

Understanding Western Hand Saws



Aaron Moore

2013

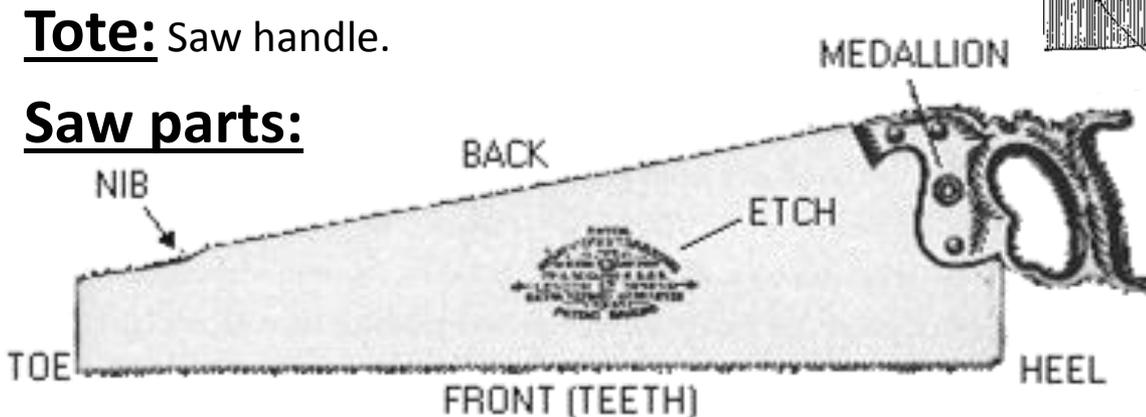
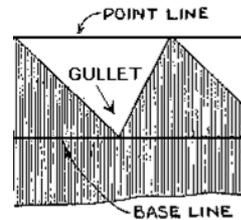
Common Types of Woodworking Saws

- **Bow saw:** Thin blade tensioned in a wooden frame. Often used for curved cuts, but with the proper blade and frame, bow saws can handle the general woodworking chores of ripping and cross cutting. Typically replaced by a band saw in most shops today.
- **Fret saw:** Small U-frame saw with an extremely fine blade. Used for cutting fine details, patterns, curves, or clearing the waste in dovetails. Typically replaced by a scroll saw today (except for clearing waste in dovetails).
- **Coping saw:** Larger version of a fret saw with similar uses. Cuts faster than a fret saw with thicker blades that break far less frequently, but coping saws do not turn on as tight a radius and cannot fit in the kerf of most hand saws for clearing out dovetail waste.
- ***Hand saw:** A frameless saw consisting of a saw plate and handle. No back on the saw, so blades must be thicker to avoid kinking during use, but they can cut infinitely long as there is no back to limit the depth or distance of cut. Typically replaced by a table saw today.
- ***Panel saw:** A hand saw 24" in length or less.
- ***Back saw:** A saw, typically intended for joinery cuts, with a strip of steel or brass on the top edge of the saw plate. This stiffens the plate, allowing thinner steel to be used for cutting (less material removal) and adds weight to the saw for balance. Typically replaced by a table saw or router today.

*We will focus on these saws for this class

General Terminology

- **Cross cut saw:** Any saw optimized for cutting across the grain of wood.
- **Rip saw:** Any saw optimized for cutting along the grain of wood.
- **Kerf:** The area removed from a board by a saw, determined by the thickness of the saw plate plus the amount of set to the teeth. The wider the kerf, the harder the saw is to push while cutting (wide kerf = more material to remove = more effort).
- **Open vs Closed handle:** Open handles are common on smaller saws and do not completely enclose the fingers. Closed handles do enclose the fingers and are used on larger saws where the extra strength is needed to avoid cracking the handle. It may also be the handle the saw maker thought looked most appropriate aesthetically.
- **Gullet:** Space b/w teeth. Saw dust is stored here while the saw plate is cutting through the wood.

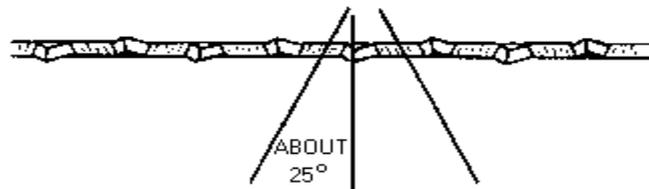


Properties of a Hand Saw

- **Rake Angle:** The angle between the face of a saw tooth and an imaginary line perpendicular to the baseline of the saw teeth or front of the saw, seen when viewing a saw from the side. It is generally 12 to 15 degrees on a crosscut saw, and zero to eight degrees on a rip saw.



