

Wenzloff & Sons ♦ Saw Filing Notes

When workmen light of [find] a good blade, they don't mind whether the teeth are sharp or deep or set well. For to make them so is a task they take to themselves, and thus they perform it. They wedge the blade of the saw hard into a whetting block ...

With the handle towards their left hand and the end of the saw to the right, then with a three-square [triangular] file they begin at the left hand end, leaning harder upon the side of the file on the right hand than on that side to the left hand so that they file the upperside of the tooth of the saw aslope towards the right hand, and the underside of the tooth a little aslope towards the left, or almost downright. Having filed one tooth thus, all the rest must be so filed.¹

There are four steps to sharpening a saw: Jointing, Shaping, Setting, Repointing (or sharpening). Of those four steps, often just the last, repointing, needs to be performed if the saw's teeth are in good shape.

Skipping the steps prior to repointing is akin to honing a chisel during use. Often a chisel only needs honed on one's finest stone (repointing). If there is a sufficient wear to the chisel's edge, one needs to use a coarser stone prior to the fine stone (shaping). If there is a good chip, one may need to grind the edge back (jointing). When each step in sharpening a saw is needed is discussed in each section below.

How often does one need to sharpen a saw? This depends on the saw and its use. Some saws, again like brands of chisels, need sharpening more frequently than others. Many vintage handsaws have softer steel than others. This is also true of saws made today. No matter the steel used, every handsaw will need sharpened if it is used. Moxon reminds us that the workman does not mind this task.

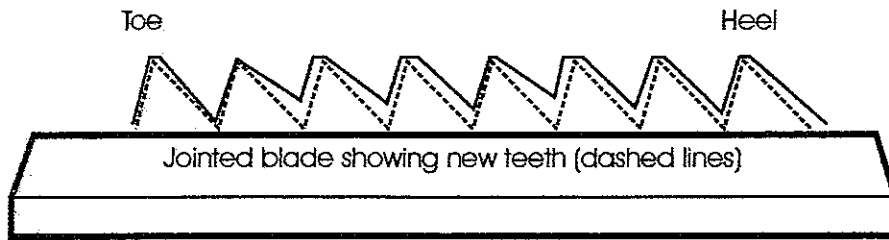
Jointing

Jointing is not a step that needs to be performed each and every time one sharpens a saw. If the teeth are in good condition (tooth tips appear even, gullet depths look the same), one can skip jointing. If a saw has been filed a few times and even though the teeth appear even, it is best practice to begin with jointing. Jointing is a best practice if the saw has been bought used as well.

The graphic below shows an exaggerated toothline badly in need of jointing. I say, "exaggerated," but I have seen worse. The solid line represents this sorry excuse for a toothline following jointing, while the dashed lines represents the ideal tooth shape.

¹ Joseph Moxon, *Mechanik Exercises*, from the amplified version copyright Christopher Schwarz, 2008 Lost Art Press

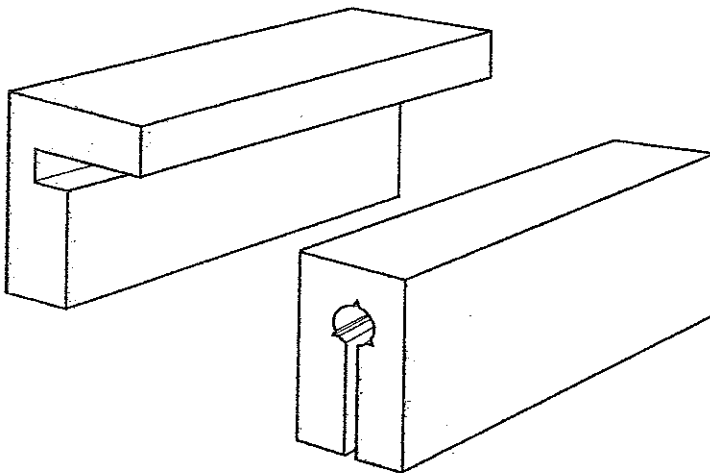
Wenzloff & Sons ♦ Saw Recommendation Notes



This graphic will be repeated throughout in order to demonstrate various effects of filing. One aspect to note in the above graphic is the second tooth from the left. The file has not touched it when jointing. Not every tooth has to be hit by the jointing file. For certain, most all should be. But should there be a few teeth not hit, don't worry about it. You will get to it after a few sharpenings. Further jointing to get the last tooth is simply a waste of steel, shortening the life of the saw.

