



SAW AND SCRAPER SHARPENING

From the Editors of **Popular Woodworking Magazine**

popularwoodworking.com

Shop-Made Saw Vise

PAGE 1

A Better Way to Sharpen Scrapers

PAGE 6

Saw Sharpening 101

PAGE 12

SPONSORED
BY  Lee Valley

veritas®

Innovation in tools®

Find us on:



Veritas® remains committed to designing and manufacturing exquisite woodworking hand tools that do not compromise on functionality. Every tool is designed with the discerning woodworker in mind; it is built to the highest standards, comfortable to handle, and made in Canada.

For more information on Veritas® products, call or visit:
1-800-683-8170 leevalley.com





Shop-made Saw Vise

Combine wood, leather and steel for a new take on an old tool.

BY JASON THIGPEN

If you sharpen your own handsaws, a proper saw vise is an essential tool. The jaws on a saw vise clamp down tightly on the saw plate, holding it securely as you file each tooth. A well-built saw vise will absorb vibration and chatter, resulting in faster filing, longer file life and better results.

There are a handful of new vises in production today and vintage versions are plentiful. Vintage versions are great, but damage and wear can pose problems. The clamping mechanisms on a lot of old vises are a weak spot, either broken or worn past the point of use.

After months of searching for a well-made unit that wouldn't require a lot of rehab, I began to design my own saw vise. The result is a vise that not only has a classic look, it is a workhorse that has greatly surpassed the performance of any other vise I've tried, new or old.

All you need to make it are a few off-the-shelf components and a weekend. You can use any hardwood you like, provided it's straight-grained rift-sawn or quartersawn material. I used some maple and oak scraps.

CLAMPING MECHANISM

This shop-made saw vise excels due to a few key features that all work together. The heart of the system is the $\frac{5}{8}$ " eight threads-per-inch Acme-threaded screw and wing nut. Acme thread is capable of applying a great deal of force, and the threads won't gall, strip or weaken over time.

I used this combination with great success on a Moxon vise I built during the past year. The wing-nut assembly can be easily made if you have access to a welder. If not, buddy up with a local welder and have him or her fabricate one for you. It's simple and straightforward.

Using a hacksaw, cut a $4\frac{1}{2}$ " length of threaded rod. Weld a nut on one end, creating the threaded post. For the wing nut, cut two $2\frac{1}{4}$ "-long pieces of $\frac{1}{2}$ " rod. One end needs to be flat, while the other gets a bevel of around 25° . (I've found 25° is just the right angle to provide a solid grip while remaining low profile.) A simple wooden jig holds the components in place while they are welded together. Then apply a coat of gun bluing to the hardware, followed by a few coats of 3-in-1 oil.



(Editor's note: McMaster-Carr sells "Acme Handle Nuts" if you wish to buy rather than make a handle.)

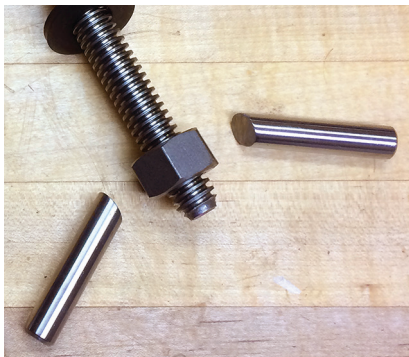
JAW PREP

I used a single piece of 8" x 18" $\frac{3}{4}$ " rift-sawn white oak for the jaws, ripping the piece in half after the following steps.

My longest backsaw is 16" long and my largest handsaw is 28" long. The 18" jaw length of the saw vise allows me to sharpen every backsaw I own without repositioning them. My handsaws only have to be repositioned once. Only the top 1" section of the jaws will contact the saw plate.

To accommodate the thicker back on a backsaw, cut a $\frac{1}{4}$ "-deep recess in all but the top 1" of each jaw. This is best accomplished with a stacked dado set on the table saw.

With the fence set 1" from the blade, make your initial pass on the jaw, then rotate the workpiece and make a pass on the other long edge. Incrementally move the fence away with each successive pass until the recess is complete.



▲ **Ready for welding.** I chuck the handles in my drill press and buff them to a sheen using progressively finer grits of sandpaper. After welding, I apply gun bluing.

Change to a rip blade, then rip the piece in half. You are left with two jaws that are 4" x 18", and each has a 1"-wide "grip" at the top.

The jaws are shaped to work with the saws in my arsenal. I prepared a template for the jaws using posterboard, then placed each saw I own on it to simulate the actual filing position.

I marked where the handles interfere with the vise jaws, then used those marks to dictate the shape of the jaws. Using a combination of drafting templates, I sketched out a shape that is both pleasing and functional. The tops and backsides of each jaw are angled so I can get up close with my saw files, adding slope to my gullets if needed.

Mark a 1/4" flat along the jaw face, then two bevels on the edges. Then mark and drill 1 1/2"-diameter holes for the inside corners of the jaw cutaway. Rough out the chamfers on the band saw; clean up the cuts with handplanes.

The goal is to remove as much "visual"

weight from the vise as possible while retaining its mass and strength where needed (similar to the concept behind Windsor chair seats).

Once the bevels are done, cut the jaws to shape at the band saw, then clean up the cuts using a combination of rasps, files and scrapers.

LEG PREP

The legs are built from 3/4 hard maple and are cut to a final width of 4". I machine all of the components to almost final dimension a few weeks prior to the build to allow them to acclimate to the shop. Then, using winding sticks and handplanes, I fine-tune



▲ **Quick work.** Hogging out the excess using a stacked dado set is the most efficient stock removal method to create the jaw's recess.



▲ **Cleaning time.** I use a high-angle smoothing plane to clean up all of the jaw surfaces after rough shaping. The 60° tool works well on white oak, leaving behind a glassy surface.

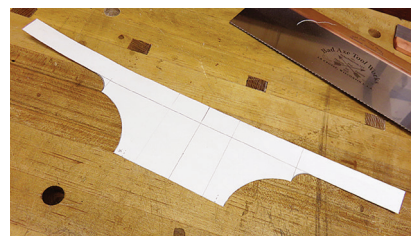
each one before cutting the joinery. Square stock is vital to this build.

