found it was noticeably more difficult to remove the "pre-crimped" back. Give it a shot."

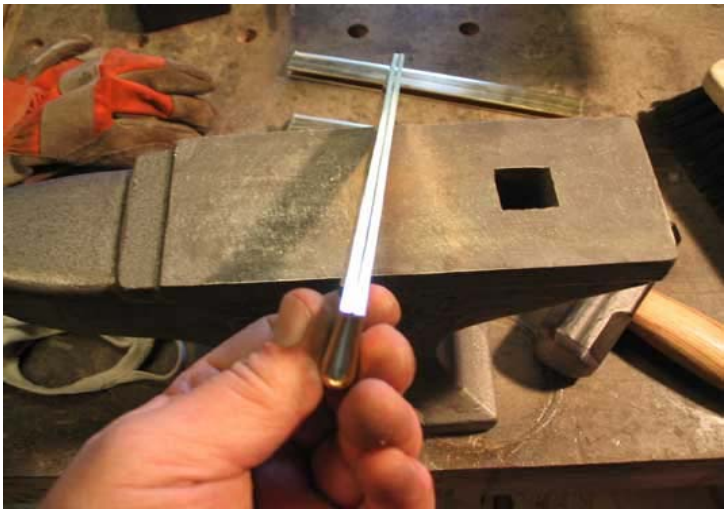
That all sounded very reasonable, so I did give it a shot. I didn't have as satisfactory results as Andy did, having had better luck hammering the back straight down onto an all ready installed blade. When I tried his method, it seemed to me that I ended up just driving the sides apart, and the opening at the edge of the back just got wider the deeper the blade went.

I honestly think that without being able to be right there beside each other to see exactly what the other was up to, variations in how each of us did it could have produced different results. I think that's important to point out here - if you, the reader, think that there must be better ways - you could well be correct - so experiment. But, since I'm writing this, and you're not -

What I Finally Did That Worked Best for Me

I found I had more success with hammering the back onto the blade, and then hammering it as flat as possible. At first, using too light of a hammer combined with my inexperience led me to hammer the brass too hard, leaving hammer marks that were difficult - nay impossible - to get out completely without thinning the back too much. A 4 lb. hammer, bought at Harbor Freight for about $6 on sale, did the trick much better. An anvil completed the package, giving me something with some weight to work the metal against:

I had to be very careful that I brought the head of the hammer straight down on the brass, centering it right at the top of the back at the center of the radius of the curve, just like you see in the photo above. The mass of the large hammer made this easier, allowing me to lift it only about 4" or so above the brass, and bring it straight down. I worked the entire length of the back without the blade installed at about one inch increments, from front to back, flipping it over working the other side - then starting over again until the back just starts to close up, like in the photo below:



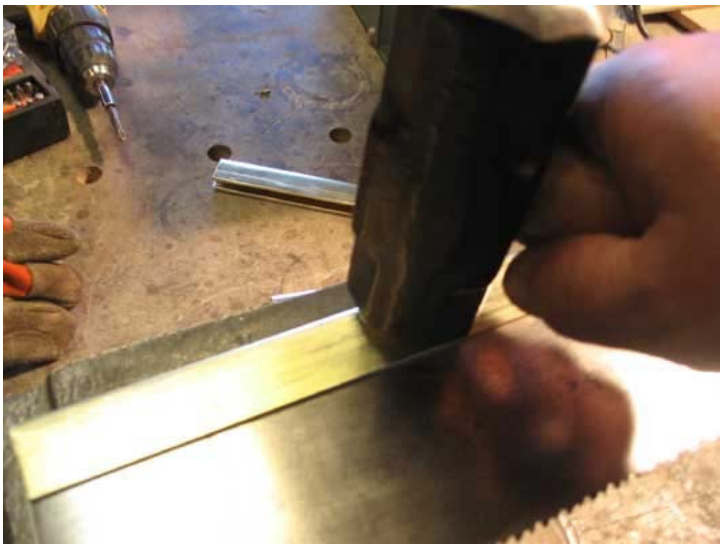
Notice the opening is straight for it's entire length... If you aren't careful, it's easy to introduce a bend into the brass that can be difficult at best to remove. It's best to try and minimize this by working slowly, keeping the bend as uniform as possible.

Next, I place the blade into my vise (with some plywood cauls to help prevent marring the sides of the bade), and slide the back onto the blade. It's tight enough that it requires a small hammer to tap it all the way home (the teeth in the blade shown were just left over from the saw that I got it from so please ignore them - I later removed these teeth to file new ones, much finer):

Which reminds me - it's best to have done the majority of the cleaning of the blade before you get to this stage, as it will be more difficult to clean the blade with the back installed. Did I mention that before? Must be important...

Back to the task at hand - if in the last step, the back goes on tight enough, this might even be a good place to stop and call it good enough. I did this on a couple of the saws I made, and they seem fine. That wasn't the case with this one, though, as with most. You can see in this photo the stage it was at:

While it stayed on the blade, I could easily pull it off with just my hand - not good enough for my purposes. I started the same process as above, where I was hammering the bend of the brass (but this time with the blade installed) to tighten its grip on the blade - again, in 1" increments, on both sides of the blade until it held it firmly: Occasionally, as the back bent, it was necessary to tap the blade in a bit so it remained fully seated.



This part is very hard to explain, as it's more about the feel of the hammer as it comes down on the blade. You reach a certain 'happy point' where it all seems to come together. I did twelve backs, total (screwed one up, so only eleven saws were made) and I was happy that I had plenty to practice on. By the last one I was really starting to "get it", and the work was coming out much quicker with much less work to remove the hammer marks. You have to work patiently and not forcefully, but not necessarily timidly either.

I can't stress the importance of the anvil, either. The one I screwed up was one that I was working using the "anvil" on the back of my machinist's vise. I was having a heck of a time getting it straight, and eventually produced stress cracks in the brass from working it too much. Eventually, I learned that it really didn't take nearly as much working as I had originally thought it would and that in fact - the less I worked the brass, the better.

Here you can see an end view after I've flattened for it's entire width over the blade:

There it is - the back is installed. However - no matter how careful you are, there is bound to be some damage done by the hammer or bending or what not that you've done to it by this point:

You can kind of see some of the scratches that were made by the brake in the bending process, but what you can't see is there is just a bit of waviness that's been introduced into the brass during the hammering process. The best way I found to clean up the blade is using a belt sander, clamped upside down onto my bench. For really rough work, a 36-grit belt removed material quickly, but leaves too coarse of a finish. It's best to work that up to at least 120 grit belt (toward the end, that's all that was necessary) to get it to a fairly nice "brushed" finish:

You can see some of that waviness I'm referring if you look closely in the reflection of the light, at the top and just to the right of center of the back in the saw above.

While you're sanding the back, the brass can get pretty hot - it's a good idea to keep a bucket of water handy to cool the blade off with, so it doesn't get too hot and begin to lose it's temper. Keep a towel or something handy to dry the blade off with when you're done, because you don't want the blade to start rusting again! For underneath the back, it's not as important to keep the steel from rusting a little bit. It might even be a good thing - a little bit of rust might help hold the blade in place.

Once I get the marks worked out, I sand the back to about 220 grit. That brushed finish that's left is not the final finish, however, but it's good enough for this stage, as there is still lots of work to do to the blade, with many chances to mar that finish. Therefore, once the hammer marks are worked out of the brass, it's best to leave that final finish until later.

There's one last step to shaping the blade, and that's cutting it to length. The final length at the back needs to be about 5/8" (** see below for comment *)* longer than the back to allow you to attach it to the handle with enough blade left to hold the screws. I also cut off a slight angle right behind the brass to fit the handle better, angled down slightly to the approximate location the blade will protrude from the bottom of the handle:

Added 10/6: Again, I've had the opportunity for others to use these, and have had the comment that the blade should be closer to the handle. The way to accomplish this is to make the final length at the back needs to be about 1" longer than the back rather than 5/8" as stated above, then cut the blade at a steeper angle (closer to 45 degrees) where it fits into the handle. You'll need to account for this steeper angle when sawing the slot in the handle that accepts the blade.

It's a good idea to file off any burrs that are left over from cutting off the blade, and the other end of the blade. I'll give it some finishing touches later.
The blades are now ready to be installed into handles and sharpened...

Handles

Well - what's the sense of going though building your own back saw, if you don't spend some time looking for the best possible handle you can get? I could have made one up myself, but what makes a good handle was as true 150 years ago as it is today. Saw making as an art was at its peak between 1850 and 1920, and there were hundreds of makers with many, many different handles, so I undertook a bit of a search to find one I thought was just right.

Choosing a Pattern

The first pattern I looked at was on disstonianinstitute.com's web site - an open handled saw made by Disston. I liked the basic lines of it, but I've handled older saws that are a bit more comfortable than Disston's. The main feature about the saws I found more comfortable was a small "hump" in the middle of the handle where it fits into the palm of your hand.

I found a handle of a saw made by J. Buck around 1900 or so on Bob Brode's web site that I thought would be perfect. To properly size a handle, the best way is to make a test blank to see for sure it it's the right size. Using Photoshop, I resized the photo for about 5 different sizes, and then I chose 3 that covered the gamut of sizes and band sawed out 3 blanks to try for size. The one I ended up choosing was smaller than I imagined, but fit my hand quite nicely. It's only around 5% larger than the handles of the Disston saws I have, which surprised me - I thought it would need to be much larger. It seems it only requires the smallest change in size to make huge differences in how a handle feels.