One can make a holder for the file needed for jointing. Flat files or triangular saw files can be used. "Smooth" cut flat files should be used for smaller toothed saws. The teeth of the file will grab the tips of the saw's teeth less. For large, low PPI handsaws, a bastard cut file can be used. Between those two extremes, I find a 6" or 8" mill file to be efficient. I prefer using a 7" triangular file that I have used for sharpening low PPI handsaws because the edges wear before the center of the file itself. With care, either a flat file or a triangular saw file can be used to joint a saw without a "proper" or shop-made jointer. Be warned, you can injure yourself even with a jointer.

The following graphic shows the end profile of two holders. The one on the left for a flat file, the one on the right holds a triangular saw file.



The shop-made jointer on the left is made by using a plow plane to strike the groove for the file 2/3 of the way through a 6" long block, followed by a single saw cut. The groove left over after the saw cut needs to be a press fit for the file. The jointer on the right is made by drilling a hole lengthwise through a 1" x 2", 4" long block. The hole should be just less in diameter than the width of the chosen saw file. Then, using a DT saw, two parallel cuts are made just wider than the kerf on the saws it will be used on. The file is tapped into place.

Following jointing, it is a good practice to use Dykem lay out fluid to "paint" onto the freshly jointing teeth. I prefer to use the layout fluid after jointing rather than before as some recommend. The benefit to me is that I can easily see the colored flats after a pass of the file in the gullets.

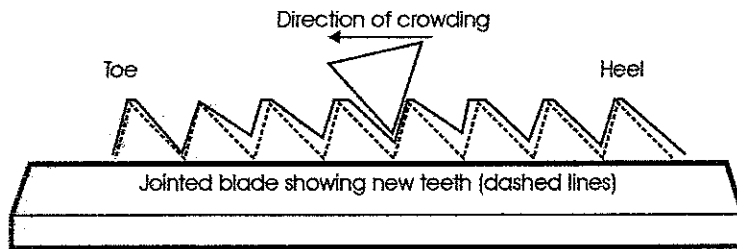
Wenzloff & Sons ♦ Saw Filing Notes

Shaping

Shaping the teeth is where most problems occur. Shaping teeth involves what is termed “crowding.” Crowding as relates to filing a saw means that between any two pairs of teeth on a saw that has poorly shaped teeth to begin with, you will need “push” or “pull” the file. Crowding the back of a tooth pair is pushing the file into the back of a tooth pair. Crowding the face of a tooth pair is pulling the file towards, or into, the face of the tooth pair.

No matter how well shaped the teeth were the last time jointing was performed, nor how well filing has been done since, you will see flats of unequal length once jointed. During the shaping of the teeth, crowding the file one way or another is required to properly shape the teeth.

Crowding is illustrated below.



Because the tendency is to apply pressure to the face of the tooth pair being filed, it takes a bit of thought to apply pressure—to crowd—towards the back of the tooth in front. In the example above, due to the tendency to apply pressure to the face of a tooth, instead of following the rake of the tooth, one will “naturally” pull the file into the face and make the tooth smaller than the one in front. By applying slight forward pressure as one is filing downward, you will be better able to maintain the desired distance between the tooth pair. Maintaining the distance between pairs of teeth means that the gullets are of the same depth and the PPI of the saw is maintained.

Crowding assumes one is holding the file in the proper aspect—rake and or fleam angles—while filing downward. Reality says that one will want to allow the file to twist, which changes the rake, rather than holding the file to maintain the rake. Therefore, at the beginning of shaping a tooth pair, if you mindfully maintain the rake angle, once the file has begun cutting, the file will be easier to control in regards to rake. Periodic checking to see whether rake and or fleam angles are being maintained is a good practice when crowding a tooth pair.

Shaping is best done gradually. Do not try to shape a tooth pair or, set of teeth pairs, completely in the first pass(es). It is best practice to work one's way down the toothline filing a few strokes on each tooth pair and look from the side the effect the first pass or two has had. Marking a tooth with a permanent marker that needs more attention—either more filing or to be left alone or hit lighter on the next pass—is a good practice.

