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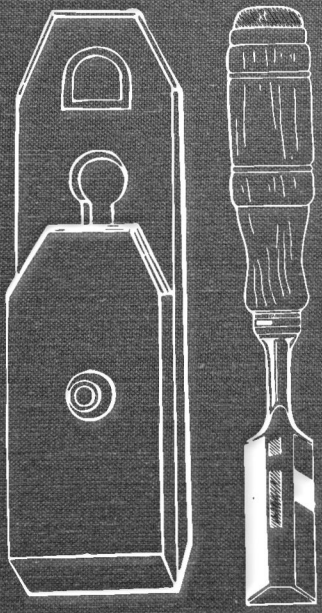
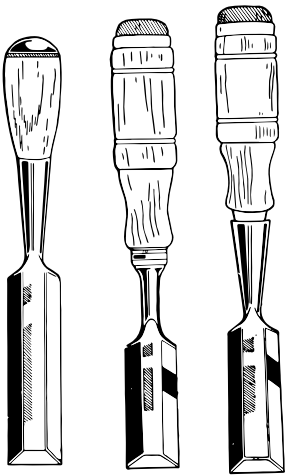


by Christopher Schwarz

SHARPEN THIS



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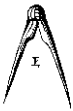

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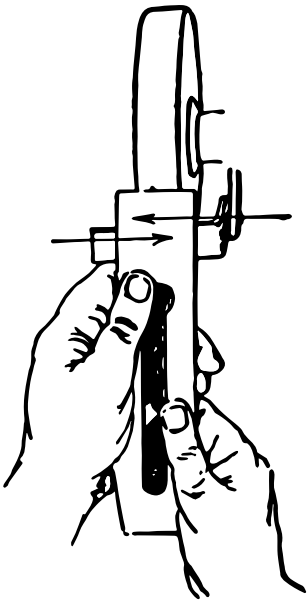
For Dr. Tim Henriksen, who told me
10 years ago I should write this book.
And he was correct.



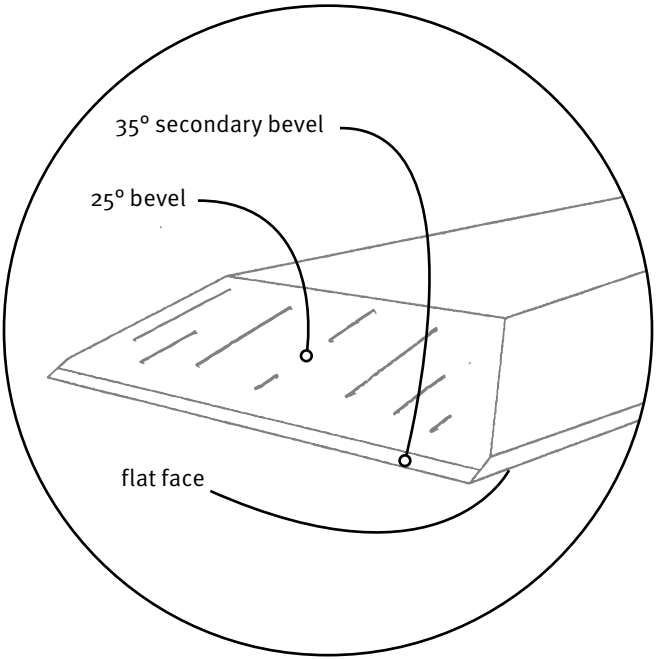


Fig. 1. Anatomy of a chisel edge.

1
INTRODUCTION

THE BOOK I NEVER WANTED TO WRITE

AS FAR AS I KNOW, there were no books dedicated to sharpening woodworking tools published before the Industrial Revolution. Back when the civilized world was comprised mostly of wood, cloth, stone and little bits of steel, sharpening was a common – almost pedestrian – skill.

Sharpening back then was much like the skill of eating with a knife and fork today. Yes, you are taught how to do it. Yes, there are many ways to do it (different cultures hold the tools differently). But in the end, everyone knows how to get the job done and doesn't ponder the fine points of silver vs. steel flatware, two tines vs. four, or the sharpening angle on a fish knife.

Unfortunately, when sharpening skills vanished from the population at large we then started to think that sharpening was difficult. And as soon as that happened, our capitalist system began to churn out products to "help" us with this impossible task. Handplanes (like razors) got replaceable blades that didn't need sharpening – you just threw the dull ones away. All manner of new sharpening media were invented to make the process faster, easier or less messy. Jigs,

INTRODUCTION

guides and entire machines were invented and manufactured to save us from simply rubbing steel on a stone.

And finally, we got what we deserved: the sharpening gurus. These (mostly well-meaning) people turned a simple task into something that had to be dissected, studied with scientific equipment, quantified, analyzed, discussed and (here's the worst part) debated.

Add to that the explosion of information from the internet, and it's easy to see why many beginning woodworkers own four sets of sharpening stones, six honing guides, two grinders and zero sharp chisels.

Because the world of sharpening is so stupid, I vowed to stay away from it as much as possible. But during my 15 years as an editor of *Popular Woodworking Magazine*, I had little choice in the matter. So I reviewed dozens of sharpening systems for the magazine and worked with professional woodworkers all over the world on articles about their sharpening methods.

And after some reflection on those 15 years, some things became clear to me.

All sharpening systems work well. I have watched carpenters sharpen chisels on a building's steps (with a loogie as a lubricant). And I have seen professional sharpeners polish giant knives for a veneer slicer with sub-micron honing compound. It's simple: Rub steel and rocks together, and you can get a sharp edge.

Most sharpening equipment is unnecessary. A tool

merchant once told me how excited he was about a new 30,000-grit stone. "How well does it work?" I asked. "Who cares," he replied. "The profit margin is incredible."

You need to stick with one system to become a good sharpener. Every sharpening system has its peculiarities. If you jump around from waterstones to diamond stones to oilstones to sandpaper, you'll never master any of them. You'll be a poor sharpener and poor in the real sense, too.

During the last couple decades, I have taught these ideas to my students. But it's been a losing battle. Every year there are more sharpening jigs, new brands of sharpening stones and new pseudo-scientific studies that prove that the best way to sharpen tools is _____.

And so I decided to write this book, which I'd hoped someone else would write. The working title was "How to Sharpen Woodworking Tools if You Don't Have an Ax to Grind." Here are my bona fides for the task. I don't manufacture sharpening tools; I make furniture. I sharpen every day – not because I love to sharpen but because I love to build stuff. Sharpening is not a hobby for me, and it does not make me any money. And most importantly, in the end I do not care how you sharpen your tools.