JOINERY PREP

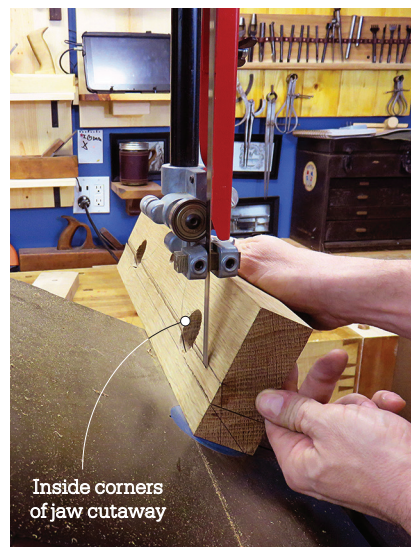
To accommodate the massive force that can be applied by the Acme screw, I decided on a drawbored mortise-and-tenon joint between each leg and its corresponding jaw. The parts will be assembled later, but first cut the joinery and drill for the hardware

The leg tenons are 5/8" thick, 3" wide and 2" long. I offset my tenons toward the outside, using a 1/16" interior shoulder to keep a flush surface on the inside of the jaws.

Flush the legs at the top, clamp them together, then mark and drill a pilot hole,



▲ **Shape shifter.** A custom template for your vise jaws allows you to play with a multitude of shapes and configurations. Find one that accommodates all of your saws while leaving mass in the center where it's needed.



▲ **Less is more.** Removing material on the outside of the jaws makes it easier to file, allowing you to add slope to your gullets if so desired.

"...There are still some honest men who are not scared to use hand tools, who can sharpen a saw, plane, or adze..."

— L. FRANCIS HERRESHOFF (1890-1972),
BOAT & SUBMARINE DESIGNER & BUILDER



SAW VISE

NO.	ITEM	DIMENSIONS (INCHES)			MATERIAL	COMMENTS
		T	W	L		
2	Jaws	2	4	18	White oak	
1	Front leg	1½	4	21	Maple	TOE*
1	Back leg	1½	4	13	Maple	TOE*
1	Hinge	½	1	4	White oak	

* TOE = Tenon one end

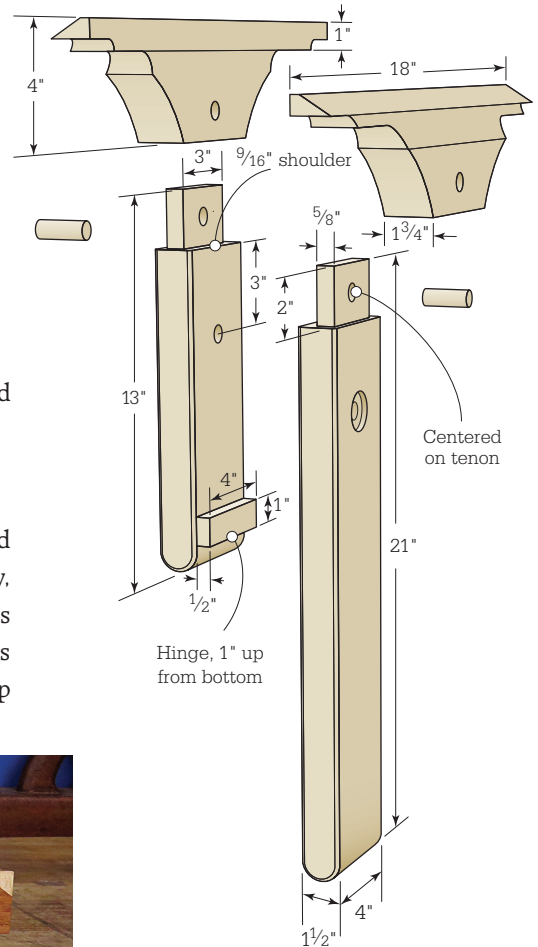
located on center 3" from the shoulder, for alignment. Now on the front of the front leg, drill a shallow 1⅜"-diameter recess to house the washer.

On the inside surface of the back leg, drill a ⅝"-deep, 1"-diameter hole, then trim it with chisels to form a six-sided mortise to house the captured nut for the wing-nut assembly. Now drill ⅝"-diameter through

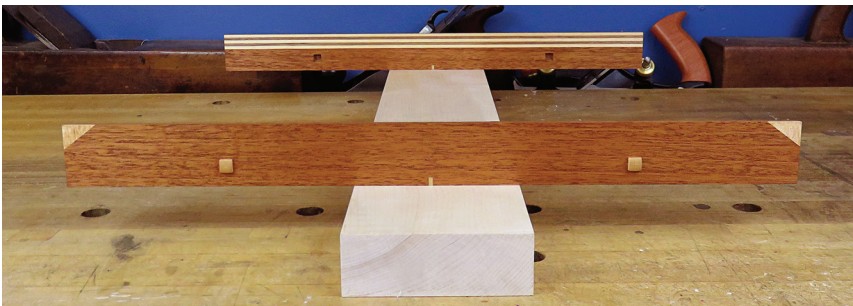
holes in each leg for the threaded Acme rod.

LEATHER HINGE

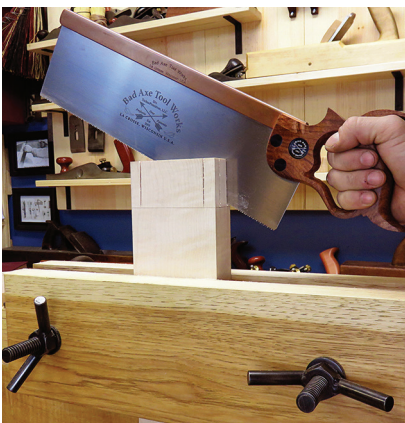
The jaws on a saw vise don't need to open up a lot to work effectively, because most saw plates are less than .040" thick. A hinge that opens farther just adds potential for slop



EXPLODED VIEW



▲ **Straight & square.** After roughing out the stock and letting it acclimate, I check for twist using a set of winding sticks. I square the stock using handplanes before laying out the joinery.



▲ **Moxon moxie.** Using a Moxon-style vise to elevate the work, I cut the tenons by hand. (Use your excess Acme thread to make one of these devices; you won't regret it.)



▲ **Plumb the depths.** I hog out most of the mortise waste on the underside of the jaws using a ⅝" Forstner bit at the drill press, then use a wide chisel to clean up the edges and corners. The valleys created by the bit make a good guide to create plumb walls.

SUPPLIES

ENCO

use-enco.com or 800-873-3626

1> Acme threaded rod, ⅝"-8, 36"
#408-0202, \$10.53

2> Acme threaded nuts, ⅝"-8
#407-2202, \$2.56 each

1> Extra thick washer, ⅝"
#319-8049, \$1.24 each

MCMaster-CARR

mcmaster.com or (330) 995-5500

1> ¼"-20 flat-head socket cap screw - 2⅝" long
#91253A558, \$9.50/pack of 10

1> ¼"-20 brass threaded insert
#90016A029, \$11.97/pack of 25

1> 12" length, ½" steel rod
#8920K155, \$3.32 each

TANDY LEATHER SUPPLY

tandy-leatherfactory.com

1> 1"-wide x 50"-long cowhide strip
4526-05, \$16.99

Prices correct at time of publication.