With that mockup in hand - I grabbed a blade for a saw (before it had a back on it), cut a slot in it to hold the blade and tried it to see if I liked the angle of the handle in relation to the blade. I'm glad I did, because it was much too severe. It's been mentioned that if you point with your index finger while holding a saw, it should point directly at the middle of the saw. This makes sense, as the handle should be holding the saw basically at a right angle to the work.

I checked the Disston pattern, and it was not severe enough - at least to me. So, I went back to the Buck pattern I had, and in Photoshop, changed the angle so it was roughly half way in between the Buck pattern and the Disston pattern. Here is what I came up with:

It retains the handle of the Buck Bros. saw that I like, yet the angle is more appropriate to my needs. If you wish to use the same pattern, the one above should suffice - right click on it and select “save image as” and save the image to your computer somewhere, and print it off with a graphics program such as Paint or Photoshop. If you print it directly from your browser, it may not come out at the proper size, which is 7.319” x 4.806”, or 527 x 346 pixels at 72 dpi.

Added 10/6: I’ve since had the opportunity to let others use some of these saws... most seem to agree that the handle is a bit too big. If you reduce the graphic above about 5% (or make it 500 x 328 pixels at 72 dpi - or 6.94” x 4.56”) it will make it about the same size as the handle is was originally patterned after. My hands are large by comparison to most others, which is the reason the larger size feels comfortable to me.

Here's the smaller version:

Also - the swoop of the handle at the bottom back can be "shortened" (for a lack of a better term) - this has the same basic effect. My best advice is to try it with a couple scraps first. Remember, a rough sawn blank like the one in the photo below should feel just a bit small and constricting in your hand. Rounding over the edges has the effect of making them feel a bit bigger, too.

It was off to the band saw with me to cut the pattern. I left the portion that attaches at the blade for later, so I could make sure that I had enough wood there for the screws that attach the blade to the handle, and so I would have some extra wood to cut off after mortising out the slot for the blade:

The grain of the wood in the handle needs to be oriented to there is a straight run of grain through the thinnest part of the handle, like you see in the photo above.

Mortising the Handle for the Blade

After band sawing out the blank, the next step is to mortise the handle to accept the blade. First, using a marking gauge, I mark the center of the handle where the blade will be - all the way around. I'll also be using it later to help guide my saw cut for the blade - bur first comes the mortise for the back.

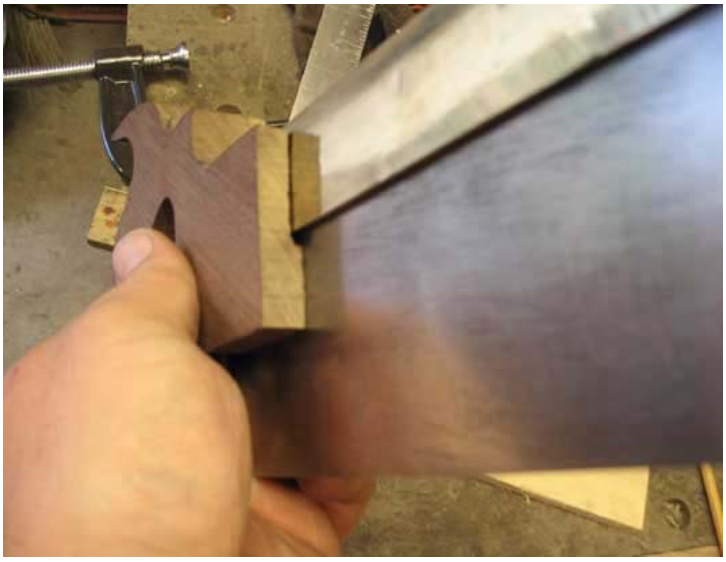
I use a wood clamp to hold the handle steady and perpendicular to the drill press. A brad point bit that is a size smaller than the thickness of the back is used to drill holes to a prescribed depth - I hold the intended saw blade up to the handle to mark it's depth, then use the depth stop on the drill press so the holes are all uniformly deep:

After drilling the holes, it's over to the vise where I used a combination of different sized chisels to pare out the remainder of the slot:

I don't pare it completely to finished depth yet - it will be better if I can use the intended blade in the slot to get it to individually fit the blade into it's intended home. To do that, I need to cut the remainder of the slot for the blade.
An important note: the width of the saw you choose to cut this slot is important. I have 5 backsaws, and only this one was thin enough to cut the slot so it wasn't a sloppy fit. This would be more of an issue if I were using thinner blade stock than I was... Remember, it's also not the thickness of the blade you're using - it's the thickness of the kerf it cuts. Test it on some scrap first.

The photo to the left shows the depth of cut I made. You can use the intended blade as a guide, drawing its profile on the side of the handle blank at its desired location, and sawing to the depth it indicates.

After that cut is made, I can start fitting the blade into the handle:



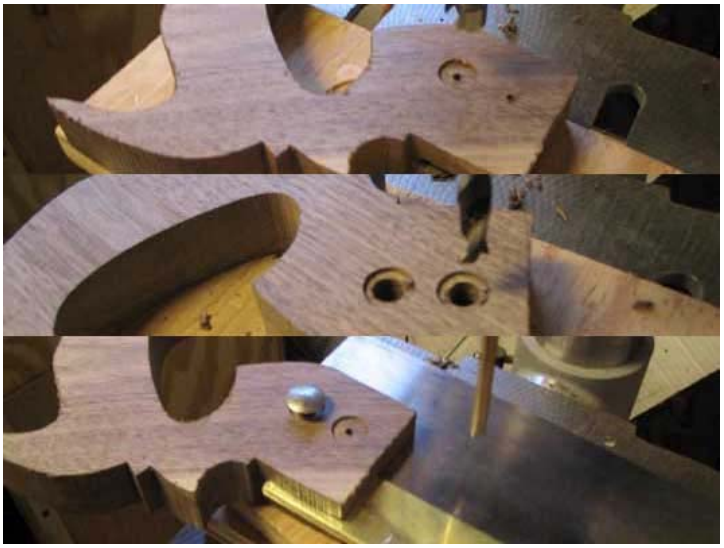
As I insert the blade into the handle, it begins to bind against the sides of the mortise, so I pull it out and pare more wood away until it slides in snugly. You can see in the mortise where the blade is binding on the wood, as it will be compressed slightly, and a bit darker. Be careful and don't force the blade into it's slot, as the way the grain of the wood works in this area it makes it easy to break off the corner, making the handle a complete waste. If I needed to make the slot for the blade wider, I simply used folded up sandpaper.

Drilling Out for the Screws

For the saw nuts/screws, mount the blade into the handle and draw a line parallel to the brass back, but just below it about ¾ of the thickness of the screws you have chosen. The screws should not go through the brass, only the steel of the blade. Each one seemed to be different, so I just used each set of screws to help me determine their location by placing them next to each other on top of the blank, and use an awl to mark the centers of the screw locations.

There is a certain order that these holes must be drilled, so that each subsequent hole can be centered properly within each other. The first hole is only a guide for the rest of the

holes to be drilled, and is made only through the handle (not the blade) using a 1/8” or smaller bit. The next procedure is to drill the recess for the saw screws so it mounts flush using a forstner bit. Measure the width of the saw screw head and if you don’t have that size of forstner bit, use the next size smaller (shown as the top part of the photo below). When it comes time to put in the screw, if the recess for the head is just barely smaller than the screw head, it may be small enough of a difference that the screw head will simply compress the wood enough not to be a problem. Where the recess is still too small, and the head of the screw or medallion don’t fit into the recess, I mark the area around the used a gouge with a smaller diameter than that of the screw head or medallion and carve out the difference until it did fit. Another option might be filing down a spade bit until it is the right size, or using an adjustable bit for a brace in combination with a forstner or brad point bit.
The next hole is for the nuts on the backside of the saw (see the middle part of the photo below) and is drilled only half way through the handle using a brad point bit.



For the last hole I mounted the blade and got a standard high speed steel bit the width of the screw that I was using for the handle, then drilled the first hole through both the handle and the blade. Then, using a screw to make sure the blade didn’t move and misalign the hole (see the bottom of the photo above) I drilled the final hole.
Before I can insert the screws into the handle, I need to square up the holes to accommodate the square portion of the saw screw, which is there to aid in tightening it up, stopping it from turning in the hole:

You must not skip this step. If you try to force them, the handle will crack - almost guaranteed.

When the holes are all drilled, I test fit the handles:

Don't over-tighten the screws yet - you need to be able to take the whole thing apart for the next step. You shouldn't tighten the screws fully until you are sure you will never have to take them apart again. This is a good time to make the final cut on the band saw - the portion just below the nuts. You can see the pencil line in the top saw where I was to make that cut.

Forming the Handle

The remainder of the handle is formed using some very basic hand tools:

Rasps and files, followed by sandpaper. Some people will look at this stage of the project as drudgery - but I find it the most exciting. It's during these sessions that you start to discover some of the old "tricks" of the trade, many now lost to time only to be rediscovered accidentally by the occasional woodworker engaging in pursuits such as these. Don't worry, I won't wax philosophic about that crap, I'll let the reader engage it on their own.