This book is an attempt to boil down everything I've learned about steel, sharpening media and technique. And then explain it so you can choose any sharpening

system and use it to produce edges that any working woodworker would be thrilled with.

And, for the most part, I want to help you sharpen your tools as quickly as possible. And that's for this one important reason: The process of making tools dull is a lot more fun than making them sharp.

2
WHAT IS SHARP?

SHARPNESS IS SIMPLE. It's when two surfaces intersect in a "zero-radius intersection."

You will hear the expression "zero-radius intersection" a lot when people discuss sharpening, but what does it mean? Like a lot of things with sharpening, it is easier to explain things by explaining what they are not. In this case consider two different edges.

With one edge, the edge's two surfaces (the tool's bevel and its flat side) intersect. But because the tool has been used a lot, its cutting edge has been worn down. When this happens, the tip is rounded over, so it has a radius (just like a circle). This is a dull edge. Or we could call it "an intersection with a radius." Important tip: a radius will reflect light.

With the second edge, the two surfaces intersect, but where they meet there is no radius, no rounded-off area. What is there? We hope that the two surfaces – the bevel and the flat side – meet and share one single row of iron atoms all along the tip. There is no rounding over of the tip, and so we call it a "zero-radius intersection." Second important tip: this edge will not reflect light.

That zero-radius intersection can occur no matter how you sharpened the tool. You can create a zero-ra-

WHAT IS SHARP?

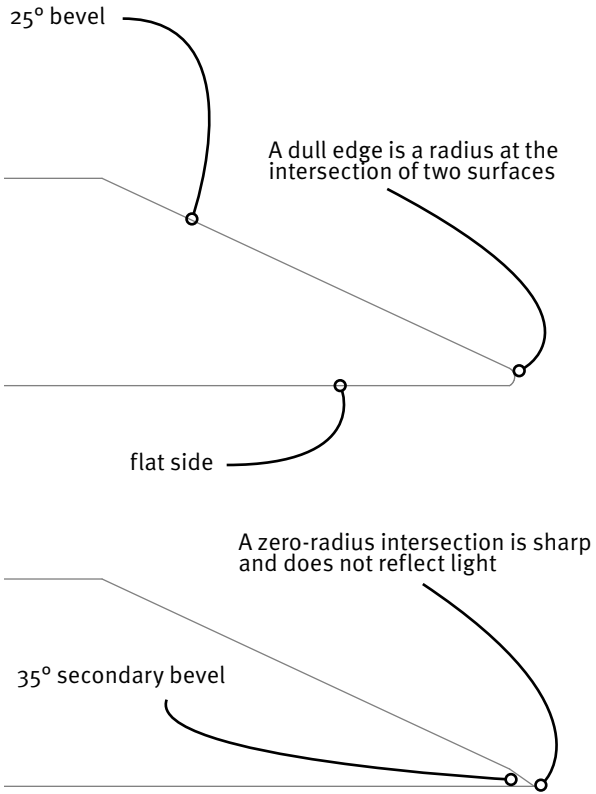


Fig. 2. A dull edge (top) reflects light. A zero-radius intersection (below) does not.

dius intersection by rubbing a chisel on a cinderblock, or with a grinder or a sharpening stone.

You can easily imagine that a chisel sharpened on a cinderblock is not going to be a good, long-lasting edge. That's because there are other things besides sharpness that affect how a tool cuts and how long it lasts. Knowing these basic principles will help make you a better sharpener and help you diagnose problems you might have.

ANGLES BETWEEN THE BEVEL & THE FLAT SIDE

An edge is two surfaces that intersect. There is an angle between these two surfaces, and it is part of the equation that determines if you have a good edge or not. People fuss a lot with angles, but it's not necessary at all to do good woodworking.

With most woodworking tools, we call one of our two surfaces the "bevel," and the second one gets another name, such as the back, the flat side or the unbeveled side. I'm going to call it the "flat side" here.

In woodworking, a wide range of angles between the bevel and the flat side will work. In my experience the lowest angle that works is about 15°. Below 15°, the edge crumbles immediately.

The steepest angle that works is about 90°, and that will produce an edge that scrapes the wood rather than shearing it.

Between those two angles, 15° and 90°, are some

WHAT IS SHARP?

all-purpose angles that will work for almost all woodworking tools. In my experience, that range is between 25° and 35°. If you pick one of those angles for all your plane irons and chisels and stick with it, you will have one less thing to remember (and one less thing to mess up) when sharpening.

I use 35° for almost all my tools. You might choose 30°. Or 32.5°. I won't argue with your choice.

Raising or lowering the cutting angle affects the way the tool works. When you lower the cutting angle, the tool is easier to push through the wood. The downside is that tools with a lower angle between the bevel and flat side get dull faster.

The opposite is true with tools with a steep angle between the bevel and the flat side. The tool requires more force to make a cut if the cutting angle is steep. But the upside is that the edge is more durable.

Note that you can manipulate the cutting angle of the tool by deciding which surface – the bevel or the flat side – is the cutting surface. This idea might seem confusing at first. But consider cutting a dado with a chisel, and I think it will make sense.

When you begin popping out the waste in a dado, the chisel's bevel is facing up, and so the cutting angle is determined by the bevel. If the bevel is 35° then the cutting angle is 35°.

Once you get deeper into the dado, you need to flip the chisel over and work with the bevel facing down. Now the cutting angle is determined by your hands

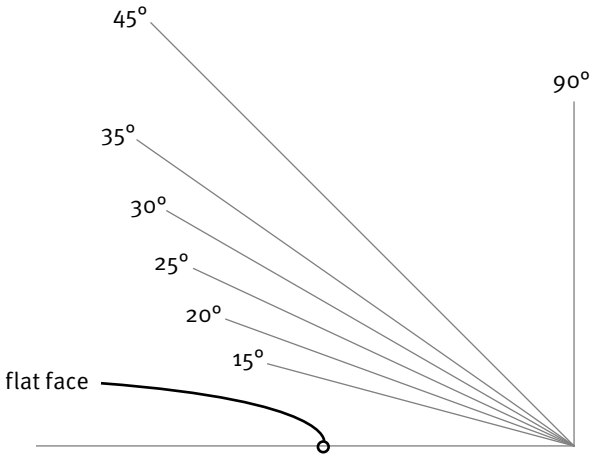


Fig. 3. Common sharpening angles on woodworking tools.

and how you hold the chisel. Typically this might be 45° or 55°.

It's best to not worry too much about angles, though some people will tell you that every chisel should use a slightly different angle to do a certain job. Pick one angle between 25° and 35° for your plane irons and chisels. Stick with that, and you will be fine.