Setting

Setting teeth is perhaps the easiest task in filing a saw. Still, there are a few concepts that need to be kept in mind. Until one understands the effect of a particular saw set at a particular setting on a particular thickness of saw plate, it is best to set too lightly than too heavily. Please note that the thinner the saw plate, the less pressure required to set a tooth. Pressing too hard will deform the steel, snap a tooth off, or crack the plate.

Each type of saw set bends the tooth differently in some way. Some create a sharper bend than others. Some sets on their lightest setting bend higher or lower than others. Still others bend at a greater angle even if the set bends at the same place on a tooth of the same size as another saw set.

Wenzloff & Sons ♦ Saw Recommendation Notes

All these choices—and yet others—were made for you by the saw set maker. What do I look for in a saw set? For either the pistol or plier type of saw sets, I prefer one that uses a double plunger. I also prefer flat anvils but finding a good one or modifying a saw set to utilize one is a topic for another time. So for the types of sets mentioned, one with a round anvil is acceptable to me. The double plunger type has a plunger that presses the saw plate against the anvil prior to the strike pin—the plunger that actually bends the tooth—touching the tooth. This does two things. First, it helps to orient the saw plate to the proper angle before the strike pin bends the tooth. This helps keep the tooth from bending below the gullet (assuming the set is correctly adjusted). It also helps keep from adding more or less set than desired.

Of these two types of sets, the brand that is readily available new is the Eclipse-clone made by Somax. The Somax saw set's body is made from aluminum and is relatively soft. Do not drag this set across the teeth of the saw when setting. The teeth can and will eventually cut into the part of the body that limits how deep the set sits on the teeth. This can be rectified when it happens. The other drawback to the Somax saw set is the anvil is made from pot metal. Over time, depending on how many times the set is used, the anvil will deform in the areas most used. This too is alterable by swapping out the anvil from a vintage saw set using a round anvil that is $\frac{3}{4}$ " in diameter as is the Somax. Most vintage saw sets of the plier type used for hand saws have a $\frac{3}{4}$ " in diameter anvil. For both these issues regarding the Somax, I will post instructions on my web site.

The Stanley 42x is the best of the vintage sets. Relatively expensive to purchase when they are found. The Eclipse, of which the Somax is based, is another good vintage set to purchase. The Stanley 42x is a one-size fits all set. It can have clearance issues on saws where there is little clearance below the handle. The Eclipse type can set saws with less usable depth than the pistol-grip type like the Stanley.

The prime reason a saw is set before final sharpening is because a tooth rotates a little outward using a saw set. The lighter the set the less rotation, but it is still there. The face of the tooth rotates out and back. On a cross cut this means there is less fleam angle than originally desired. On a rip there is another issue: the top of the tooth is no longer parallel to the cut, rather the flat runs uphill towards the center of the plate.

Two light strokes with a file is generally enough to correct these effects on a saw with thin plate. Thicker steel may require three to four light strokes.

Ok. Setting. There is no way to get around the fact that setting a saw with a given set involves a bit of trial and error, of which experience will lessen surprises. In the beginning, it is best to use a lower setting and test the amount of set at the heel of a saw. This area is less used and therefore supports a little experimentation.

The saw needs be positioned high in the vise. Saws with backs pose the greatest clearance problem depending on the vise one is using. If there is not enough clearance below the handle for one's particular saw set to adequately set the saw, this area can be easily set with the saw laying on its side and the saw plate is supported on a thin piece of hardwood. A simple nail and hammer can then finish setting the affected teeth, first to one side then the other.

It is important that every other tooth be set to the same side, the saw turned around facing the other direction in the vise and the other teeth set to the opposite side. On a saw being filed that has too much set to begin with, there are ways to lessen the set. However, for coarser saws I recommend letting it lessen through future sharpening. For joinery saws, if the amount of set on the saw is great enough to cause control problems then one should consider lessening the set.

In a pinch—or by design—one can also use a simple nail and a lightweight hammer to add set to a saw. When I have done this, the saw plate is laid flat on a board, the nail positioned near the tip of the tooth to be set and a

Wenzloff & Sons ♦ Saw Filing Notes

light tap on the end of the nail by the hammer to bend the tooth. The wood provides resistance. The nail position near the tip forces the bend to be above the gullet. In this manner, every other tooth can be set, the saw plate flipped over and the other teeth done. Old-timers used this method for high-ppi saws for ages. It takes a bit of getting use to, but a fairly even set can be achieved with practice.