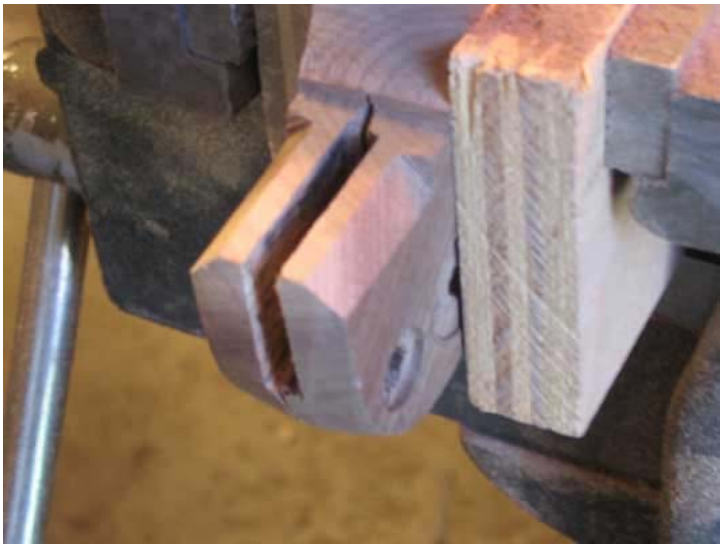
The first round in shaping the handle is using the coarsest rasps to remove the most material, as above. I like the light from a north-facing door to help me see the contour develop. One thing to watch out for here is spelching (yes - that is a real word! - I'm just not sure on which planet...). Spelching is basically where the end grain is crushed - where it may feel smooth, it has that "messed up " look to it. It's caused by using too much pressure and not removing enough wood with the file to cover the damage done with the rasp. I tried to get a photo of it, but couldn't get a satisfactory one - but if you use a rasp, it is something you know about.

After the rasps, files are used to finish out the shape and smooth the coarse cuts left by the rasps (and spelching, hopefully!). The process is continued on both sides of the handgrip. After the grip is formed, I add a few small details, like rounding off the bottom of the handle where the blade protrudes:

You need to be careful not to cause tear out - use the file from each side, working towards the center... Hey! Is that one of those "old tricks" mentioned above?

I also use a file to create a pair of reveals at the top of the handle where the back protrudes (photo on left)

Why were these put there? Mostly in case the slot for the blade was off center. Putting a reveal like this would make it less visually apparent. Another "old trick"!



When finished shaping, I sand the handle starting with 80 or 100 grit sandpaper, finishing with 150 grit if I want to do any carving on the handles, or 220 grit if I don't. If I'm not going to do any carving on the handle, it's ready for the finish, which I'll cover in another segment.

Adding Teeth

Something that I've never found much information on is cutting new teeth on saws. Most will tell you that you either need a machine, or to take it to someone who has a machine to cut new teeth - I'm here to tell you it ain't so. I've made teeth - *from scratch* - on dozens of saws *without the use of an expensive machine*... and it's not that hard to do.
A great reference site on saw sharpening (existing teeth) does exist on the web and is available at http://www.vintagesaws.com/cgi-bin/frameset.cgi?left=main&right=/library/library.html. Most, if not all, of the sharpening procedures are covered on that site, some maybe in more detail than what I do. I will also cover some of the basics of saw sharpening well enough to do a good job, using my experience, from a "what users need to know" sort of perspective. But it certainly never hurts to check out other references for additional perspectives.
An important note - sharpening saws is pretty much impossible to accomplish without some sort of a saw vise, be it iron or wood. If you buy one, avoid the no-name steel versions and go for the classic cast iron ones from companies such as Disston or Wentworth.
Should you decide you would rather make your own - an excellent plan for a wooden saw vise is available on The Cornish Workshop's web site. I've used both cast iron and wooden saw vises, and each have their respective advantages and disadvantages. I've found that both types work well, and I personally don't prefer one to the other.

Less than a week after I first wrote this, my Disston model 3D saw vise went the way of the dodo, developing a crack that essentially renders it useless. Not having another handy - I looked closer at the plans mentioned above. While it would work great for standard saws, it would not work at all on backsaws without a great deal of modification. I decided just to buy another old Disston rather than try building a wooden one.
Added 11/04/04 - Jasper Homminga has contributed a small article on making a simple wooden saw vise - available on this web site HERE.

Some advice for those who haven't done much sharpening, or have only sharpened larger saws - go slowly and use a light touch until you get the hang of it. Even then, not all days are good saw sharpening days. There have been many instances for me while sharpening saws where I just about gave up in frustration because I just couldn't get the teeth to come out right - it took a little time away from it to get some perspective. Teeth as small as these are can be difficult to get right without some practice.
I've also found that a magnifying light is of great help when doing such fine teeth.

Joint the Cutting Edge Flat

Using a large flat bastard file, I straighten out the cutting edge of the blade. It's important that it be both perpendicular as well as straight, otherwise the teeth won't be on the same plane. To accomplish this, I use a square scrap of wood to guide the file along the saw blade, as is seen in this photo:

Commercial versions of file holders were made, but I've never owned one. I know my dad has one tucked away someplace - I've always gotten by with a simple scrap of wood. I wouldn't mind having one, though.

Marking the Teeth

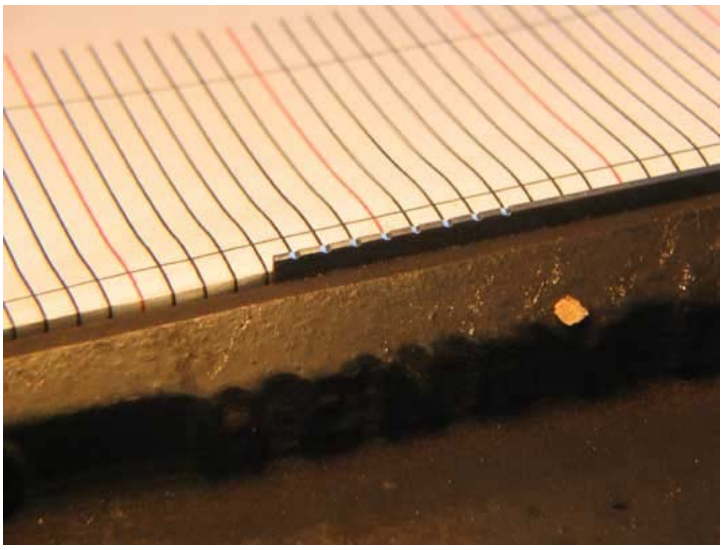
I use a cad program to draw a set of lines that are spaced at the correct number of Points Per Inch (PPI) that I want so I can print it out to use as a reference. This can also be done with a square and a tape measure (using measurements on the tape, like 1/16" which equals 16 PPI), or if you have another saw that has the number of teeth you want you can use it as a guide.

In case you have no other options, I have made up some jpegs that have lines at the number indicated (pictures like the sheet you see me using in the photo below) that might do the trick. Right click on the following to download the one you want (warning, 130 to 190 Kb each) and print them off - the size of each jpeg is 7" wide by 10" tall at 150 dpi - using a graphics program such as Photoshop (I believe Microsoft Paint will work as well). If you print them directly from your web browser, you might not get the correct size - you should double-check it in any case.

Links to files in PDF format:
11 PPI
12 PPI
13 PPI
14 PPI
15 PPI
17 PPI
A guide for fleam:
25 Degree Guide

I mount the paper in the saw vise directly next to the saw blade. You could also use some spray adhesive to mount the paper directly to the saw blade, if that helps you. When done, a rag dampened with mineral spirits should dissolve the adhesive and clean it and the paper from the metal.

For me, at such a small scale, it's usually best to start out by simply marking out the locations of the teeth using an old file. Hold the file so one side is perpendicular to the blade so you can sight along side it to match the lines in the paper:



The photos I'm using are for a 9 PPI blade; so that you can see what I'm doing better than if I used the actual photos from the 15 PPI (or so) blades sharpened for these backsaws. The process is the same for either, however.

If you have difficulty in using a file, a hacksaw blade can also be used for this step. Its thinness allows you to see the lines more clearly. Really, all you need to end up with is something that can guide the start of your file in the next step.

Sizes of Files Used in Sharpening Saws

This is taken verbatim from vintagesaws site - I have no reason to quarrel with it:

File Type	PPI of Saw
7” Regular Taper	4-5.5
7” Slim Taper	6,7
6” Slim Taper	8
6” XSlim Taper	9,10
6” 2XSlim Taper	11
5” 2XSlim Taper	12-14
4” 2XSlim Taper	15-20

Absolute adherence to the above is not necessary, just recommended. You should try to be close, though. Too large of a file for too small of a tooth can lead to problems with the file being too rounded at the corner to be effective, and the opposite can waste a file by using too much of its side up, dulling it when you try to use another corner of the file. I find I can use a file for shaping teeth for quite a while, but for final sharpening it really pays to use a nice sharp one. For teeth finer than 16 PPI, you can also look into using a needle file. I’ve not done this, but others have reported success to me using them.