ADJUSTING THE VISE JAWS

When first setting up your saw vise, the jaws need to be adjusted for the whole assembly to work correctly. Ideally, any saw that is inserted into the vise will be held in place without pressure from the screw.

The ends of both jaws should make contact at all times. It is this contact that holds the saw in place while you fine-tune the position of the teeth. This is where the beauty of the leather-clad hinge is realized. The leather compresses, allowing you adjust the contact between the jaws by tightening or loosening the two screws.

Use an Allen wrench to slowly tighten each screw until the corresponding end of the hinge makes contact. There should still be a gap of at least $\frac{1}{16}$ " in the middle of both jaws; this will close up when the Acme screw is tightened. If the contact between the jaws changes over time, use the screws to adjust it until it a saw can be supported. <JT>



Consistent alignment. Two Allen-head screws pass through the hinge assembly and screw into threaded brass inserts. I like to mark the orientation of my hinge; it helps keep the jaw alignment consistent if you have to disassemble and reassemble the vise.



No-headache tension. By tightening each screw, you can increase the tension on each end of the jaws' spring joint. Snug the screws down until a standard handsaw can be supported without any assistance from the wing nut. Adjust the hinge as needed for seasonal changes and wear.

to be introduced. By using a $\frac{1}{2}$ " x 1" x 4" "hinge" of white oak with leather strips glued to each side, the jaws can be opened enough to slip a saw in while introducing a clamping force that holds the saw in place,

even with the Acme screw loose. This allows you to fine-tune the position of a saw before final tightening. This force can be adjusted using two hinge mounting screws (see "Adjusting the Vise Jaws" above).

For those screws, drill two $\frac{1}{4}$ " counter-sunk through-holes from the front of the long leg, located $9\frac{1}{2}$ " up from the bottom of the long leg and 1" in on each side. Now clamp the legs together with the inside faces touching, and mark the inside face of the short leg for the threaded-insert hole locations ($1\frac{1}{2}$ " from the bottom of the leg).

Though the packaging says to use a $\frac{3}{8}$ " bit for the threaded-insert mortise, I prefer a $\frac{25}{64}$ " bit; the tolerances are too tight with the smaller bit.

Drill mortises, and place the threaded inserts in them.

The last bit of drilling is for the two $\frac{1}{4}$ " through-holes in the hinge (the leather won't hurt the bit).

spring joint." This is a spring joint on both the vertical and horizontal planes of the jaw. You're likely familiar with the concept of a spring joint when gluing panels; the concept works the same here. I like to add both spring joints as the final step in shaping the jaws. A lot of material has been removed from the jaws at this point, so some movement is to be expected.

Check the jaw faces for square and fine-tune as needed.



▲ **Depressing work.** Using a block plane, start forming the lateral spring joint by taking a few light passes in the middle, working your way to the edges with each pass. The resulting depression should be approximately $\frac{1}{16}$ " when complete.



▲ **Nut housing.** To house the nut on the threaded rod, chop out a mortise on the back of the rear leg. A 1" Forstner bit removes most of the waste; a chisel takes care of the rest.

COMPOUND SPRING JOINT

The final and most important feature of this saw vise is what I've dubbed a "compound



Use a block plane to create the vertical spring joint. Taper the jaw face inward by a few degrees, starting at the top and working down. When the Acme screw is tightened, the initial contact is at the top of the jaws. As you tighten, the legs will bow slightly inward causing the jaws to ever-so-slightly pull in as well. That results in a solid 1" contact area along the length of the vise.

For the lateral spring joint, start in the middle of each jaw; take light passes and work your way to the ends. The final concavity should be right at $\frac{1}{16}$ " in the middle. It is imperative that you don't alter the vertical spring joint while planing the lateral one.

When the Acme screw is tightened and the spring joints close up, the resulting grip on the saw plate is amazing.

FINAL ASSEMBLY

Once the jaws have been shaped, spread a liberal layer of glue into the mortise, insert the tenon and drive that $\frac{5}{8}$ " dowel home. The joint should be rock-solid and ready for a century or more of use.

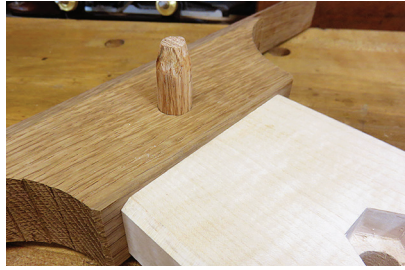
After trimming and flushing the dowels, it's time to add the leather strips to the jaws and complete final shaping.

Gluing leather strips to each jaw face not only increases the grip strength, it also protects your saws from damage. Liquid hide glue and plastic wrap make quick work of the leather install.

After the glue sits overnight, remove the plastic wrap and add the finishing touches to the jaws. I like to cut a chamfer on all edges using a drawknife, rasp and spoke-shave. The chamfer not only adds visual interest to the piece, it also makes the vise more user-friendly.

CARE & MAINTENANCE

The beauty of a wooden saw vise is its ability to be maintained. Like a wooden handplane, a wooden saw vise can be tuned and repaired as atmospheric conditions



▲ **Classic joinery.** A $\frac{5}{8}$ " dowel is used to drawbore the joint. I used an offset of approximately $\frac{1}{32}$ "; hardwoods don't require a lot. Using the $\frac{5}{8}$ "-diameter dowel greatly reduces the odds of it splitting while being hammered home.



▲ **Plastic fantastic.** Using plastic wrap is a great way to hold the leather strips in place where traditional clamps won't work. The angles on the jaw make any normal clamping setup difficult. Because a lot of pressure isn't needed for this application, plastic wrap is ideal.



◀ **Make it safe.** The 90° corners on the oak jaws can be sharp and dangerous. Adding a chamfer is made easier by securing the leg to your benchtop, allowing the jaw to overhang. This gives you access for easy shaping.

and wear dictate.

If the top of the jaws get beat up over time, you can remove the leather by applying heat or moisture to the hide glue, then plane the top of the jaws smooth and glue a new strip of wood on top. After blending the new piece in with the existing jaw, glue the leather back on and get back to sharpening.

You can replace the jaw faces the same way, reintroducing new spring joints as you do.

A few coats of boiled linseed oil followed by a 50/50 blend of beeswax and paraffin are my go-to finish for shop tools. I use a polissoir to apply the wax and burnish the wood. The Acme screw will benefit as well from the same wax mixture – a few dabs on the threads will keep them operating smoothly.

USING THE SAW VISE

The longer front leg on the saw vise allows it to be secured several ways to your benchtop – it can be gripped in a face vise or leg vise. If you have an apron around your bench, a couple of dog holes and holdfasts can hold it in place.