ABOUT POLISH

Once we create a zero-radius intersection, the tool is sharp. However, the edge might not be ideal for the job we need to do.

WHAT IS SHARP?

Fig. 4. A bevel-up chisel starts the waste removal in a dado joint.

Fig. 5. A bevel-down chisel work finishes the waste removal.

For example, if you created a zero-radius intersection with a #60-grit grinding wheel, the edge will be sharp, but it will be coarse and weak. So the wooden surface left behind will look rough instead of smooth. And you might only get a few minutes of work out of this ragged (but sharp) edge.

That's why we have different grits of stones. The finer stones polish the steel, removing scratches left by the coarse abrasives. Which brings us to another important principle with sharpening: The higher the polish, the more durable the edge.

Polishing your edges with the finest sharpening stone in the world doesn't really make it all that much sharper (you already achieved sharpness with a coarse stone). Instead, polishing your edges makes them more durable and, to some degree, it improves the look of the wooden surface left behind by the tool.

For most of human civilization, there were limits to how high a polish we could get with naturally occurring abrasives. So there wasn't much of a debate about how high you should polish your edges. But today we have manufacturers that make sharpening systems that are way finer than what was available only 50 years ago.

Is this a good thing? For woodworking, not really. Mostly, ultra-fine sharpening grits are a way to separate you from your money. And to make you spend more time sharpening instead of building stuff. If you stick to the sharpening grits that woodworkers have

WHAT IS SHARP?

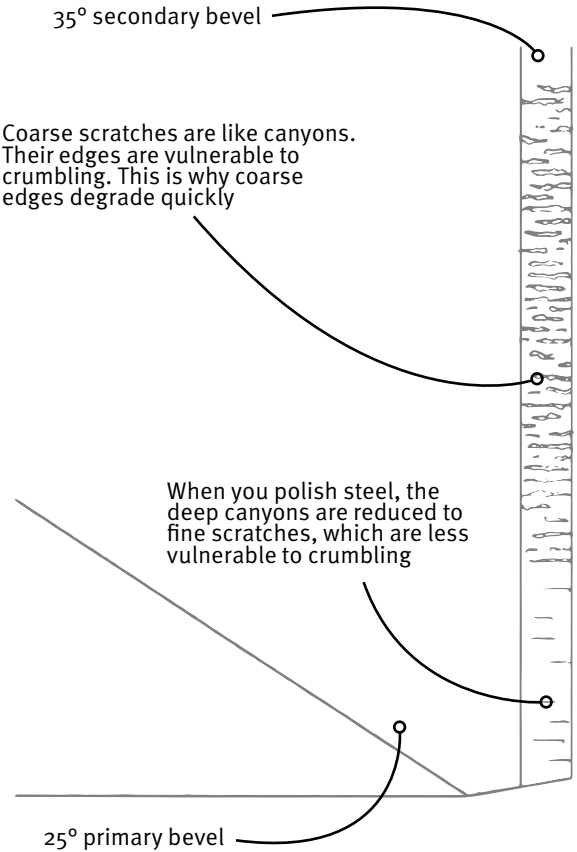


Fig. 6. A chisel's edge, with both coarse scratches and fine ones.

used for centuries, your sharpening chores will be light, and your wooden surfaces will look just as good as the ones in museums.

The next chapter on sharpening media will give you a clear idea of what is necessary and what is super-fine snake oil.

DETERMINE SHARP FROM NOT-SHARP

Now we know what sharp is in our minds – a zero-radius intersection – how can we tell if a tool is sharp without an electron microscope?

There are several practical methods. The first is visual. As mentioned earlier, a zero-radius intersection does not reflect light, but a radius will. So when I pick up a tool I stare at its tip and move the tool around a bit to see if I can catch some light.

If I see a thin line of light at the tip, then the edge is almost certainly too dull for woodworking. Note that this bright line – what some call a "glint" – doesn't have to extend across the entire edge to be a problem. With plane irons, it is common for the middle part of the cutter to get more wear than its corners. So you might only see the glint in the center of the tool's edge.

Also, if the edge has been damaged by hitting a nail or some other hard material, the glint might look like a cluster of small twinkles at the tip. Usually this means the edge needs to be repaired by grinding away the damage (more on grinding later).

WHAT IS SHARP?

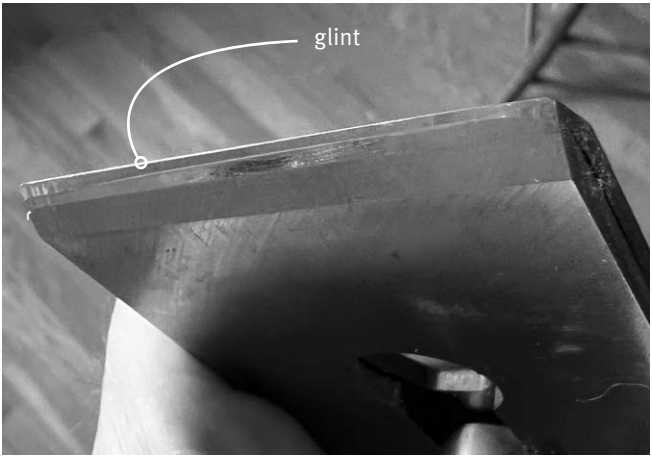


Fig. 7. The narrow, bright line at the tip is evidence this tool is dull.

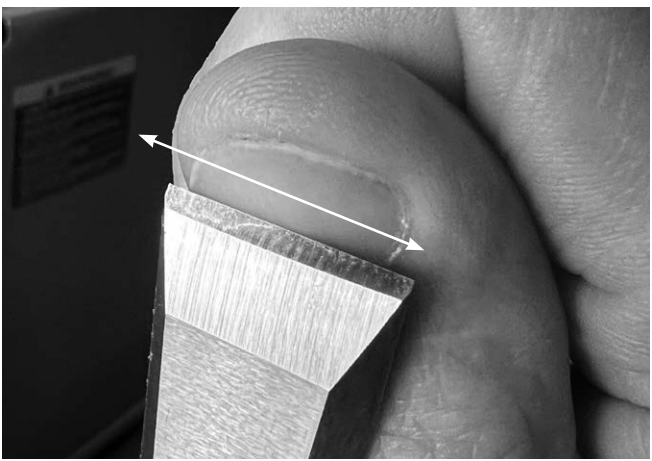


Fig. 8. The thumbnail can feel if the edge is smooth across its width.