Files less than 6” long can be difficult to find in your local hardware store. I’ve had good luck getting them from Lee Valley, Highland Hardware, toolsforworkingwood.com, and of course, they are also available from Vintage Saws.

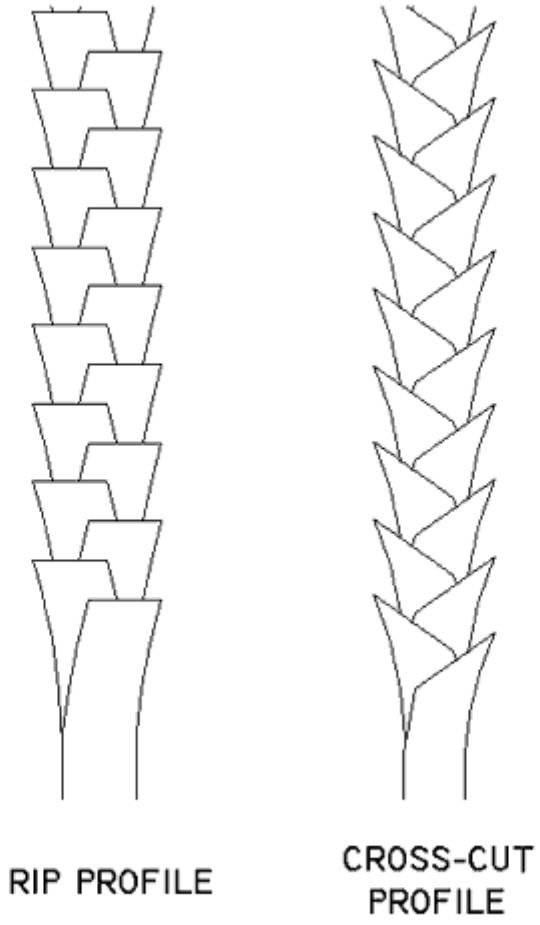
Shaping the Teeth

Because the teeth are so fine, I have real difficulty in sharpening anything finer than 15 PPI - but personally consider anything much finer than that unnecessary. I also prefer a pretty aggressive cut too - I will try to point out what makes a saw cut more or less aggressively.

Even though its still early in the process, its a good idea to file the teeth using the rake angle geometry you want to end up with - either a rip or a cross-cut profile. These are two distinctly different styles of teeth, and you need to decide now what you want. Rip saws are for sawing along the grain, crosscut are for across the grain. Rip saws are somewhat easier to file for a beginner, but get a few crosscut saws under your belt and you’ll wonder why you thought they were so difficult.

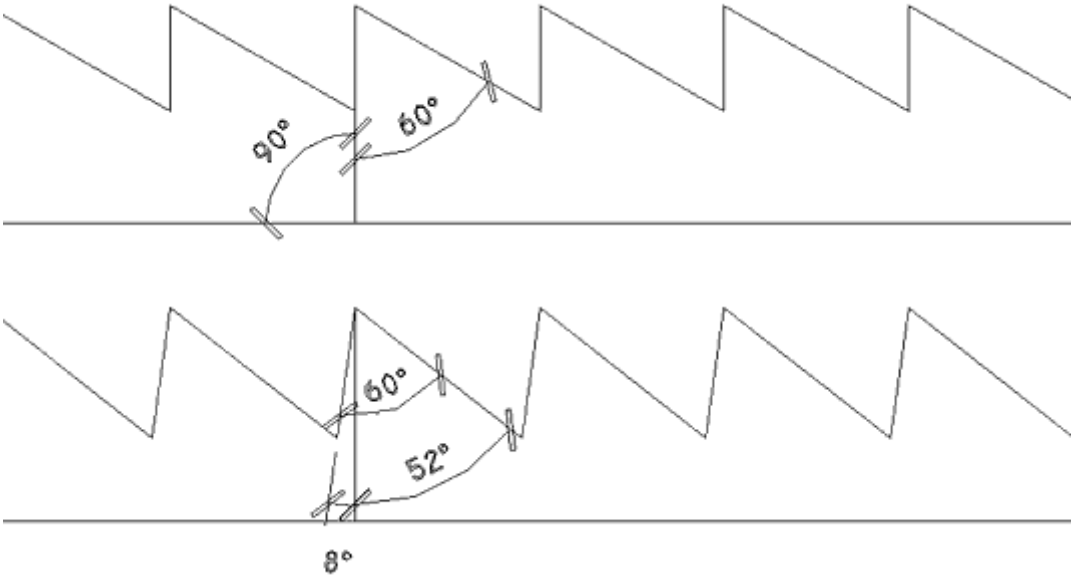
Since the saws being made here could be used for either purpose, I’ll discuss both. A fairly recent “innovation” is that dovetail saws should be filed rip, since that is the direction in which they were cut, and recently more and more dovetail saws are being sold in this configuration. This was not the case when I was learning - a crosscut profile

was considered to be more useful than a rip, because while you can use a crosscut saw for short ripping functions (albeit slower), the opposite is decidedly not the case.
This is because a rip saw leaves a much rougher edge than a crosscut saw - you can get away with this when sawing with the grain, but not going across it (it's for much the same reason you need knickers in a dado plane, but not in a rabbetting or grooving plane). Using a rip saw invariably means you must use a marking knife of some sort to cut the edges of your dovetails - or use a backer - before you saw them, else you will get a ragged edge on the back side of the cut. The chance is less so with a crosscut saw, because the teeth act more like knives than the chiseling cut of the rip saw. Here, you can see what the differences are in the two types if you were to sight down a saw from the end:

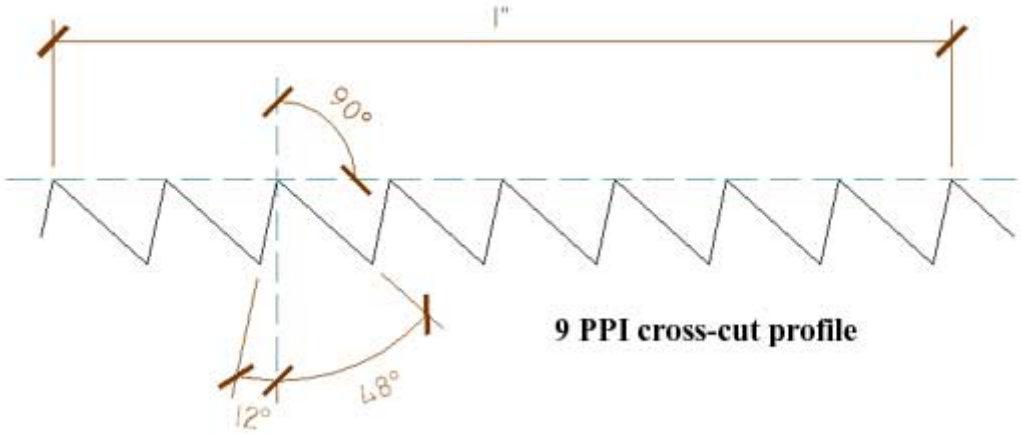


Dad always told me that you could slide a needle down the valley that forms between the teeth of a well-sharpened crosscut saw. I say this just to point out the slicing cut that it makes. Personally, I have used each for cutting dovetails - and I can't say I prefer either

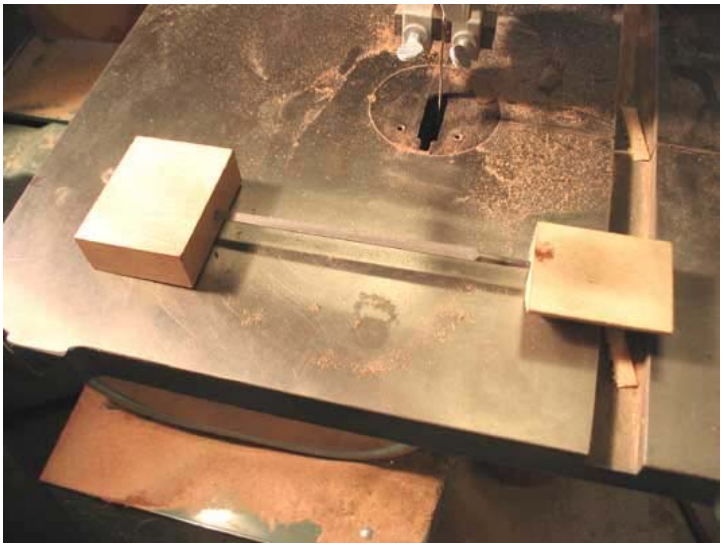
way. Regardless, a crosscut saw is needed for making some shoulder cuts for tenons, so having one of each seems like a good idea.
For rip teeth, you can use the following as a guide for setting the rake angle (note, the heel - or handle - of the saw would be to the right, and the toe - end - of the saw to the left):



The top one is the more aggressive pattern, which can be more difficult to use if you're not as experienced with hand saws as you'd like to be. If starting cuts is an issue with you, you might consider the lower diagram (or something between the two), which relieves the angle of attack slightly to make for a less aggressive cut. It'll be slower, but easier to use. Disston started using the lower profile at some point after the turn of the century for some of their saws, so there's no need to feel like you're cheating if you do decide to use the less aggressive cut. I know users who sharpen their dovetail rip saws up to a full 15 degrees to make them easier starting. I would suggest you experiment with your own to find out where you are most satisfied.
Much the same is true for a crosscut profile, but it starts out with a less aggressive angle. Here is about the most aggressive angle I would use on one:

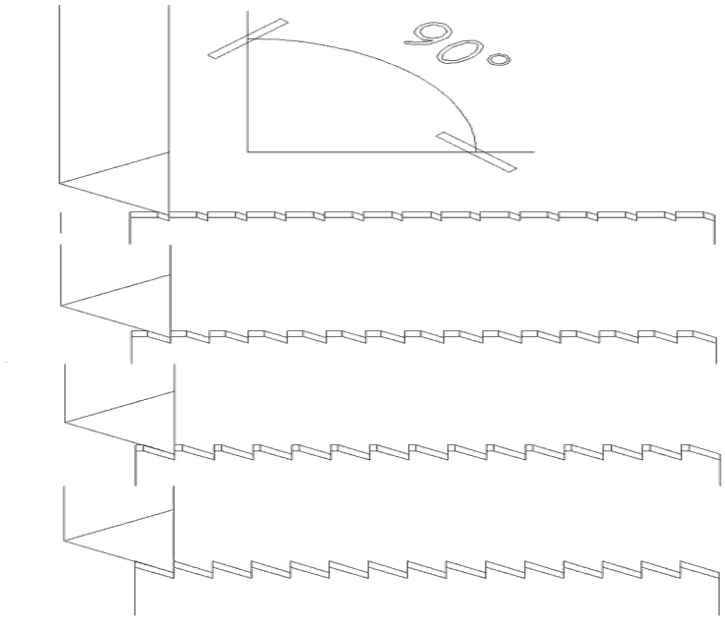


You can increase the 12-degree angle for a less aggressive cut, if you prefer. There is more discussion of these angles on the Vintage Saws site, if you are interested.
Truth be told - I never sit there with an angle gauge to determine what exact angle I'm filing. I stick the end of the file into a block of wood at what "looks" to be about right, and go with it. I often jam the other end of the file into another block of wood to help me maintain a consistent angle, however, and use a bevel gauge so I can repeat the angle when I turn it around for the other side.



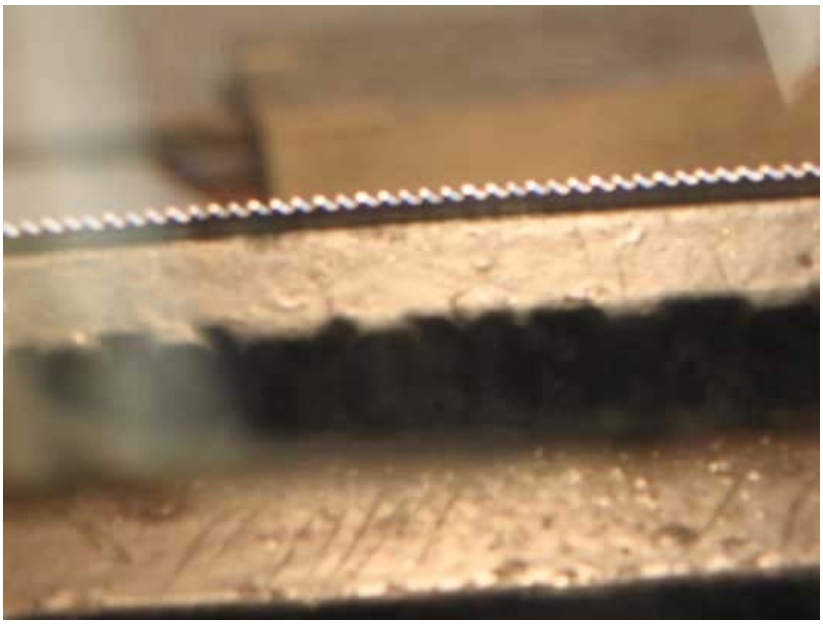
To initially shape the teeth, I work from one side only, and perpendicular to the blade. Trying to skip every other is difficult at best, and unnecessary at this point, as I'll finish sharpening them later by doing every other tooth.
I'm not going to worry about the fleam angle (crosscut saws only) at this point, just getting the teeth properly shaped.

Starting from flat, this will be the progression of the teeth as I file them (note - I'm showing a rip profile, but a crosscut would be similar):



For shaping the teeth, I try slowly bring it to the next to the last diagram, leaving just a little bit of flat space on the top of the teeth. This helps me by serving as a guide to maintain the appropriate size of each tooth as I'm filing away. I stop there, and leave the remainder for the final sharpening.

A bit blurry - but I think you can see what I mean...



Adding Set to the Teeth

Now is a good time to "set" the teeth. "Setting" the teeth simply refers to bending every other tooth over slightly one way (the remaining are bent the same amount the other way) to increase the kerf size cut by the blade. You can see the end effect in the rip and crosscut profiles diagrammed above. The reason for this is to keep the blade from binding against the wood it's cutting. Softwoods need more set, as they "spring back" more. Wet woods need the most set. Hardwoods need less, and for cabinet grade hardwoods, it's best to try and get away with as little kerf as possible. It's been my experience that you need at least some.

Setting the saw is done with a tool called, surprisingly, a saw set. Stanley's are among the most common with the 42x being my preferred - but others can be just as serviceable. For teeth finer than 14 PPI, it might be necessary to file down the hammer of one of these so it fits properly over the saw tooth. The ultimate goal is to end up with a set where about ½ of the tooth is bent over. Subsequent sharpening sessions reduce the amount of set simply by filing it away as you file down the tooth, therefore requiring you re-set the teeth at least every third sharpening, and maybe more often with finer teeth.

Using a saw set - notice the mark I've made on every other tooth with a marker:

Start by setting every other tooth on one side, then flip the saw around and set the remaining teeth the other direction. At this first set, it might help to start over again and do it twice to make sure the set is consistent on both sides. You may want to do this second round of teeth setting after you have sharpened the saw, especially if you are too eager in your sharpening and file away most if not all of the set you've just put into the teeth.

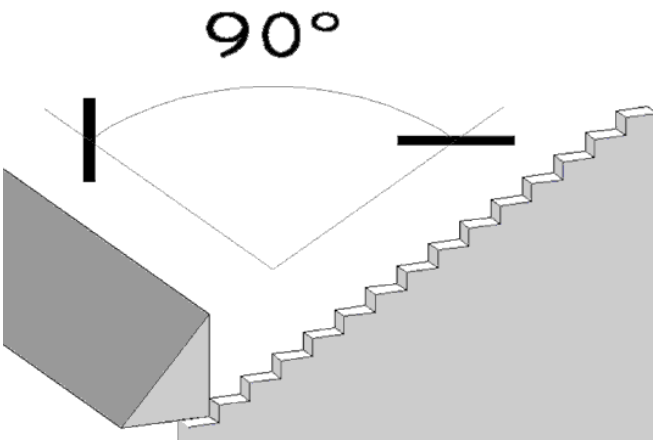
A word of warning - if you set a tooth one way, then decide you need to set it the other way, you could break the tooth off. It is generally good practice to avoid doing it, so heed the following advice. One problem I always seem to have when setting teeth this fine is that I lose my place while setting every other tooth. To overcome this, I often take a marker such as a Sharpie and mark every other tooth for reference, as I mentioned above. This helps me avoid problems like mentioned above where you accidentally set the teeth the wrong way. If you do - don't fret, it's not the end of the world. Subsequent filings will essentially remove the set, and at some point in the future you can start over. Till then, it won't make a huge difference in how the saw performs so long as you are

consistent in the set from side to side. But do try to avoid it.
Once I've set the teeth, the saw is ready for final sharpening.

Sharpening

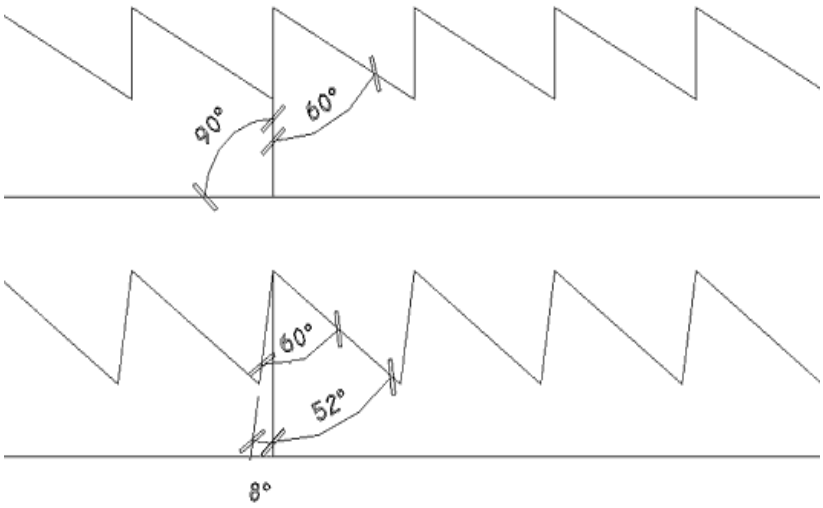
One note about sharpening such fine teeth - even your stance at the vise can make a difference in how you apply pressure to the file - and if you don't move as you progress down the saw, it will make a difference in how the saw is being sharpened. Stop every so many teeth and adjust yourself accordingly! Besides, you need to make sure you can see what you are doing.