- **Fleam Angle:** The angle that is filed into a crosscut saw's teeth, creating a knife edge that slices wood fibers when cutting. On crosscut saws, fleam typically ranges from 15 to 25 degrees, depending on the saw's number of points (PPI) and whether the saw is used mostly in softwoods or hardwoods. Rip saws typically have no fleam.

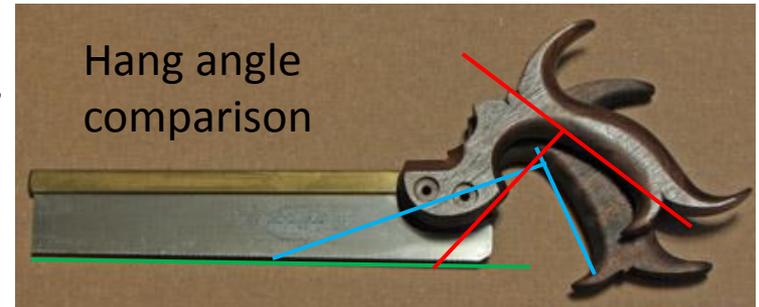


- **Set:** Distance a tooth is bent out from the saw plate to create clearance for the plate to pass through without binding. A good backsaw should only have 0.002"-0.003" of set to each side of the saw plate.

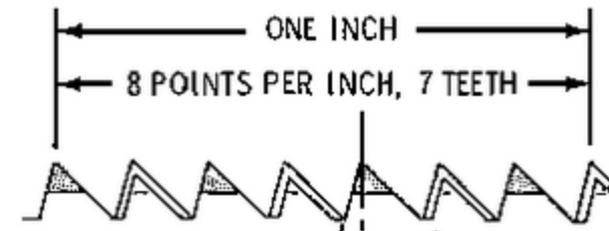


Properties of a Hand Saw

- **Hang Angle:** The angle between the handle grip and the tooth line of the saw plate. Steeper angles direct the push-force closer to the heel of the saw, making it cut more aggressively and with more effort. Smaller saws require steeper angles in general because the blades are shorter. The hang angle should always direct the push-force somewhere along the tooth-line, usually within the middle 80% or so.



- **PPI or TPI:** Points per inch or teeth per inch. PPI is always 1 number higher than TPI (see picture). The higher the ppi/tpi, the slower and smoother the cut.



- **Materials:** A good saw should use high quality spring steel for the plate. Many modern saw makers use Swedish steel. The tote should be wooden, shaped to comfortably fit your hand with no hard edges. Poor handles are alright for a few quick cuts, but you'll feel the difference after that. The back (if there is one) is typically brass, steel, or even copper. It usually depends on style, desired weight to balance the saw, and cost that ultimately determines what material will be used.

How a Saw Cuts

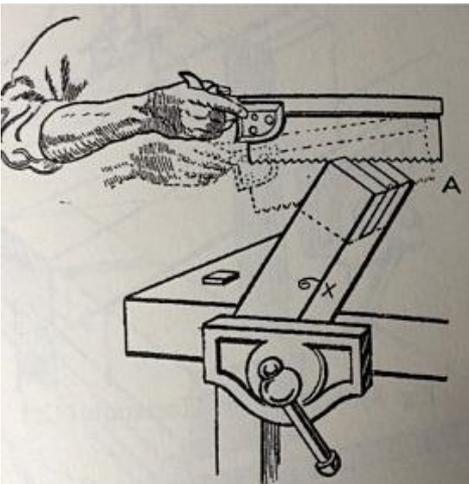
- **Rip cuts:** When ripping, the saw is cutting with the grain. These cuts include ripping a board to width, cutting dovetails, tenon cheeks, etc. Because the saw is removing material in the direction of the wood fibers, the finish will be smoother and little tearing occurs. Therefore, large teeth (low tpi) allow for faster cuts. There is little to no rake or fleam on a rip saw. Think of chiseling with the grain, the wood is happy to be cut in this direction so the saw teeth are essentially dozens of small chisels cutting the wood. As each tooth cuts a small piece of wood, that material is stored in the gullet until that tooth clears the wood and the material can fall out, creating a pile of saw dust.
- **Cross cuts:** Cross cutting is obviously sawing perpendicular to the grain. These cuts include cutting a board to length, cutting tenon shoulders, etc. Now tpi, rake and fleam become valuable because simply plowing teeth straight through the wood (like ripping) will catch the fibers and tear them, leaving a ragged edges. A higher ppi results in a smoother finish, but will cut slower compared to rip cuts with course teeth. For rough cutting boards to length (when finish isn't critical) lower tpi may be used, but fleam and rake should still be included. These two angles create knife-like teeth that actually sever the wood fibers. Therefore, every other tooth is sharpened with opposite fleam so the fibers are severed on either side of the saw plate. After each side of the fiber is cut, the middle crumbles away into dust. If you pay attention, you will notice saw dust from rip cuts actually looks different from the dust created by cross cuts.