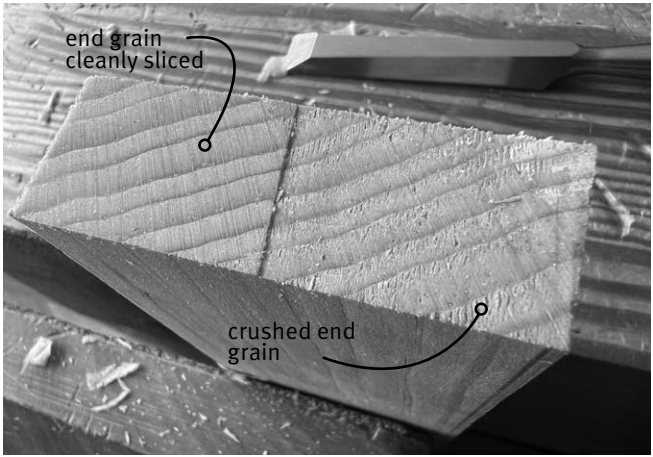


Fig. 9. Paring white pine's end grain can reveal faults in an edge. The left side was cut by a sharp tool. The right by a dull one.

If I look at the edge and don't see a glint of light at the tip, I'll rub my thumbnail gently along the edge to feel for roughness or damage that I can't see. If the edge is perfect, my thumbnail will slide smoothly along the edge. If the edge is damaged, I'll feel the roughness – it's like driving over potholes with a tiny car.

If the edge passes those two tests, I'll go to work.

When I teach sharpening, I demonstrate two other tests that are good for beginning sharpeners or people whose eyesight isn't great.

The first uses a block of white pine, usually the end of a scrap 2x4. Clamp it in a vise so the end grain points up. With your tool, try to pare away a thin shav-

WHAT IS SHARP?

Fig. 10. A sharp edge will slice newsprint cleanly.

ing of end grain. If the tool is really sharp, the resulting surface will be translucent and perfect. If you see white scratches in the end grain, then the tool is damaged. If you see crushed end grain, the tool is dull.

The second involves a sheet of newsprint. Hold the paper with one hand and slice the paper by swiping downward. The newsprint should shear cleanly.

There's an additional test out there that I think is silly: shave your arm hair with the edge. Even if I ignore this as an opportunity to visit the emergency room, the test is bogus. You can cut arm hair with a fairly dull blade.

Safety tip: Never use your flesh to test for a zero-radius intersection.

3
WHAT SHARPENS TOOLS?

CHOOSING A SHARPENING media can seem like ordering a spice level 1-10 at an Asian restaurant. Many times, the number you request (say, three) and the result (eyelids sweating from the heat) don't match up.

You would think that a #1,000-grit waterstone would cut the same as a piece of #1,000-grit sandpaper. But they aren't even close. The #1,000-grit sandpaper is far finer than the waterstone. And it gets even more confusing when manufacturers use words such as coarse, medium and fine. A Norton-brand "fine" Crystolon stone is the same grit as a "coarse" diamond stone from DMT.

While the systems make sense when you stay inside one brand of sharpening media (a #1,000-grit Ice Bear stone is always coarser than a #5,000-grit Ice Bear stone), those numbers still don't tell you what the stone does to steel. Is #220-grit sandpaper coarse enough to remove damage to steel? Or is it best used for polishing the edge?

The best solution is to discover how coarse or fine a sharpening media is in terms of microns. A micron is one-millionth of a meter. That doesn't tell you much, ex-

cept that a micron is tiny. This might help: A human hair is 70 microns thick; a spider web is 2-3 microns thick.

When it comes to sharpening, big particles – say 270 microns across – remove steel quickly. Whereas fine particles – 1.2 microns across – produce a mirror polish. Sharpening experts will say that particle size is not the only consideration when it comes to grading sharpening media. And I agree. But until someone comes up with a better system, microns are the single best one.

Once you figure out how big the particles are in a sharpening stone in terms of microns, how do you know what it is good for in the workshop?

To answer that question, you need to know that there are three distinct processes in sharpening:

1. Grinding
2. Honing
3. Polishing

WHAT IS GRINDING?

Grinding removes metal quickly, usually by touching the tool to a spinning abrasive wheel or disk. The particle size for grinding is about 270 microns down to about 40 microns. When woodworkers sharpen a tool, they rarely start the process with a grinder. Instead, the grinder is used for these three operations:

1. Remove damage to the tool caused by hitting a nail or a concrete floor.

2. Change the shape of the tool to do a different operation (for example, make the cutting edge of your

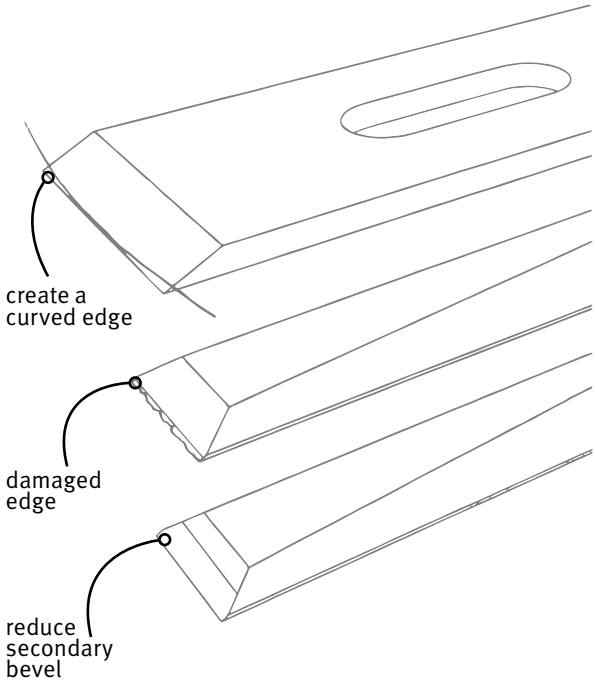


Fig. 11. Grinding an edge can quickly change a tool from useless to perfect.

jack plane's iron curved instead of straight).

3. Reduce the size of a secondary bevel (I'll talk more about this in the next chapter when I discuss the life cycle of a tool).

WHAT SHARPENS TOOLS?

So grinding isn't something you do every time you sharpen. In fact, I crank up the grinder about once a month, unless I damage a tool. Some woodworkers try to avoid grinding at all costs, which I've never understood. For most tools (moulding planes are an exception) grinding is necessary. It fixes many problems. And it's quick.

Here's the other important thing about grinding: You need only one grit. You don't need a grinder with #60- and #80-grit wheels. That does nothing but gobble up valuable tool steel in your chisels. Pick a single grinding grit – a coarse one that you can purchase easily – and you're done.