The additional contact area created by the longer leg helps stabilize the vise during use.

Once the vise is securely mounted, slip in a saw, carefully adjust the toothline, clamp down on the wing nut and get to sharpening.

With a proper saw vise such as this one, keeping your saws sharp is easier than ever before. **<PW>**





A Better Way to Sharpen Scrapers

We compared 14 methods to find the fastest way to prepare this useful tool.

BY THE EDITORS OF POPULAR WOODWORKING

Scrapers are one of the most misunderstood but useful tools in a woodshop. A scraper in its basic form is simply a piece of hardened steel with a small hook that is created by pressing on the tool's edge with an even harder rod of steel. This tool is capable of making tear-out free cuts in hardwoods that no plane can manage.

But how to sharpen a scraper is a mysterious or confusing process for many woodworkers. One reason for the confusion is that there are many different published techniques out there, many of them offering conflicting advice.

So I compiled a list of 14 different techniques for sharpening this rectangle of steel that have been published since 1875. All of the 14 techniques basically agree that there are three steps to sharpening a scraper: Filing the edge of the tool, removing the file marks with a sharpening stone and then creating the

hook (sometimes called the burr) with a hardened rod of steel, usually called a burnisher.

But none of the accounts agree on the details. Should you file the edge of the scraper with the file parallel to the edge or at an angle (and if so, what angle)? What kind of file should you use? Should you stone both the edge and faces of the tool? To what grit? And how should this be done?

Do you have to burnish the faces of the tool before turning the burr of the scraper? If you do, what angle do you use? And how should you burnish the edge to create the hook? At what angle? Do you slide the burnisher along the edge as you turn the burr?

So one weekend I tried all these techniques then compared the results. I used high-quality scrapers from Lee Valley, Bahco (formerly Sandvik) and Lie-Nielsen. All of the published techniques

basically worked and created a tool that made shavings. Yet some techniques were faster, some required fewer hand skills to master and some made a hook that really grabbed the work.

After trying these techniques, applying my own training and talking to an expert on steel tooling, I think I've found a 15th way to sharpen the tool that doesn't require a lot of equipment, and is fast and is easy for beginners.

LIKE ANY TOOL'S EDGE

What's important to understand is that a scraper is like any cutting tool and it responds to your sharpening efforts in the same, predictable way.

A sharp edge is the intersection of two steel surfaces (in a chisel, it's the bevel and the face, which is sometimes called the back of the tool). Any cutting edge is at its sharpest when these two surfaces meet at the smallest point possible.

STEP ONE: FILING THE EDGE



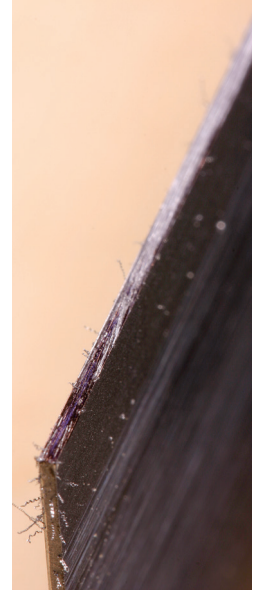
A permanent marker will help you determine if you have filed the edge sufficiently. Once the color has been removed, you are ready to stone the edge of the scraper.



Two or three passes with a file is usually all it takes. Use only a push stroke with a file and use the fingers of both hands to keep your filing jig's fence flat against the scraper.



You can make a perfectly good filing jig from a scrap of hardwood as shown here. Cut a kerf in the block that allows the file to be held with a firm friction fit.



After two strokes with the file, the color is almost gone from the edge.

The edge becomes more durable as it gets more polished by higher grits. Polishing removes tiny scratches in the steel, and scratches are the places where the edge begins to break down and become dull.

A harder steel can also contribute to a more long-lasting edge. However, if it is too hard it can be fragile and susceptible to shock.

All these rules apply to scrapers. The cutting edge of a scraper is two surfaces: the edge and the face. The more polished those two surfaces are, the more durable and sharp the edge is. So with that principle in mind, here's the thinking behind my scraper-sharpening technique.

STEP 1: FILE THE EDGE

The edge of the card scraper should be

filed square to the tool's faces (all the sources agree on this). You should use a fine file. Look for one with single rows of parallel teeth (this is called a single-cut file) and teeth that are fine, usually labeled "second cut" or "smooth." Scrapers are soft and easy to file, so a coarse file will create deep scratches that are difficult to remove.

Color the edge of the tool with a permanent marker. This will allow you to see where you are cutting. When the color is gone, the filing is done.

How you hold the file in use is in dispute. You can work with the file parallel to the edge, perpendicular to the edge or anywhere in between. All can result in a square edge, but there is only one technique that gives perfect results every time regardless of your skill with filing:

Use a jig, either commercial or shopmade. Veritas makes an inexpensive jig that I like. You also can purchase a vintage saw jointer, which was used to file handsaw teeth down for reshaping. Or you can cut a kerf in a block of wood to hold your file. Freehand filing is great if you are skilled at it. Most of us are not, so I recommend a jig.

STEP 2: STONE THE TOOL

After filing, you smooth away those scratches with a sharpening stone or two. Some sources say you have to stone only the narrow edge of the scraper. Others say you stone both the edge and the faces. Because we now know that a good edge is the intersection of two polished surfaces, you should stone both the edge and face.



How do you stone the edge? You can rub the tool on edge on your stone, but this can make it difficult to balance the tool. Some published accounts recommend sandwiching the scraper between two blocks of wood for additional support, but you'll usually end up abrading the wooden blocks more than the tool.

Alternately, you can bow the scraper as you rub it on the stone to spread the edge out over more of the surface. This works well with flexible scrapers but is quite difficult with the thicker ones.

Instead, I like to hone the edge of the scraper on the sharpening stone with a single block of wood supporting it from the side. I'll sharpen on the face of the stone as shown at right. This is foolproof and allows you to spread the wear out across the stone's face by moving the block of wood.

With the edge stoned, how do you stone the two faces of the tool? Here is where the real trickery begins. Every other technique that discusses this has you rub the face of the tool to and fro on the stone. This works, but it takes a while. The face of a scraper is a lot of steel to deal with. Most woodworkers do what they can on the faces and give up when they get bored. And that doesn't cut it.

Why sharpen a bunch of steel you aren't using? So I took a page from the playbook of David Charlesworth, a British craftsman. He sharpens the unbeveled face of a plane iron by propping up the back of the tool on a thin ruler set on the stone. This technique, called the ruler trick, sharpens only the section of steel up by the cutting edge.