Filing Rip



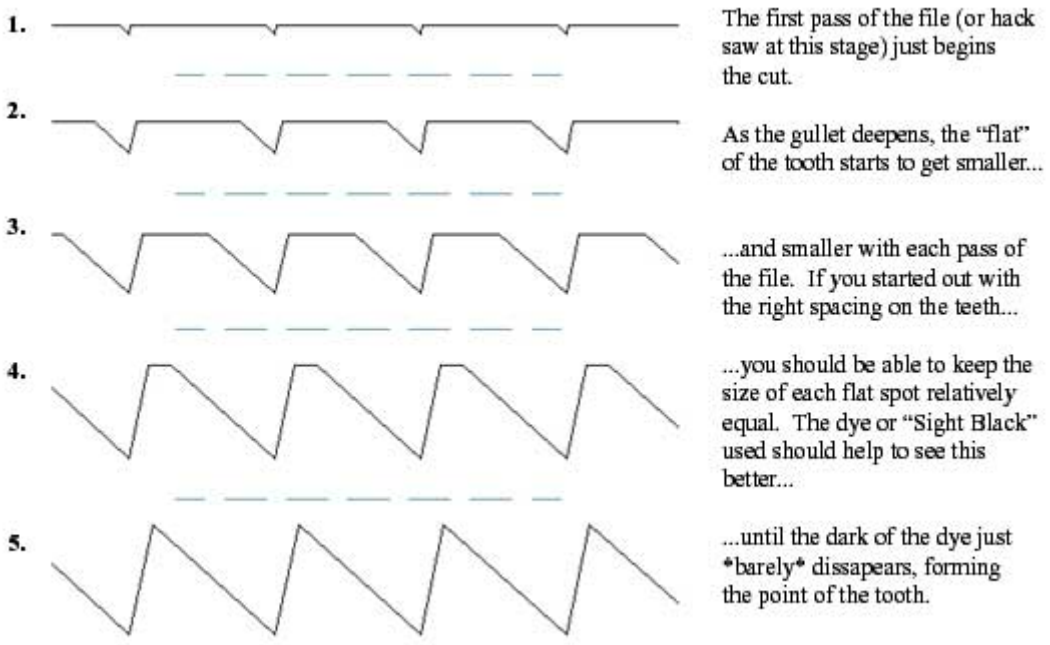
For rip-filed saws, you're nearly finished. All that's left is to run a file across every other tooth from one side, then flip the saw and run the file from the other direction on the remaining teeth. This is done so the filing is consistent from each direction, and any inconsistencies that are created by your technique are repeated in an opposite and equal manner. The angle should be the same one chosen previously (the lower is the less aggressive pitch):

It often helps to use something to darken the teeth so you can see which teeth you've filed and which you haven't. You can use chalk, layout dye, or "Sight Black", which an anti-reflective aerosol spray used by gun-owners for reducing glare when sighting through their scopes. It wipes off easily, leaving nothing behind. Another great method is to use the soot from a burning candle or alcohol lamp.



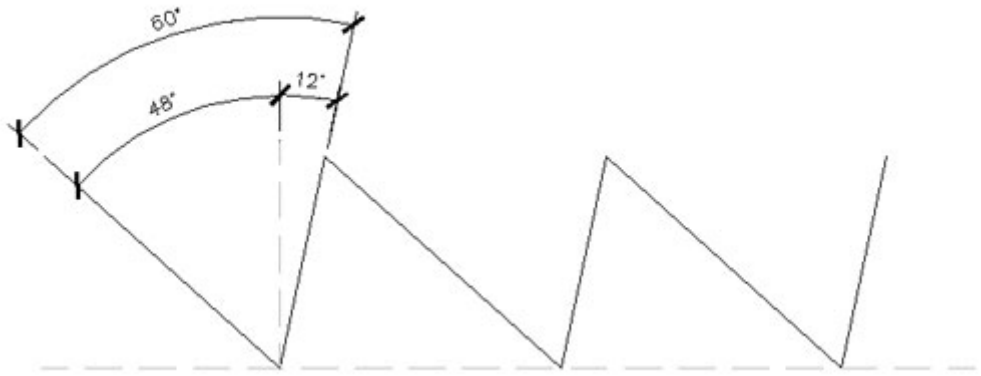
As shown in the above diagram, file the teeth at 90 degrees to the blade, using the same angle used in shaping the teeth above. Here's the real-world shot:

This last step usually only takes a light stroke or two of the file, just enough to remove the "flat" part left behind in the step above (see the "shaping" diagram). The flat will help you as a reference, filing the very last of it away should leave all of the points of the teeth in the same plane along the length of the saz, as seen in steps 4 and 5 of the diagram below - which goes through the entire shaping process:

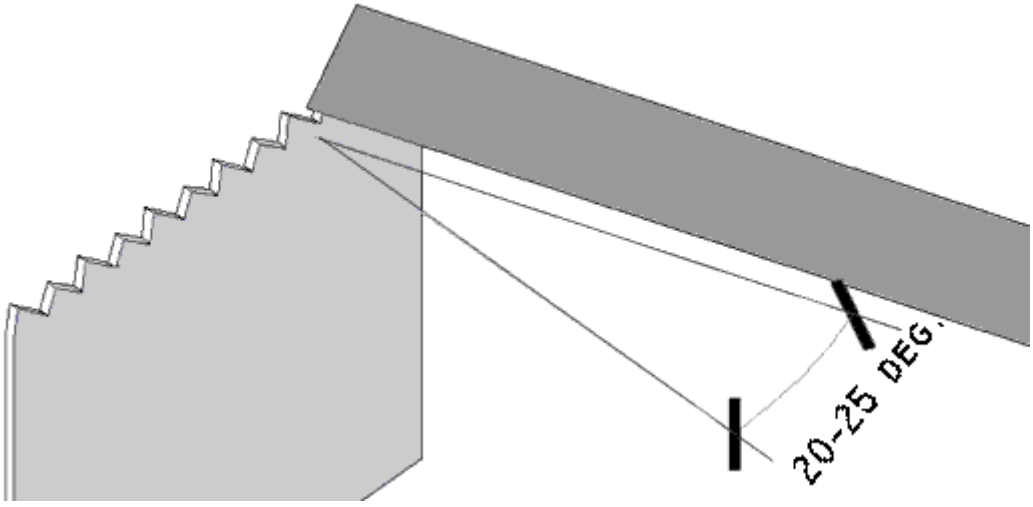


Filing Crosscut

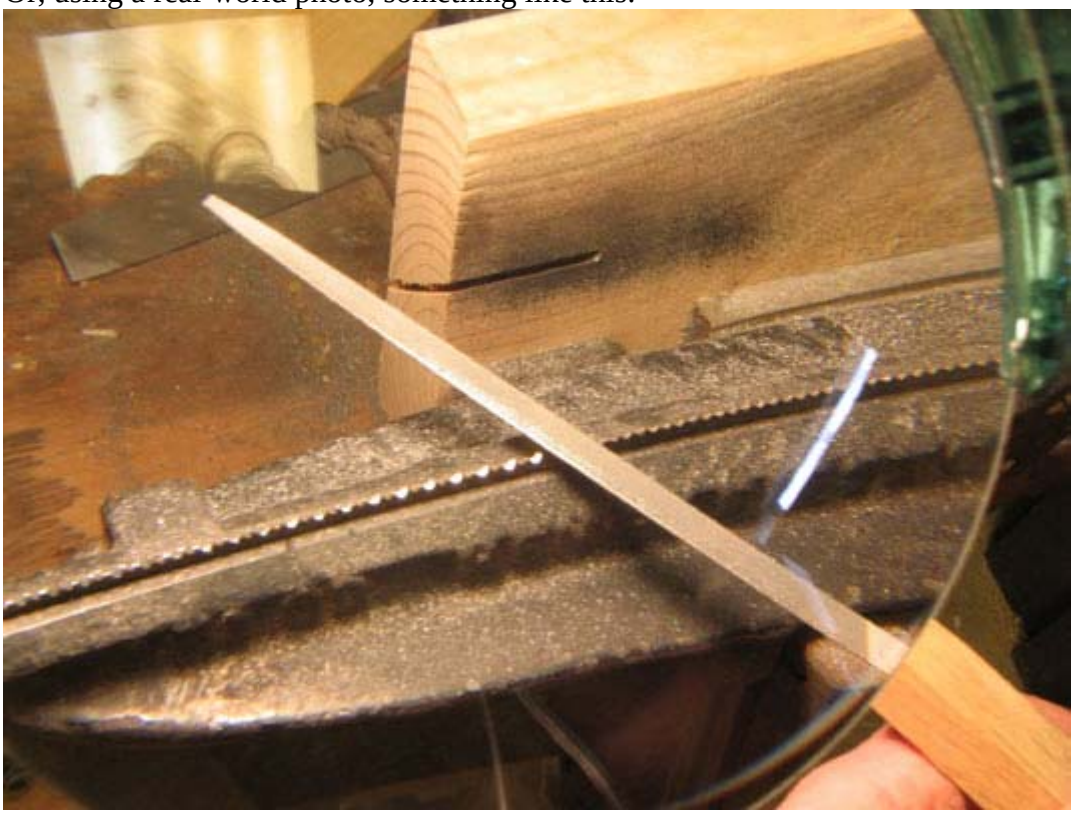
The process for crosscut saws is much the same as for rip saws above, but with two very important differences - the first being the angle the teeth were cut at - which will be the same angle you chose when shaping the teeth previously, similar to this (the 12 degree angle is the minimum, most aggressive angle I would use on a crosscut saw - more rake angle will give you less aggressive, easier starting, but slower cutting performance from your saw):