WHAT IS HONING?

The word "honing" can mean several different things. In this book, it means one thing. Honing is when you take a dull tool and create a new "zero-radius intersection" on it. In other words, honing cuts away the dull radius at the tip and creates a fresh edge on the tool.

The particle size for honing is about 35 microns down to 12 microns. Particles of this size are coarse enough to cut steel quickly – most edges will be renewed after about 10 seconds. But the particle is fine enough that it doesn't leave deep scratches that are difficult to polish out.

Here is another important part of honing: You need only one stone or grit to do this. If you own a #1,000-grit waterstone and a #1,200-grit waterstone, those

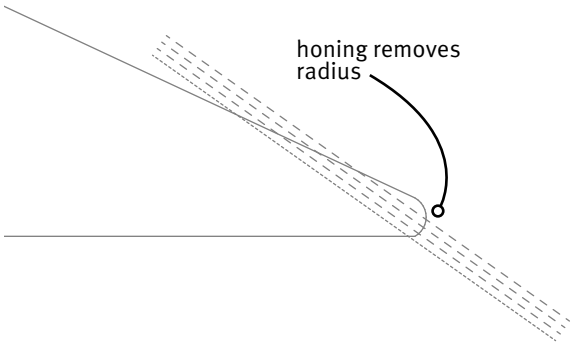


Fig. 12. A honing stone quickly removes the dull radius at the tip to create a fresh cutting edge.

are both honing stones. You don't need both. If you use both stones, you will eat up steel faster than necessary, slow down the sharpening process and quickly create a secondary bevel that is enormous and annoying. So pick one honing stone and be done with it.

WHAT IS POLISHING?

Polishing is all about removing the scratches left by honing so that the edge is both smooth and durable. Though there are historical guidelines, how much you polish is personal preference. You might have one polishing stone or you might have three. Or you might have a polishing stone and a piece of leather called a strop that is charged with polishing compound. (Stropping is not magic; it's polishing.)

Polishing occurs with tiny particles, from 10 microns

WHAT SHARPENS TOOLS?

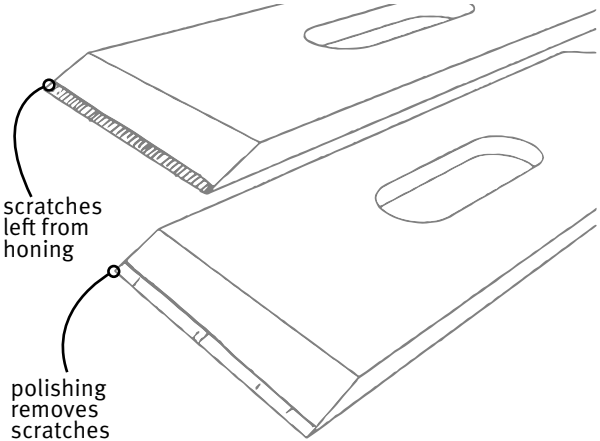


Fig. 13. Polishing stones remove small amounts of material to reduce the coarse scratches left by honing.

down to 0.5 microns. The smaller the particle size that you finish with, the more polished the edge. With polishing, there is a point of diminishing returns. Removing fine scratches can take time on the polishing stone, sometimes a lot of time. And the benefits can be difficult to notice.

(Note: Sharpening gurus will say you simply aren't sensitive enough to realize how the super-fine polishing grits are helping. The bottom line with sharpening is this: If you can't discern a benefit, there isn't one.)

So what is typical among woodworkers when it comes to polishing? Some will hone, then polish their edges with a stone that is 2 or 3 microns and get back

to work. Others will do that plus go a step beyond and finish with a 1-micron stone or a strop charged with 1-micron compound.

Going beyond 1 micron – into the world of sub-micron particles – is for people who see sharpening as a distinct hobby. Or for people who just want to believe that their $360 sharpening stone is doing something.

DETERMINE THE MICRON SIZE OF SHARPENING MEDIA

Most manufacturers publish the micron sizes of their sharpening media. If they don't, ask them. If they won't (or can't) tell you, maybe try a different brand. Another way to determine the micron size is to ask a knife maker. If there is a group of cutting-tool enthusiasts who are crazier about sharpening than woodworkers, it's knife people.

Many knife makers who obsess about sharpening keep track of the micron size for most brands of sharpening media. And they publish those numbers on their websites. However, what no website can tell you is how consistent the sharpening media is. For example, a cheap artificial polishing stone might have been contaminated at the factory with large particles that are more suited to honing than polishing. The result is that those few honing-sized boulders will prevent you from ever polishing out all the scratches in your edge. The oversized stones simply make more scratches the more you use it.

WHAT SHARPENS TOOLS?

This is not theory. I have bought and used man-made stones that were contaminated with coarse grit. However, before you return the stone or throw it away, try flattening it a few times to see if:

1. You contaminated the stone with coarse grit by accident (it happens).

2. The big particles are on the stone's surface, and the stone will work fine once you remove them.

All this talk of contamination is to say: You get what you pay for. Better-quality stones are more consistent. No-name stones that you bought off the back of a truck are a crapshoot.

HOW TO CHOOSE YOUR MEDIA

First, pick a grinding medium. As mentioned above, grinding is not part of the daily ritual. And it typically is done with an electric motor or a hand-crank machine. So with grinding, pick a media that you can afford. Silicon carbide will be the least expensive, followed by diamond wheels or CBN (cubic boron nitride) wheels. (What does the money buy you? Less maintenance.)

For honing and polishing, use as few different types of media as possible. For example, you will make it hard on yourself if you use one diamond stone, one oilstone, one waterstone and then some honing compound. Each of these media provides different feedback, each sharpens at a different rate and each has a different procedure to maintain it.

Instead, select only waterstones as your system, for

example. Or only diamond stones – plus maybe some diamond paste. Or oilstones plus a strop that's charged with polishing compound (oilstones only get you so far). Or sandpaper. Stay within a single system as you learn to sharpen, and you will advance rapidly.

The chart at the end of this chapter will give you a feel for the micron size of many typical sharpening products. And it shows which products are for grinding, which are for honing and which are for polishing.

It doesn't matter which sharpening system you choose. They all work. If you want some down-and-dirty discussion of the advantages and disadvantages of the different systems, read the appendix at the back of the book.

You don't have to have a rational reason to pick a system. Many woodworkers choose the same system as the person who taught them to sharpen. Or they start with a stone that was owned by a beloved ancestor. Or they just like the idea of owning 20 carats of diamonds. Or they only have $20 to spend.