Would this work with card scrapers,

SUPPLIES

LEE VALLEY TOOLS

800-871-8158 or leevalley.com

1▷ Veritas variable burnisher
#05K37.01, \$33.50

1▷ Veritas jointer/edger
#05M07.01, \$19.95

1▷ super-hard milled scrapers, set of four tools
#05K30.10, \$19.90

Plus other burnishers and styles of scrapers are available.

Prices correct at time of publication.

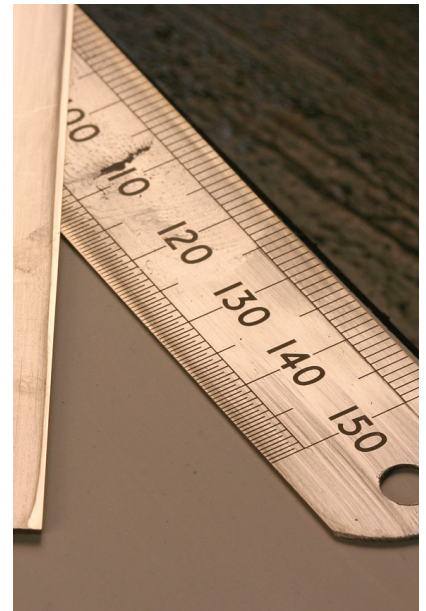
STEP TWO: STONING



There are many ways to stone an edge. This "2" x 2" x 5" block is what I prefer. You can move the block as you rub the scraper against the stone, which spreads the wear out on your stone. Alternately, with thick waterstones you can use the side of the stone and support the scraper with a block of wood.



Hold the ruler with one thumb or it will slide. Use your other hand to stroke the edge against the stone. The wood block improves control.



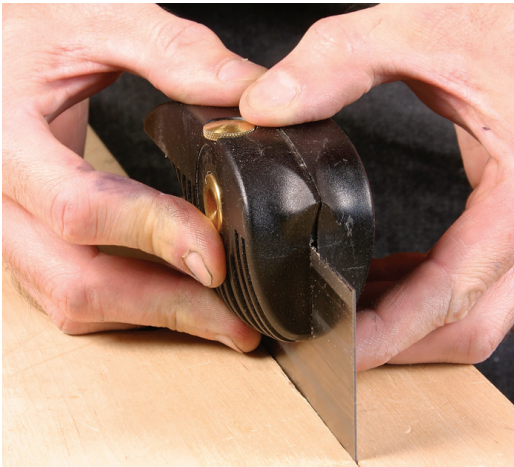
The ruler trick sharpens the scraper only at its cutting edge, saving much time and effort.

STEP THREE: BURNISHING

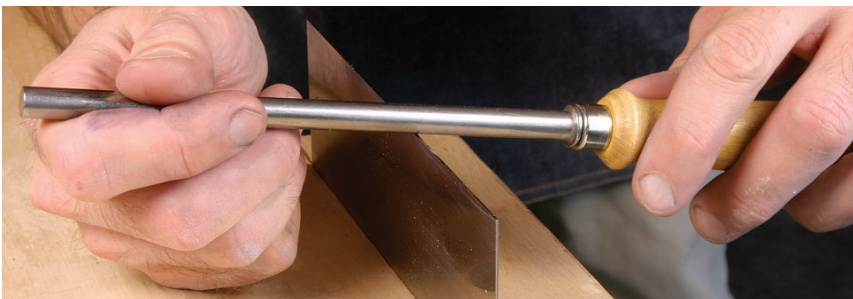
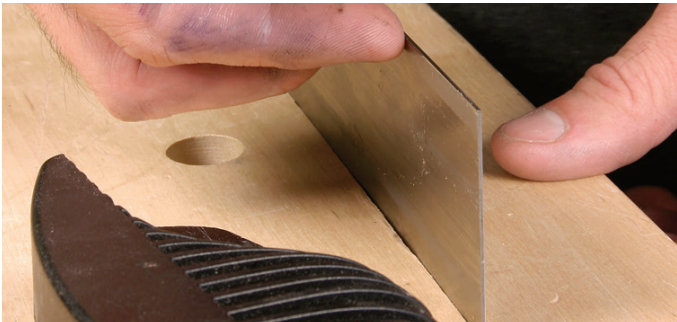
Rub your burnisher flat against the scraper five or six times. This work-hardens and consolidates the material. And it draws out the steel at the edge, making it easy to turn the hook.



A jig such as the Veritas Variable Burnisher allows you to turn a hook with little chance for error. If you are having difficulty with burnishing free-hand, this is an excellent option.



After three passes with the burnisher using mild downward pressure, feel the edge for a hook as shown. It should feel like a tiny lip that your fingernail could almost grab.



Burnishing freehand is tricky for some and a cakewalk for others. Here's a tip: Rest one hand on the bench to control the angle of burnishing. Use the other hand to draw the burnisher along the edge of the scraper. This usually helps increase your control.

I wondered? It does. And brilliantly. You sharpen only the metal up by the edge. It takes far fewer strokes. And the slight change in edge geometry has no discernible effect on the final cutting edge. Thanks David.

The other question is what grit of stones you should use. This is honestly up to you. The more polished the edge, the more durable it will be in use.

I start by marking the face with a permanent marker. First work the tool with a coarse stone, such as a #1,000-grit waterstone. Then go directly to any fine polishing stone, such as #4,000, #6,000 or #8,000 grit. Oilstones or sandpaper are fine options as well. To improve your grip on the tool, you can affix a strip of $\frac{1}{4}$ " x $\frac{1}{4}$ " x 6" scrap to the scraper with double-stick tape. Or spread a thin layer of silicone rubber on the strip of wood and let it cure. The cured silicone makes the wood grippy (as long as it doesn't get wet).

STEP 3: BURNISH THE TOOL

Of the 14 scraper-sharpening techniques I tried, eight recommended burnishing the flat face of the scraper before burnishing the edge to turn the hook/burr. The explanations for why you burnish the flat face of the tool were varied: To soften the metal, to harden the metal, to consolidate the metal, or to warp the metal over the edge so you can turn it into a burr.

So I did what any mind-muddled journalist does: I called an expert. Ron Hock runs Hock Tools and sells a wide variety of replacement plane irons.

Here's what Hock concluded: Burnishing the flat face of a card scraper does two things: It work-hardens the metal by compressing the crystal struc-



ture of the steel. The burnisher is harder than the scraper. Burnishers will typically be of a Rockwell hardness (Rc) of 58 to 60. Modern scrapers are typically Rc 48 to 53. The harder burnisher will compress the steel of the softer scraper, making the steel harder and probably more durable in use. Burnishing the face is especially useful with old scrapers, which have a Rockwell hardness that is lower, more like in the mid-40s, Hock said. (Scrapers were typically made from old saw blades in the early days.)