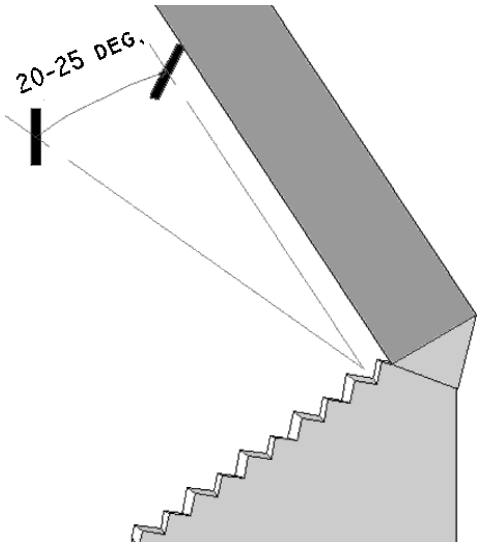
The other difference is the fleam angle. For our purposes, fleam angle is just the angle that you file the teeth at, which basically means 20 to 25 degrees off of perpendicular, as shown below, whereas a rip saw is file perpendicular. File every other tooth, then flip and file the remaining. Always file pointing in the same direction relative to the saw - if you do one side angling the file towards the toe of the saw, make sure that you also file towards the toe of the saw when you flip and file the other side.



Or, using a real-world photo, something like this:

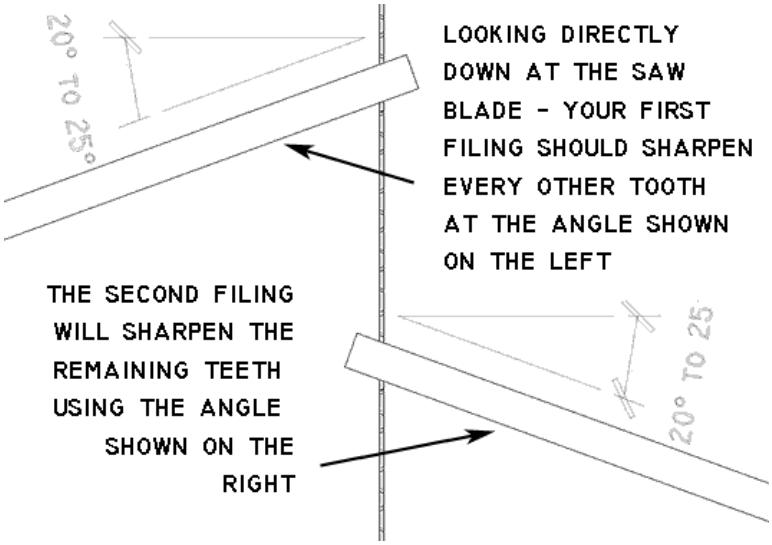


Because you are just introducing this angle to the filing, it may take an extra stroke to remove enough material to properly form the teeth. Just be careful, and watch that you don't remove too much that it makes it difficult to file the teeth from the other side. If you have to, just file a little, flip the saw file the other side, then repeat until you are finished. It's easier if you remove too little than if you remove too much.



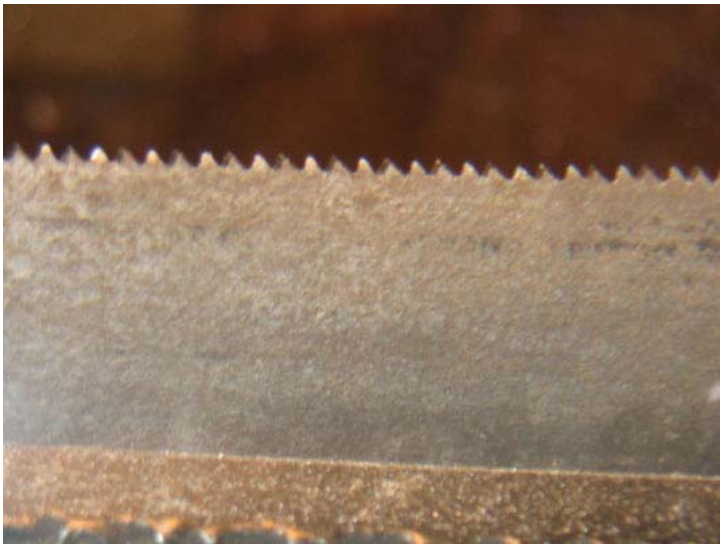
It is important that you file the proper teeth for crosscut, and how you file them is determined by the set of the teeth. I tend to pick a side (i.e. the tooth bent away from me will always be on the right), and then file towards the toe of the saw. It seems silly, but look at how the teeth are forming in this diagram, with the cutting points of the teeth on the outside edges of the blade:

I know this might seem trivial, but I've caught myself filing the teeth backwards! So watch yourself! To help clarify the angles a bit more, here's an overhead view of how the files should be held:



For backsaws. I use about a 20 to 25 degree angle. A steeper fleam angle results in a sharper saw, but also one that dulls quicker (on panel saws I use a 15 to 20 degree angle). You should end up with evenly shaped teeth, as below:

It can be hard to tell (and even harder to photograph), as because of the sharpening every other tooth might look small - so look at it against a light colored background and look at the entire tooth.



Final Tuning

For a final tuning, after the saws are complete and assembled, draw a straight line on some lumber (with the grain for rip, across it for crosscut) and do a test cut. There are two things you are looking for - the first is that the saw tracks along the line correctly, and the second is that the tooth marks left in the wood don't show an obvious tooth pattern, like if one tooth is set more severely than the rest. The fix for both of these is to draw a stone (I have an old broken oil stone I use just for this purpose) along the side of the teeth. To correct a tracking problem, stone the side of the teeth that the saw tracks to. It should only take one or two light draws with the stone to correct. If it takes more, you may need to re-set the teeth on the saw.

A few generic tips on sharpening that might prove helpful that I've not mentioned previously, but should be:
I've seen or heard reference to this statement many time in reference to sharpening a saw: "When filing the teeth, it can help to count the number of strokes so as to remove the same amount of metal on each tooth". While I agree with this statement in principle - and can be a great help to a beginner, a better method is to joint the teeth, then gauge your filing according to removing the "flat" left behind by jointing.
When sharpening - always "lift" the file on the backstroke to avoid dulling the file more than necessary.
To reduce the amount of set on each side of the blade equally, take an equal number of strokes on each side using an old oilstone.

That should about cover the sharpening process. The next section will cover putting a finish on the handles, attaching them to the blades, and some final touch ups that I've done to get the saws to their final, "finished" state.

Finishing

All that's left now is some finishing, both for the handle as well as the blade of the saw. Also, I wanted to use this opportunity to practice a little bit of carving, mostly just for the experience. You can practice and practice and practice on scraps, but rarely does it do as much good as "practicing" on the real thing. One of the biggest reasons I took up building tools (other than the fact I needed some) was to give myself an opportunity to hone some previously un-tried or forgotten skills, and these saws were no exception.

Carving

I've acquired an interest in carving as of late, and wanted to practice some for projects I want to do this winter. These handles were a great opportunity to practice a little bit of it, albeit to the horror of others...

Being this is norsewoodsmith.com and being of nordic decent myself - I thought something of a celtic/viking flair would be appropriate. A repeating theme in Viking art is intertwined snakes, so I came up with a pattern that fit onto the handle, drawing right on the handle - then used an Exacto knife to outline it:

That alone isn't enough, as the line made by the razor knife is too fine. I brought out my chip carving knife - the one dad made for me a few years ago, and followed the lines I'd just made with the razor knife.

On the first ones I tried, I came back in and widened the cut by angling the chip carving knife about 45 degrees.

With later ones, I didn't bother. It turned out to be unnecessary - after a finish was put on, just having the line was enough:

After I finished carving the patterns, I hand sanded the wood to about 220 grit. More than that is unnecessary, and you risk burnishing the wood so it won't accept a finish properly.
This, obviously - is a completely optional part to making saws. I was just having fun doing it, and wanted to personalize them a bit more.

Finishing the Wood Handle

As a final step to preparing the handle, I hand sand it with 150 then 220 grit sandpaper until I'm satisfied with the finish. Being these are tools and not show pieces - I don't spend an inordinate amount of time preparing them... Besides, I expect these saws to get used, so damage is bound to happen over time in any case. It's most important for comfort during use and for protecting the handle itself, so that is where I place my priorities when finishing tool handles.