All of these are valid ways to choose a system, and all will result in sharp edges.

WHAT SHARPENS TOOLS?

GRINDING MEDIA

Microns	Commercial Product
268	Norton #60 wheel
251	CBN #60 wheel
213	CBN #80 wheel
192	Norton #80 wheel
181	CBN #100 wheel
173	Lee Valley Coarse India
141	P100 paper, Norton #100 wheel
127	P120 paper, Norton Coarse Crystolon
116	#120 paper CAMI
97	Norton Coarse India, P150 paper
93	#150 paper CAMI
78	Norton Medium Crystolon #180 paper CAMI, P180 paper
68	Lee Valley #280 waterstone
67	Shapton #220 waterstone
65	Norton X-coarse Diamond Stone #220 Waterstone P220 paper
60	DMT X-coarse Diamond Stone Norton #220 waterstone #220 paper CAMI
58	P240 paper
54	Norton Medium India #240 paper CAMI
53	P280 paper
46	P320 paper

WHAT SHARPENS TOOLS?

GRINDING MEDIA (continued)

Microns	Commercial Product
45	Norton Fine Crystolon
	DMT coarse diamond stone
	Tormek coarse diamond wheel
43	Norton coarse diamond stone
	#280 paper CAMI
41	P360 paper

HONING MEDIA

36	#360 waterstone, #320 CAMI
35	Norton Fine India
	Washita oilstone, P400 paper
29	#500 Shapton waterstone,
	#600 Lee Valley waterstone
	#360 paper CAMI
27	P600 paper
25	DMT fine diamond stone
	Tormek fine diamond wheel
23	Lee Valley Fine India
	#440 paper CAMI
22	Norton X-fine India
	Soft Arkansas oilstone
	Norton fine diamond stone
	#600 waterstone
	P800 paper
20	#800 Lee Valley waterstone
16	#1,000 Lee Valley waterstone

WHAT SHARPENS TOOLS?

HONING MEDIA (continued)

Microns	Commercial product
16	#600 paper CAMI
	P1,200 paper
15	#1,000 Shapton waterstone
14	#1,000 Norton waterstone
	#700 paper CAMI
13	Lee Valley Soft Arkansas oilstone
	#1,200 Lee Valley waterstone
	#800 paper CAMI
	P1,500 paper
11	Hard White Arkansas oilstone
	Norton X-fine diamond stone
	#1,200 waterstone

POLISHING MEDIA

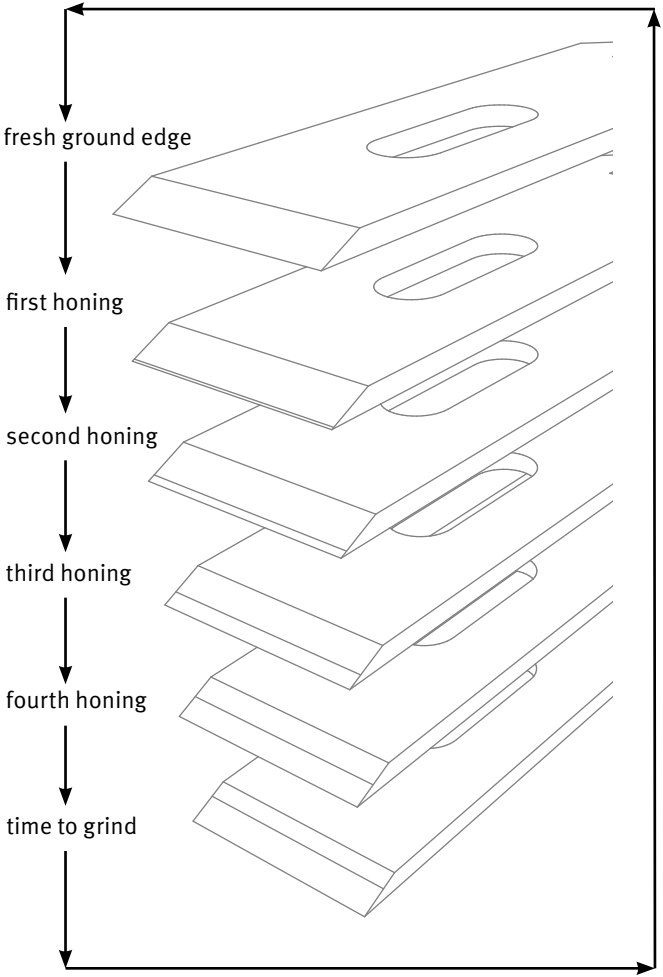
10	P2,000 paper
	Lee Valley Hard Arkansas oilstone
9	DMT X-fine diamond stone
	#1,500 waterstone
	#1,000 paper CAMI
	Tormek X-fine diamond wheel
8	#1,500 paper CAMI
	P2,500 paper
	#2,000 Norton waterstone
7	#2,000 Shapton waterstone
	DMT ceramic stone
6	Hard Black Arkansas oilstone

POLISHING MEDIA (continued)

Microns	Commercial product
6	Translucent oilstone
	#2,000 paper CAMI
	DMT Dia-paste (6 micron)
4	#4,000 Shapton waterstone
3	#4,000 Norton waterstone
	DMT Dia-paste (3 micron)
	Tormek PA70 honing compound
2	#4,000 Lee Valley waterstone
1.84	#8,000 Shapton waterstone
1.2	#8,000 Norton waterstone
1	#8,000 Lee Valley waterstone
	DMT Dia-paste (1 micron)
0.92	#16,000 Shapton waterstone
0.5	#15,000 waterstone
	Green honing compound
0.49	#30,000 Shapton waterstone

Notes on the chart: CAMI is the system used to grade sandpaper in North America. The grits that begin with a P (such as P800) are graded under the FEPA system and sold in Europe. Products shown without a brand name are generic ones sold in many outlets under various brand names. The designations between grinding, honing and polishing grits are my own.

Source: Published numbers; queries to manufacturers.


fresh ground edge
first honing
second honing
third honing
fourth honing
time to grind

4
LIFE CYCLE OF AN EDGE

ONE OF THE MOST FREQUENT (and unanswerable) questions I get about sharpening is: How often should I sharpen?

The correct but unsatisfactory answer is: Pretty much any time the question "Should I sharpen?" pops into your head.

When I ask myself that question, I stop and look at my tool's edge. Can I see a glint of light at the tip of the bevel? If I can, it's time to sharpen. I look at my work to see if the surface is clean or if it's marred by fine white lines or scratches in the wood. If I can see those lines, the edge is likely damaged and needs to be re-ground. And I think about the last few minutes of work I've done. If the work took more effort than expected, it's time to sharpen.