The other thing that the burnisher does is to draw the steel off of the face of the scraper. Essentially, it moves the metal so the steel makes a small point where the face meets the edge. Why is this important? It makes the scraper's burr much easier to turn when you burnish the edge of the tool. You can turn the burr in fewer strokes and without much downward pressure on the tool.

Hock's points about steel fit in perfectly with my experience during the 13 years I've sharpened card scrapers. Must you burnish the face to get a burr? No. But if you don't burnish the face, the burr is more difficult to turn, and you must use more pressure or more strokes. Using more strokes or pressure can introduce error and create an irregular burr.

Point two: Burnishing the face creates (in my experience) a burr that lasts longer. Hock suggests that this is because the steel has been work-hardened by the burnisher before turning.

Once you burnish the face, you have to turn the hook with the burnisher by running the burnisher across the edge. Like with all things with card scrapers, there is debate. At what angle should the burnisher be held against the edge: 0°, 5°, 10°, 15°?

Should you use light pressure? Heavy pressure? How many times should you draw the burnisher across the edge? Some accounts say you burnish first at 0° and then burnish again at a slight angle. (I've done it this way for years. It works, but so does skipping the step. See what works for you.)

I have always been stymied by the question of the final hook angle, so I tried a little experiment and prepared a scraper with four different hooks (5°, 7°, 10° and 15°) made using the Veritas Variable Burnisher. Then I gave the scraper to Bob Lang and asked him to use it as I watched, and we then discussed the different working characteristics of the four hooks.

The conventional wisdom is that the steeper the hook, the more aggressive the tool (15° is supposed to be for removing paint; 0° is supposed to be for marquetry). But the truth is, we could get excellent results with all the edges. You could get the wispiest shavings with a 15° hook if you used light pressure. In fact, the only scraper that seemed to perform significantly different is one that I prepared with no hook. That one took only light shavings.

So how much pressure should you use when burnishing? I use pressure that is similar to when you "spread butter on bread," an apt description by woodworking author Graham Blackburn.

Should you use one stroke? Two strokes? More? I stroke the edge until I can feel a burr. Then I stop. This takes two or three strokes.

I again recommend a jig for the burnishing, especially if you're a beginner or aren't able to stay in practice with your burnishing. I'd never used a jig until a couple years ago, and I'd never had prob-

lems with freehand burnishing either (but I sharpen a lot). The jig gives you speed and consistency. You don't have to think about it, you just do it. And errors are rare.

Most sources recommend adding a drop of oil to the edge before burnishing to prevent galling. What's galling? That's when you force metal parts together (screw threads are a common example) and there is so much friction that the high points heat up and cause tiny welds on the high points that then break off, making the corner feel rough. I've done this, but I had to try to do it to make it happen. I oil the edge because it makes the burnisher slide sweetly.

USING THE SCRAPER

To begin scraping, I flex the card scraper just a bit at the center and hold it at an angle to the work that's usually between 60° to 65° to the surface. I adjust my wrists until the scraper starts to cut shavings. If you are getting dust instead, adjust your angle first. Then check your hook to see if it is still there. A hook feels like a lip on the edge.

Scrapers are great for removing tear-out, but you do have to be careful not to create a depression that will show up after finishing. When you work a small area, it's best to then blend in that low spot with the area around by working the wood around your problem area with the scraper as well.

Scrapers are subtle tools and are capable of a great number of tasks. In fact, there are even more uses for a scraper than there are ways to sharpen it – and that's saying something. **◀PW▶**



We've all been there: You reach for your saw in the middle of a project, and before you start the cut, you drag your finger along the teeth and say to yourself, "Meh...they're sharp enough." But you soon find out they are anything but.

Wouldn't it be nice if you could sharpen your own saws and never have to settle for the misery of a dull saw again? With a small investment of time and money, you can.

So let's jump right into the four critical steps to sharpening any handsaw: setting, jointing, filing and stoning.

SETTING

A saw's set – the right and left projection of the teeth from the saw plate – determines the width of the kerf and prevents the saw from binding in the cut.

Setting the teeth might not always be needed, so the first step is to evaluate.

To test your saw's set, make a cut in a piece of wood whose species, thickness and moisture content is typical of your work. If the saw binds (gets stuck in the cut), it requires setting. If the blade is loose in the kerf, however, then it may be over-set, which can be corrected in the final step of stoning.



▲ *Rip teeth vs. crosscut teeth. Rip teeth (left) are shaped like tiny chisels and are shaped and sharpened by filing square across the blade. Crosscut teeth are shaped more like knives and are formed by filing at an angle to the blade.*

Most saw set tools adjust to allow setting different sizes of teeth and types of work. I recommend adjusting your tool to create the slightest amount of set for a backsaw, and only a touch more for a handsaw. Ignore the numbers on the tool; they are there only to confuse you. If your saw requires setting, begin by



▲ *Set. Slip the saw set over the saw blade, rest it firmly on the toothline, align the hammer with a sawtooth, then squeeze.*



Saw Sharpening 101

A well-tuned tool pays great dividends when the blade hits the board.

BY MATT CIANCI



▲ **Joint.** A file (held here in a shop-made saw jointing guide) levels the teeth to one another and creates a flat top on each. (You can purchase a similar jointing guide; search for “card scraper jointing guide” online.)

clamping the saw in a vise with the toothline about 2" above the jaws. Starting at the heel of the saw, identify the first tooth set away from you. Place the saw set so the center of the hammer (the steel mechanism that bends the tooth over the anvil) aligns with the point of the tooth. Make sure the casting rests solidly on the toothline and squeeze the tool firmly. You will see the tooth bend ever so slightly away from you.

Skip the next tooth and move on to the next tooth set away from you. Set it as you did before, and repeat down the entire length of the saw. Now flip the saw around in the vise and set the teeth you skipped on the first pass.

JOINTING

Jointing a saw every time you sharpen it ensures that the teeth are all the same height. It also creates a flat facet at the very point of each tooth that will guide your work in the filing step.

To begin jointing, keep the saw firmly in the vise with about 2" of the blade above the jaws. Grasp the mill file with both hands and rest it on the toothline at the heel. Run the file down the toothline toward the toe of the saw, using moderate pressure, until you see a flat facet on the point of each tooth. Two to four passes of the file should be sufficient for most saws.

It is critical that you keep the file perpendicular to the side of the saw blade as you joint the teeth. You can use a card scraper jointing guide or a block of wood to aid in this process.

Before you move on to filing the teeth, attach a rake-angle guide to the tip of the file to create consistent geometry on the cutting face of each tooth. Most rip-filed saws have a tooth rake of 5° to 10°, and most crosscuts have 15°.