My favorite finish for tool handles is Boiled Linseed Oil (BLO), followed by a few thin coats of shellac. BLO is pretty simple to apply, just wipe it on and wipe it off after about a half hour or so... I do this twice in a day, and let it dry at least overnight before the next stage. I thin it about 20 percent with mineral spirits in the summer and about 50 percent in the winter, so it's the consistency of runny syrup.

If BLO is the only finish I want to apply, I'll give it no more a coat a day until I'm satisfied with it. It must be dry before you apply the next coat - the way I tell is to hang the scrap piece of cloth I used for wiping the oil on over my vise, or another such metal object, and wait until the oil in it makes the cloth stiff... You know then the oil in the handle should be hard as well. The standard safety warning about storing oily rags and spontaneous combustion should go here... so be aware of what you do with them.

For these, I wanted to take it a step further and use something a little nicer - so I only put 2 coats of BLO on the handles - then after it dried, I brushed on a couple coats of shellac.

There seems to be some sort of a stigma that surrounds using shellac in flake form, so I'll briefly go though preparing a batch.

I prefer using flakes to using pre-mixed shellacs like what's available from the hardware store, and the reason is simple... once mixed, shellac has a pretty short shelf life.

Manufacturers can mix in chemicals that extend this shelf life, but when I look at what's on the shelf at the store, I wonder how long that can has been sitting there... 1 month, two... or maybe even 6 months or longer? Flakes will store indefinitely and are easy to mix up - and you only have to mix up what you are going to need.

I usually don't bother going through any measuring dance... you know, you need xx ounces of flake, xx ounces of alcohol, and you must chant a love sonnet to the lac bug using an ancient Celtic dialect while... I'm getting off track, aren't I?

I start with a couple of pint-sized jars that have good lids. You'll need two, though - one to mix it in, the other you'll need to filter it after the flakes have dissolved. Besides flakes and jars, the only other requirement is alcohol - any denatured alcohol from the hardware store will do just fine, no need to get fancy.

For something close to what's called a "2 lb. cut", or the standard thickness for finishing, I start by filling the jar about 1/3 full of flakes:

Then, add in the alcohol, filling the jar until it's about 2/3 full, put the lid on and shake it up:

It takes at least a couple hours for the flakes to dissolve in the alcohol. When the flakes have dissolved, you need to filter what's left out - I've found that the material from an old tee shirt works best. Others have used coffee filters, but I find they take too long (if I can even get the stuff to go through them) and an old shirt works plenty fine. Why must you filter it? Shellac is made from the secretions of a bug, and the flakes are often unscreened (or only partially screened) to remove the junk that can get into them:

You'll find pieces of bark, pieces of bug - bunches of stuff you don't want to get into your finish. Straining it through a filter of some sort will remove the impurities. It won't remove the wax, though... The wax in shellac isn't always a bad thing, but there are times you might want to remove it. To make your own de-waxed shellac, all you have to do is let it sit in the jar for a few days undisturbed. The wax will settle out to the bottom, and you can then cant off the "de-waxed" shellac off of the top into another container. If you don't - remember to shake up the shellac occasionally as you use to keep the wax in suspension. Actually, you should always remember to shake it a bit before using it, as there will always be something that needs mixing in there.

For more information on shellac and other finishes, you can refer to Homestead Finishing's articles (also a good source for shellac flakes) by Jeff Jewitt - He's also written some books on finishing, and I've found pretty much anything written by him to be golden.

Just for the experience, I tried a few different methods for applying the shellac, including brushing, sanding, wiping, etc. and found the best method for the handles to be to brush on a couple coats, about an hour apart from each other and allow that to dry overnight. Sand that by hand with 220-grit sandpaper, and wipe on another coat of shellac using cloth from an old tee shirt. After that dries at least a couple hours, hand sand that with 320 grit sandpaper, and wipe on a final coat of shellac with the tee shirt. When that had dried thoroughly, I "sanded" the handle using 2 grits of scotch-brite pad, the first a medium then a finer grade, to where I had just removed the gloss from the finish. A coat of paste wax buffed on at this point to bring back a little sheen and to protect it, and the handle is ready for assembly.

Finishing the Metal Blade

Time for a bit of fun - I wanted to personalize the saws, so got myself some 1/8” letter stamps and put the name of my web site onto the brass back, just like the tool companies would have:

I probably should have spent more time getting the letters spaced just right, but I just eyeballed it, so not all of them came out perfectly spaced. Still fun to do, though.
Earlier in the process, I sanded the blade and the back to about 400 grit, giving it a pretty nice sheen. Since that time, I’ve sharpened the blade, assembled and disassembled the saw, and handled it many times - all of which scratched the whole thing up again. While it’s not all that important that it look good, it does actually help somewhat with cutting if the blade is smooth, and it doesn’t take much, so I spent some time putting a nice finish on the metal. Here’s a shot of everything I used for finishing the metal:

To get that finish, I started with 320 or 400 grit sandpaper, and sanded the entire surface of the metal, being careful not to get too close to the freshly sharpened teeth, if you’ve cut them yet. I hadn’t here:

If it’s a problem, you can put a piece of masking tape over the teeth for this stage. After I got the finish to a nice, even sheen across its entirety, I followed up with some 600 grit sandpaper to remove some of the scratches left behind by the coarser grits. The brass still needed a bit, so I continued on with the two grits of scotch-brite pads so I ended up with a nice, uniform glow across it. Some of the brass backs had minor imperfections like hammer marks or deep scratches- if they were too big to fix I didn’t worry about them. But I also refrained from polishing the backs to a high gloss, which would only serve to highlight those

imperfections. A nice satin sheen worked best. Finally, a coat of paste wax on the blade to protect it, and the metal parts are finished.

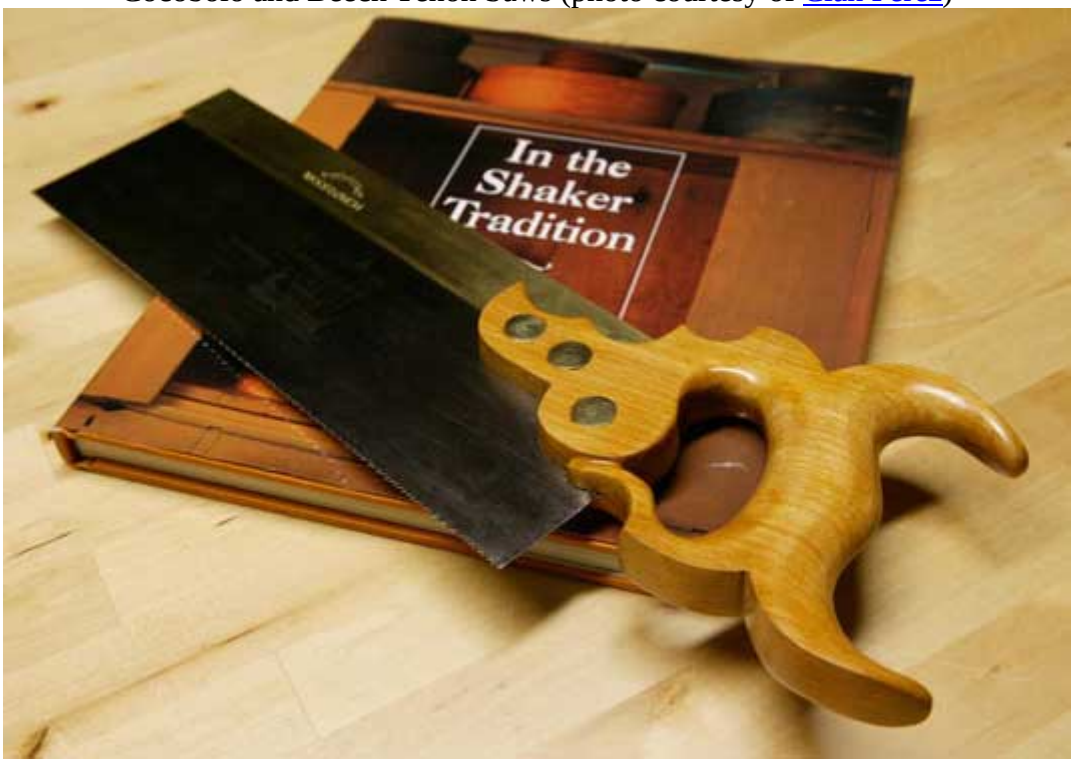
Assembly and Final Touches

Here's the part you were looking for! But we're not done yet! (D'OH!)
Using recycled saw nuts, now was the time to finish them up. I buff them clean using a muslin wheel on the grinder that's charged with tripoli:

When those are cleaned up, I assemble the saw for the last time, making sure that the screws are holding the blade firmly. When I'm satisfied all is right with the saw, I give then entire saw another coat of paste wax, and buff it out to the highest shine I can get.
There it is! The saw is finished. WHEW!

Gallery of Saws

Cocobolo and Beech Tenon Saws (photo courtesy of Cian Perez)



Beech Tenon Taw (photo courtesy of Cian Perez)

Trio of Cocobolo Saws (photo courtesy of Cian Perez)

Pair of Bocote Saws

Cocobolo

Curly Maple Dovetail Saw

Curly Maple Tenon Saw

The following are all of a three saw set with cocobolo handles:


NORSE
WOODSMITH


NORSE
WOODSMITH