You also have to become sensitive to the peculiarities of your tools. There are times when the tool's cutting edge is not causing the problem. That is, you sharpened the edge, and the problem persists. What do you do then?

Well the good news is that by taking a moment to sharpen the tool you have eliminated the most com-

LIFE CYCLE OF AN EDGE

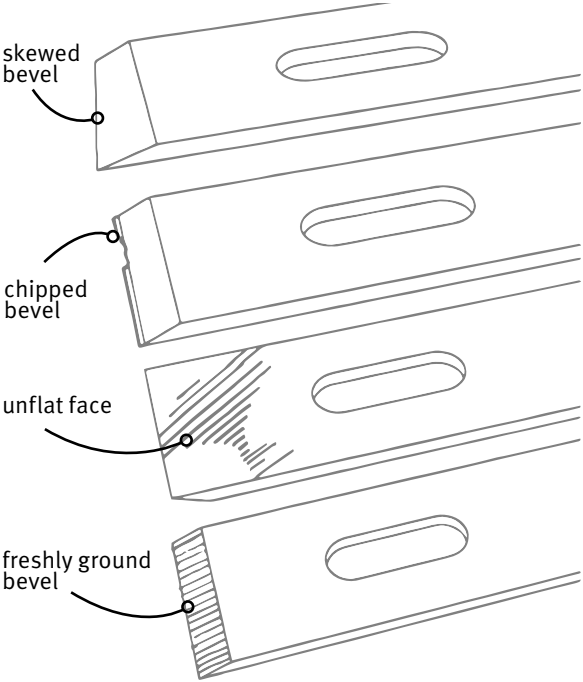


Fig. 14. After you sharpen tools for a few years, you will see their life cycle play out in your hands.

mon ailment of a hand tool: the edge is dull. After that, you need to consider the other parts of the tool. If your handplane is leaving a rough surface in its wake, the problem could be that its sole has become dented somewhere around its rim. So you need to file away

any roughness on the sole. If the plane is too hard to push, there's a good chance that the tool's chipbreaker is too close to the cutting edge, which can create some impressive resistance. And if the plane is both too hard to push and it is leaving a nasty surface on your wood, there's a good chance that the chipbreaker has slipped forward of your cutting edge and so the chipbreaker is doing the cutting – instead of the tool's cutting edge. This is a common problem.

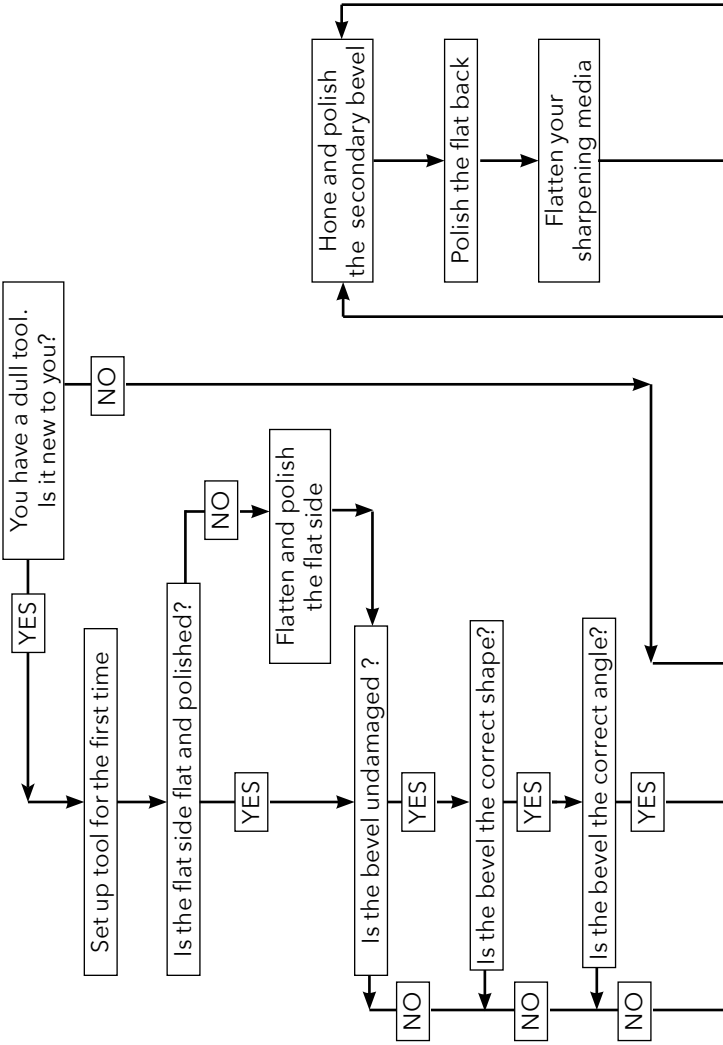
If a sharpening session doesn't fix a chisel, there's a good chance that your sharpening efforts did not cut a new zero-radius intersection. This is also a common malady among beginning woodworkers.

But in all honesty, sharpness fixes almost everything.