Repointing (Sharpening)

At last—or if the teeth are in otherwise good shape, perhaps this is where you are beginning. If you are starting here, it would serve you well if you lightly joint the teeth first. By lightly, I mean that the tips should barely show that they have been touched. Not every single tooth needs a flat, but a high percentage should show they have been.

This is the stage where rake and or fleam angles should be held as consistently as you can—but some variance will occur. No worries. The saw will still cut wonderfully.

Before this light jointing, use Dykem layout fluid. Lightly brush it on so the entire tooth from tip to bottom of gullet has color. Have your light be a raking light so you can easily see the tips getting hit by your flat file. I use a smooth cut 8" file for jointing a saw shorter than 20" and a 10" or 12" smooth cut file for longer saws.

The tips will have a shine to them from the file that can best be seen by the raking light. I use a light pressure, just enough to maintain contact with the saw. It is important that the file be held pretty level down the length of the saw. Tipping the file to one side or the other will lower that side's tips more than the other.

Once you are satisfied with this light jointing, recoat the teeth with Dykem. This allows you to see which toothing pairs have been filed should you need to take a break, as well it shows the darker tips up after a pair of teeth have been filed should you need to go back to touch them up.

There are a lot of resources on the web and in print concerning filing saws. There are a few I can readily recommend. The best book on the subject for me is Leonard Lee's book *The Compete Guide to Sharpening*. Why? Because it covers not only saw sharpening but pretty much the gamut of sharpening everything else a typical woodworker needs to sharpen—and more.

Wenzloff & Sons ♦ Saw Recommendation Notes

Saw Filing Errata

There several aspects of saw filing that affect how a particular saw performs. Of those, the three prime ones are Degree of Rake, Degree of Fleam, and Set). Lesser issues revolve around the Number of Points Per Inch (PPI amount of gullet slope and gullet depth.

One needs to understand that none of the three prime effects exist by themselves nor fully control their effect on sawing dynamic. They have a relative relationship to each other. Changing one can enhance or partially negate another of the three prime aspects.

Rake

Rake in general controls how aggressively a saw cuts.

Fleam

Fleam angles mainly controls how cleanly a saw cuts.

Set

Greater to lesser set on a saw trades freer, less restrictive control to follow a line to more restrictive following of a line, but often a cleaner resultant cut.

Regarding Rake

How strong or weak of rake is most efficient depends on the task at hand, the PPI of the saw, the wood being cut and the experience of the user. A strong rake of zero degrees to 10 degrees is the most efficient at waste removal for both ripping and cross cutting respectively. Conversely, a weak rake of 10 degrees to 30 degrees is not terribly efficient at waste removal neither in ripping nor cross cutting respectively. A weaker rake is mainly applicable on a cross cut saw, but has application for ripping. A weak rake on a cross cut saw is most applicable with higher fleam angles.

A strong rake on a rip saw, while more difficult to start the cut, once the kerf is established nearly pares ribbons of wood whose length corresponds to the thickness of the stuff being cut and the users ability to keep the teeth engaged in the cut. A weak rake on a saw filed for ripping trades efficiency for ease of starting a cut.

A strong rake on a cross cut saw is also most efficient. Its trade-off sacrifices ease of starting for aggressive cutting, smoothness of cut for swiftness. A weak rake on a cross cut saw can produce a smoother resultant cut, but not necessarily and appreciable degree. However, there is a definite smoothness imparted to the act of sawing.

Regarding Fleam

How strong or weak of fleam severs wood fibers is what controls the resultant finish quality of the cut itself. Strong fleam angles are in the 10 degree range. An extremely weak fleam angle is 45 degrees. These two poles of fleam angles represent the strong edge and swift cutting of a low fleam angle to the clean slower cutting of the progressively higher fleam angles.

Wenzloff & Sons ♦ Saw Filing Notes

Fleam on a rip saw isn't a new idea. Depending on its purpose can be progressively greater at the toe, becoming less back towards the heel. An even 2 degree fleam angle on an otherwise strong raked rip hand saw allows a bit smoother sawing at very little expense of speed of cut. It also severs the fibers more cleanly. A bit of fleam on a saw is a by-product of hand filing—the slight challenge is controlling its angle across the face of the tooth.