Path of Least Resistance

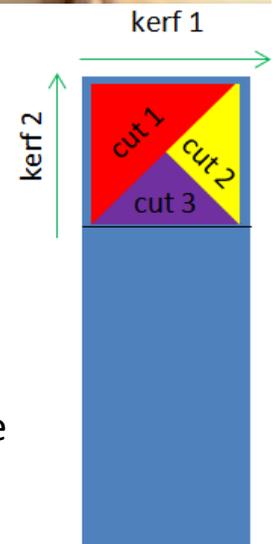
- Hand saws always follow the “path of least resistance”. This means a shallow saw kerf along the edge of a board will be followed by the saw when cutting down the end of the board, or vice versa. This can be a powerful principle to understand about hand saws when it comes to cutting wide, deep cuts such as tenons, half-lap joints, re-sawing boards by hand, etc.



This kerfing saw, made by Tom Fidgen, pre-kerfs a board’s edge a set distance from the board’s face. He then uses a hand saw to rip the board from end to end, re-sawing the wood. The pre-kerf tracks the saw along the cut.

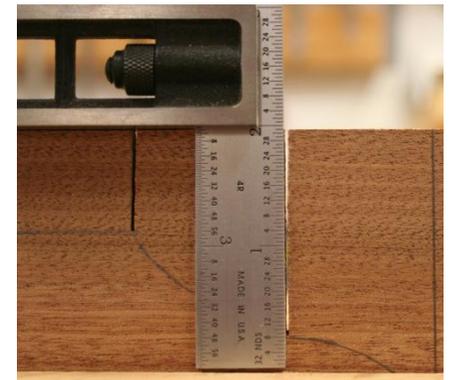


Tenons often require a wide, deep cut. Cutting two lines at once is tricky, but if you kerf the top of the board slightly, then tilt the saw toward vertical and start to cut toward the baseline you will create two shallow kerfs which result in an accurate path of least resistance for the saw to follow. The cut can now quickly be completed from corner to corner, flip the board and go corner to corner again, then remove the triangle in the middle.



Proper Technique

- **Grip:** All saws use a 3-finger grip, pointing the index finger towards the toe of the saw. The lighter your grip the better, the weight of the saw is enough for the saw to work properly.
- **Stance:** Feet should be stable, spread apart and angled apart from one another. Similar to what might be considered a “fighting stance” in martial arts.
- **Alignment:** The cutting arm should be directly inline with the cut, from shoulder, to elbow, to hand. This allows the arm to swing freely and prevents twisting the saw in the cut.
- **Cut height:** For hand saws, saw benches are ideal. For backsaws, saw hooks or a Moxon vise is ideal (see “sawing accessories” for more details).
- **Stroke:** Use the full length of your saw, you paid for more than the middle 3” after all. Short nibble-cuts are common for beginners, but it is extremely difficult to cut accurately this way, it’s slow, and you will dull the saw much faster by concentrating all the work on a small number of teeth. So share the love across all teeth.