A rake guide is a small block of wood,



▲ **Rip-tooth geometry.** A rip saw is filed to form a row of tiny scrapers. The moment the flat formed by jointing is filed away, the saw is sharp.



◀ **Watch the angle.** The angle at which you push the file across the teeth affects the saw's cutting geometry.

or a commercially made affair with moving parts, knurling and scales galore, that slips over the tip of the file to create a visual reference for the rake angle as you file. If you make your own, you'll need several for each size of file and rake angle you typically use.

RIP SAW FILING

The goal in this step is to file each tooth until the flat created by jointing disappears – and not a stroke more. The moment the flat disappears is the moment that the tooth is sharp and remains exactly the same height as the rest of the teeth. (Were

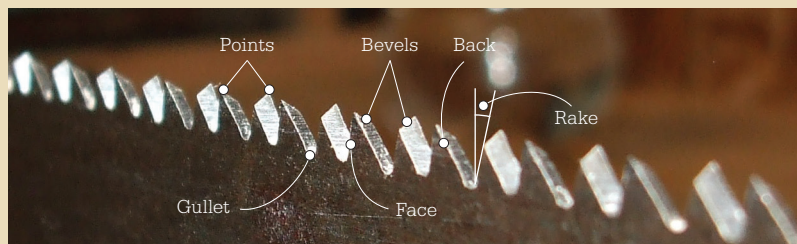
you to continue filing, the tooth would stay sharp, but get shorter than the others, rendering it useless.)

Clamp the saw in the vise with the heel on your right and the bottom of the gullets $\frac{1}{16}$ " above the jaws. Place the saw file in the first gullet. Ensure the file is seated fully in the bottom of the gullet. Hold the file perpendicular to the side of the saw blade (level with the floor) and to the toothline as viewed from above. Use the full length of the file and push it across the saw with gentle pressure.

Beginning filers have a tendency to use short, heavy, chattering strokes. Light, full, even strokes are the mark of an accomplished and precise saw filer. When you push the file across the saw you should see bright, fresh steel exposed on three surfaces: the cutting face of the tooth to the right of the file, the gullet and the back face of the tooth on the left of the file.

Continue filing across the tooth while watching the flat on the right of the file.

TERMINOLOGY



There is much confusion around terms associated with saw filing. It is important to use standardized and accurate language when teaching or learning a new skill, especially one as ancient as saw filing. These are the historically accurate and best terms to use.

Spacing: The American standard measure of tooth points per inch (ppi) on any saw that determines its coarseness or fineness. (The English standard uses teeth per inch (tpi), which is equal to points per inch minus one. So 6 ppi equals 5 tpi.) Tooth spacing is often incorrectly referred to as “pitch” by modern saw manufacturers.

Rake: The amount that the front cutting face of a saw tooth leans back from perpendicular relative to the toothline. Measured in degrees from the perpendicular. Also traditionally referred to as “pitch.”

Bevel: The interior acute angle on the face and point of a saw tooth that creates a cutting edge for cross-grain cuts. Also commonly referred to as “flean.”

Gullet: The V-shaped space between two neighboring saw teeth where the sawdust collects in use. ◀MC▶

“The expectations of life depend on diligence; the mechanic that would perfect his work must first sharpen his tools.”

— CONFUCIUS (551-479 B.C.),
CHINESE PHILOSOPHER



ON DOING IT “WRONG”

There are warnings in classic saw filing texts about sharpening entirely from one side. While I am usually deferent to wisdom of the past, I deviate from it here. Why? I honestly don't recall; it's simply the way I learned to file a saw. Many others today also file all from one side. You should be aware of this debate if you plan on sharpening your own saws. Here are the major objections:

1) Filing from one side of the saw dulls the file faster because you have to file into the teeth leaning toward you, which causes more wear on the file teeth.

The gullet edge of the file is what wears out first and destroys a file. I find the extra wear to the face edges rather irrelevant; they stay intact long after the file is useless, regardless of how you file teeth.

2) Filing from one side of a saw alone puts all of the filing burrs on the opposite side of the saw teeth and will cause the cut to steer to that side when the saw is used.

I have filed hundreds of saws. The only case in which I've found the above to be true is in dovetail saws and similar saws spaced 14 ppi or finer. The fine teeth can be affected by the burr, but an

extra stoning pass or two on the burr side of the teeth is a simple remedy. On saws with teeth coarser than 14 ppi, I've found they are large enough to overcome any problems a burr might create.

3) You cannot create saw teeth with independently shaped back bevels (sloped gullets) by filing from one side of the saw.

I would say this is mostly true. But for 95 percent of woodworkers, I don't think independent back bevels on the teeth make a difference. For most work, the benefit is negligible. Can you gain a small advantage in your work with independently shaped back bevels? Sure. But to me, it's like the difference between a Corvette and a Ferrari.

So with all of these objections, you may be wondering why don't I just flip the saw, file from either side and avoid the controversy? For that matter, why do some people cut the pins of their dovetails first? Or use sandpaper after smoothing with a handplane? Or do any of the seemingly strange things that any of us do a million times a day?

Like most things in life, I simply have no idea. But I do know my method works. <MC>

Stop filing the precise moment that the flat on the right of the file disappears. Move to the next gullet and continue the same process down the entire length of the saw on every tooth.

CROSSCUT SAW FILING

After jointing the saw, reclamp it, again with the bottom of the gullets about $\frac{1}{16}$ " above the vise jaws, and place the saw file in between the first pair of teeth at the heel, with a tooth set toward you on

the right of the file and a tooth set away from you to the left. This may be either the first or second gullet on the toothline. With the file resting in the gullet and using your index finger on the file where it rests on the saw, press the file firmly down into the gullet. The file should rotate away from a perpendicular line from the saw as viewed from above, usually 15° to 25° for most crosscut saws. This is the bevel angle of the teeth. Filing at this angle creates the knife edge that allows the saw teeth to cut across the grain of wood fibers.

Take your first stroke with the file fully seated in gullet while carefully maintaining the bevel angle, and watch the flat on both teeth to the right and the left of the file. The goal is to file until you have simultaneously reduced the width of the flat on both teeth by half.

Skip the next gullet and move to the following gullet with a tooth set toward

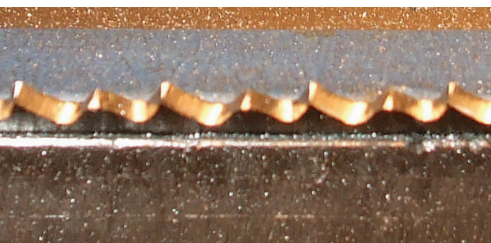


▲ **Stoning.** To remove burrs left by the filing, and to remove set, make no more than four passes down each side of the teeth with a fine India stone or #600-grit diamond stone.

you on the right of the file. Now repeat the process of filing while maintaining the bevel angle and watching both teeth on either side of the file. Reduce the flats on both teeth by half and stop. Skip the next gullet and repeat as you make your way down the saw.