Fleam on a rip filed joinery saw can make sawing the hardest of woods much easier. On saws destined to be used on Ebony and African Blackwood (and others) make for a smoother cut and in the case of woods like the African Blackwood, possible.

For cross cut saws, I favor stronger fleam angles except for joinery saws. At one end of the spectrum, a saw for cutting shoulders on the average piece of furniture, I favor a moderate fleam angle of 15 to 20 degrees. On a miter box saw, higher fleam angle of 30 to 40 degrees allows the weight of the saw to be most productive and provides a cleaner cut.

Regarding Set

The amount of set on a saw can affect the degree of effort required to push a saw through the cut. Regardless of what one hears, a saw is more efficient in cutting in a wider amount of wood species with an amount of set. How much that is depends on the purpose of the saw and what is required of it.

While a saw like Disston's Acme 120 was touted as a no set saw for cabinet makers, it does so best in really dry woods used in better furniture. What the Acme does, when sharpened properly, is to provide an extremely nice finish to the cut piece. This isn't due to the tooth shape per se. It is solely because of the lack of set. The "flat back" of the tooth ensure the sides of the teeth do not scrape and score the inside the kerf on the backstroke.

For a finish cut, one wants as smooth an edge as possible. Typically a 10 ppi or less hand saw is not what is going to achieve a finished cut that one would use in furniture. There will be further refinement (in all likelihood) using progressively finer saws making more controlled cuts. Most likely the edges of those further refined parts will be shot with a plane, or simply planed.

When sawing without sufficient set, the saw will eventually begin to bind in the cut if the blade is buried. In lesser cases, what is noticed is increased friction. In greater instances, one can kink the saw. Some woods require more set to freely saw.

Basically I simply recommend having more set on coarser hand saws and progressively less set as the saw get smaller and higher ppi. Though a smaller range of this principle, I treat back saws in the same manner. Thicker plate, more usable depth back saws get more set and as one progresses down to thinner plate and less usable depth, less set. My large tenon saws (21.5" blade and 19" blades, 8 and 10 ppi respectively) have about 4 thousandths set to each side. My two smallest DT saw has as little as I can do. In fact, the one is 8" in length made with 0.016" steel, 1 3/8" usable depth and I don't set it at all.

Regarding Points Per Inch (PPI)

A comment on PPI. PPI affects primarily three things. (1) Efficiency of waste removal; (2) Efficiency of effort; and to a lesser, or opposite degree; (3) Ease of cutting.

PPI per se is outside of the scope of a sharpening overview such as this. Using too high a ppi can fool a person into believing their saw is dull (or dulling) when in fact there are simply too many teeth engaged in the cut. PPI is just an aspect of how or why a particular saw can be appropriate or not to a particular sawing task. For any given thickness, and to a certain degree species, of wood there is a range of effective PPI. With too many teeth engaged in a given cut, one expends a lot of energy, most of it in pushing the sawdust out the exit side. With too

Wenzloff & Sons ♦ Saw Recommendation Notes

few of teeth, the cut will be unnecessarily difficult to start and leave a more ragged sawn edge than perhaps wanted. It also will not necessarily be any swifter cutting.

Regarding Sloping Gullets

Sloping gullets have of late been discussed on forums. Greater gullet depth is one of the attributes espoused by a few that have studied and/or written about it. It is true a sloping gullet increases gullet depth. Just not as much as one writer thinks. However, sloping gullets aren't filed in a saw to increase the gullet depth. The main advantage of sloping gullets is to channel waste up alongside the saw plate in a saw *that has too few points per inch for the thickness of stock it is cutting*. Further, sloping gullets is mainly a design feature for finer toothed saws to enable smooth cutting of stuff and allow the channeling of sawdust.

The other prime reason given for filing in sloping gullets is to decrease the size of the tooth at the tip while not having to add greater amounts of fleam to achieve the same effect. In theory this retains the edge lasting / stronger tooth of a saw with less fleam while gaining the benefit of a very sharp tip. Reality is that while the face of the tooth is stronger from less fleam angle, the tip is every bit as fragile. A saw filed with sloping gullets needs sharpened as much as a saw filed without them but with great fleam. So I do not generally recommend filing with sloping gullets except on a saw that has sufficient taper grinding like the Acme 120.