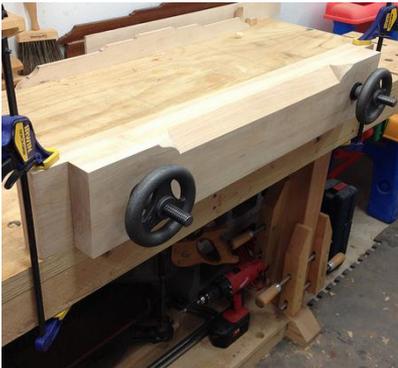


Proper Technique

- **Cutting to a line:** Many woodworkers play it safe by cutting a slight distance away from their line to avoid over-cutting... then spend hours chiseling down to their line. This minimizes the benefits of hand saws and should be avoided. Learn to lay out and cut accurately to your line. It is fast and easy to do with a little practice and proper technique.
- **Knife vs Pencil:** Many woodworkers use pencils to layout their work. This is fine for general work (rough cutting to length) or when accuracy isn't critical (cutting dovetails). When critical cuts are being made (the pins that go between the dovetails) a knife line will make a huge difference. It pre-severs fibers for cross cutting, is a finer line than a pencil (minimizing the guess work of cutting to a line) and can reach areas where pencils may be too fat (between dovetails).
- **Cut class:** *(text from www.leevalley.com/newsletters/Woodworking/1/5/article1.htm)*
 - 3rd- Removing material with little regard for accuracy or appearance. This type of cut is fast, rudimentary and useful when breaking down rough lumber into manageable pieces.
 - 2nd- Cuts that require accuracy, but the final appearance of the cut isn't critical. Dovetails or tenons, for instance, need to be accurate for a proper fit, but their surfaces will be buried in the joint so appearance is irrelevant.
 - 1st- For situations in which the appearance of the completed kerf is paramount. This type of sawing is best for parts of the joint that will be visible on the finished piece, such as the shoulder cut on a tenon. Extra steps are often required to achieve clean lines and a gap-free fit.
- **Vertical cuts:** When trying to cut perpendicular to an edge (dovetail pins), check that your board is plumb. It is much easier to cut straight down than a few degrees to the side as gravity wants to balance the saw vertically. If your board is clamped in the vise slightly off vertical it will be much harder to cut to your line, so make sure it's plumb.

Sawing Accessories

- **Saw benches**: Used in pairs, they support long boards to be broken down with hand saws (among their countless other uses). They are not “saw horses” which tend to be waist high and only support the work with a narrow board (usually the edge of a 2x4). Saw benches are knee-high, just high enough that your saw won’t hit the ground on the push stroke, but low enough that you can comfortably lean over them for sawing. They also have a wide face to work off of. Several designs exist, but the height and wide work surface are what matter.
- **Bench hooks**: An extremely simple jig for sawing comprised of a board laid on a bench with two tabs, or hooks, on either end of the board and on opposite faces. One hook grabs the bench, the other provides a stop for the work being cut. Ideal for simple cross-cut jobs like cutting the shoulder of a tenon.
- **Moxon vise**: A portable vise primarily used for joinery cuts (dovetails). It provides wide clamping support (typically up to 24” wide) and lifts the board to a more comfortable sawing height.



A Brief Word on Japanese Hand Saws

How they differ from western saws:

- Extremely thin blades, often 0.010" thick or less. This means very little material is being removed so the saw cuts very quickly.
- Saws use high PPI compared to western saws, so they cut extremely smooth.
- All Japanese saws cut on the pull-stroke to keep the blade in tension, pushing a saw that thin would kink the plate almost immediately.
- Typically use straight handles where western saws typically use pistol grip handles.
- Most (but not all) Japanese saws used hardened teeth that cannot be re-sharpened, but the blades are relatively cheap and are designed to be replaced in the handle when the teeth break or get dull. Some woodworkers prefer this because they never have to worry about learning or paying to have saws sharpened, others view it as a negative aspect because you're forever buying new blades.
- Thin blades are flexible (when no back is included on the saw) and can be used for flush cutting. Some saws are designed for this purpose and have teeth set to only one side of the plate or have no set at all.



Resources

DVDs:

Sawing Fundamentals *by: Christopher Schwarz*

Sharpen Your Hand Saws *by: Ron Herman*

Hand Saws – Tune-up, Setup, & More *by: Ron Herman*

Popular Premium Brands:

Adria

Bad Axe Tool Works

Eccentric Toolworks

Gramercy Tools

Lie-Nielsen

Veritas / Lee Valley

Wenzloff & Sons

Websites:

www.disstonianinstitute.com

www.vintagesaws.com