As you progress, notice the pattern of every pair of teeth filed in one direction with every other gullet not yet filed.

Once you have filed each pair of teeth



▲ **Crosscut tooth geometry.** Jointing crosscut saw teeth creates triangular flats at the point of each tooth. These reflect light and help guide the sharpening process.

SAW FILING TOOLS

Taper saw files (with handle): Match the tooth spacing of your saw to the proper-size file. Always use the properly sized handle.

▶ 12-15 ppi: 4" or 5" double extra slim taper (xx-slim)

▶ 10-11 ppi: 6" double extra slim taper (xx-slim)

▶ 9 ppi: 6" extra slim taper (x-slim)

▶ 8 ppi: 6" slim taper

▶ 5-7 ppi: 7" slim taper

▶ 3.5-4.5 ppi: 7" regular taper

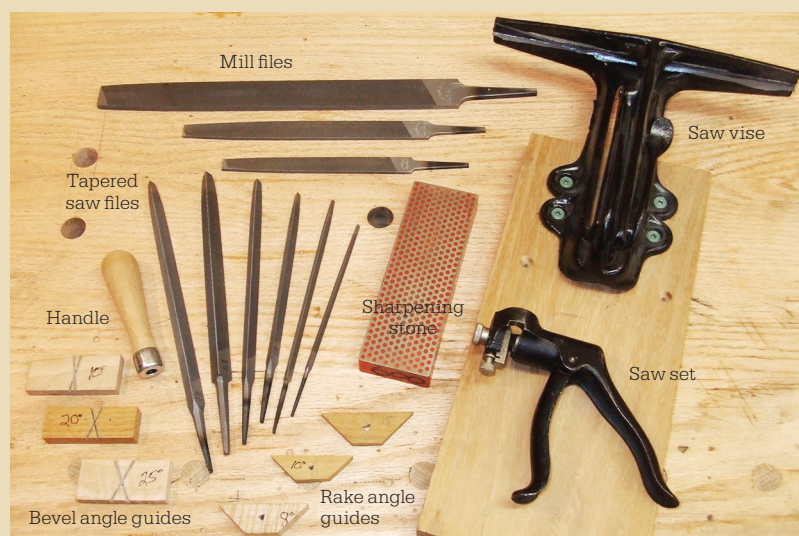
Mill file: bastard cut, 6" to 8" for backsaws, 10" to 12" for handsaws.

Saw set: any brand or style, though there are no quality new saw sets made today.

Saw vise: Shop-made of wood for the thrifty, Gramercy Saw Vise for the demanding, or vintage cast iron for the nostalgic. I file for two to four hours every day and there is no equal to my Gramercy.

Sharpening stone: 6" x 2" #600-grit diamond stone or fine India stone for handsaws, 1" x 4" stone for backsaws.

Saw filing guide: I prefer shop-made wooden guides for rake and bevel angles because they are free when made from scraps, light and endlessly customizable. That said, the new guides available from Blackburn Tools or Veritas are very helpful to students. ◀MC▶



in one direction down the length of the saw, return to the heel.

Now you'll remove the flats left from the previous step to bring all the teeth to a sharp edge. Place the file in the first gullet at the heel you skipped earlier. The tooth set away from you should be on the left of the file and the tooth set toward you should be on the right.

As before, press the file down into the gullet and notice how the file's angle

rotates to away from perpendicular – but in the opposite direction as before. This angle should be the same relative angle from perpendicular as before, (15°-25°). This final angle filed into each tooth will create the second and complementary interior bevel and complete the crosscut geometry.

As before, while maintaining a consistent bevel angle, push the file through the gullet and watch both flats on either

side of the file. Keep the file seated in the gullet and ensure that you are removing metal from the face of each tooth in addition to the gullet. Ideally, you want each flat to disappear at the same moment. This ensures that each tooth is sharp and of equal height.

Continue to the next unfiled gullet and repeat filing each pair of teeth until you complete the saw.

STONING

The final step in sharpening a saw is to stone it. Place the tool flat on your bench with the handle overhanging the edge. With a fine India stone or #600-grit diamond stone, use light pressure as you run the stone along the teeth down the length of the saw to even the set and remove the burrs created by filing. Flip the saw over and repeat. One pass per side is sufficient. (If the saw was over-set to begin with, take more strokes as required.) No more than four strokes per side is recommended. (This step is also known as "side jointing.")

You may find that in a test cut after sharpening a fine rip-filed saw (14 ppi and up), it steers to one side. This is a common result from a burr on the teeth left from filing only from one side. To remedy this, take an extra stoning pass on the side toward which the saw is steering. This will remove the burr and even the cut in the kerf.

Sure, like everything, saw filing takes a bit of practice to get good at it, but it doesn't take too much time or effort to become at least competent. Take the time to learn how to sharpen your own saws, and you'll be amazed at how much better they work – and how much time and money you'll save over sending them out for sharpening. ◀PW▶



Honing in on Sharp

In principle, achieving a sharp edge is not difficult, but how you go about it depends on what you need to sharpen and the condition of the tool. Whether you need to reshape the edge or touch up the micro-bevel, Lee Valley offers a variety of sharp solutions so you can master your freehand sharpening skills.

- Honing Guides
- Honing Compound
- Leather Hand Strops
- Diamond Lapping Film
- Folding Diamond Hones
- Ceramic Stones
- Diamond Plates
- Diamond Stones
- Key-Chain Hones
- Lapping Plates
- Lapping Grits
- Water Stones
- Water Cones
- Water Slips
- Oil Stones

Browse our catalog online or download it to the *Lee Valley Library app* for iPad®, iPod®, iPhone® or Android™ devices.

1-800-683-8170 leevalley.com

Find us on:



 **Lee Valley & veritas®**

Keen on Sharp

For those who recognize that sharp tools work better, but want to spend more time using tools than sharpening them, Lee Valley offers the best of both worlds. Visit leevalley.com to discover a variety of power sharpening systems and accessories that deliver keen edges in a relatively short matter of time so you can get on with your project.

- Sharpening Systems
- Sander/Grinder
- Tool Rests
- Grinding Jigs
- Sharpening Jigs
- Grinding Wheels
- Felt Wheels
- Sharpening Belts
- Sanding Drums

Browse our catalog online or download it to the Lee Valley Library app for iPad®, iPod®, iPhone® or Android™ devices.

1-800-683-8170
leevalley.com

 **Lee Valley**
& veritas®

Tormek® T-4 and T-8 Sharpening Systems