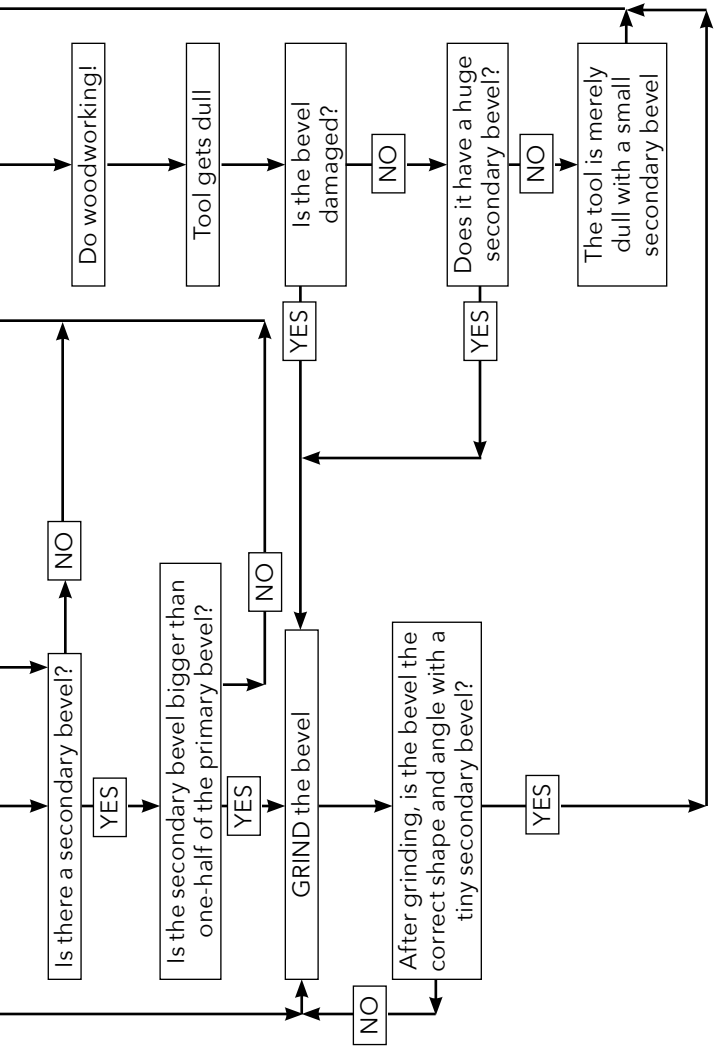
As you become proficient at sharpening, you will find there is a pattern or rhythm to the process, and it is mostly circular, like the life cycle of a frog. It starts as a tadpole that grows into a frog and then creates the next generation of tadpoles. With tools it is hone, polish, hone, polish, hone, polish, grind – then repeat the cycle. The following flow chart will – I hope – show you how sharpening occurs in a workshop during the long haul. It might take a chisel a year to make it around the circle. Or a week. It really depends on how much you use your tools and how hard you are on them.

The flowchart (which begins on the next page) begins the moment you decide a tool is dull.

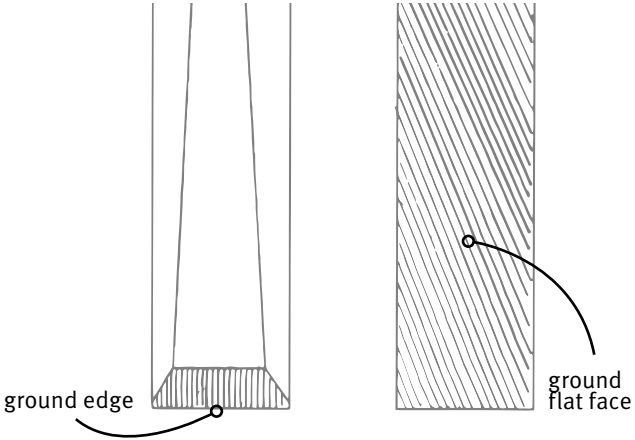
LIFE CYCLE OF AN EDGE



LIFE CYCLE OF AN EDGE



An edge from the factory



The job of the user

5
SET UP A NEW TOOL

WHEN YOU ACQUIRE a new tool, there is little chance its cutting edge is ready for work. Most manufacturers simply grind the bevel and the flat face of a new tool, leaving you to hone and polish those two intersecting surfaces.

(Why do manufacturers do this? It keeps the price of the tool competitive. Lapping and polishing steel surfaces so they are ready to go to work takes either skilled labor or expensive equipment. Some manufacturers are willing to perform this extra step. Historically, however, most have not.)

If you prefer vintage tools, chances are those edges will need even more work than new ones. Most old tools have been abused to the point where a lot of metalwork is necessary to get them working.

Here's how I examine and prepare a tool to be sharpened and put to work.

INSPECT THE BEVEL

Most new tools come with a bevel that has been ground perfectly square across and at 25° to the flat face of the tool. There should be no damage to the bevel, just the coarse grinding scratches that extend all the way to the tip of the tool.

SET UP A NEW TOOL

Fig. 15. The least you should ask from a tool manufacturer is a ground bevel that is the correct angle and straight across.

Some manufacturers will polish a tiny secondary bevel at the tip of the tool, though I haven't seen one that was ready to go to work. If the bevel is straight, ground at 25° and undamaged, you are ready to inspect the flat side of the tool. If, however, the bevel is chipped, skewed or ground at a too-steep angle (35° or higher), then your first chore is to correct the bevel at the grinder.

The next chapter (Chapter 6) details how to grind an edge. Once the tool's bevel is flat, square and at 25°, turn it over to look at the flat face.

SET UP A NEW TOOL

INSPECT THE FLAT FACE

When you look at the flat face of a tool, you are likely to see one of the following situations:

1. The flat face is covered by coarse grinding scratches left from manufacturing.

2. If it's an old tool, you might see rust or deep pitting, and perhaps some past effort to flatten or polish the flat side of the tool that was hit or miss.

3. In a few cases, the flat face has been lapped by the manufacturer. The flat side will be either polished to a mirror, or the flat side will look dull gray with no scratches immediately evident. If the flat face has been lapped by the manufacturer, don't make any effort to flatten it. You will likely only make it worse. Instead, go directly to the section on honing and polishing the bevel (Chapter 7).

If you have a tool where the back is coarsely ground or looks inconsistent, the best way to tell if it is flat is to rub it on a fairly coarse sharpening stone. I use my honing stone (a #1,000-grit waterstone in my case).

First douse your stone with the correct lubricant/wetting agent (water, oil etc.). Then rub the flat side of the tool on the stone. For narrow tools, such as chisels, use a plunging motion, pushing the tip of the tool in and out on the stone for a few strokes.

For wide tools, such as plane blades, swipe the flat side of the tool up and down the honing stone for a few strokes.

SET UP A NEW TOOL

Fig. 16. This motion prevents the flat face of the narrow tool from becoming rounded.

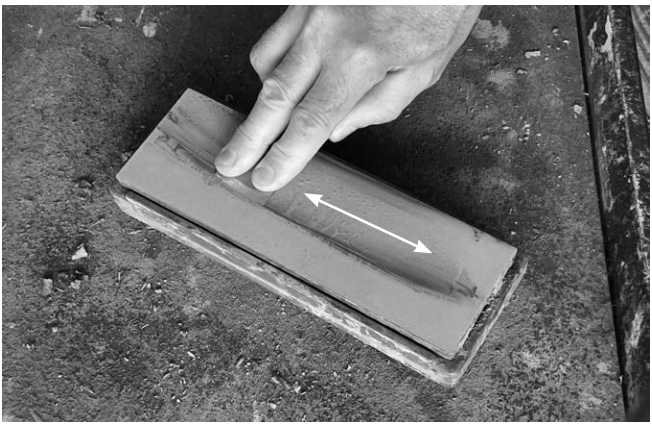


Fig. 17. With wider tools, it is more efficient to swipe them up and down the stone.

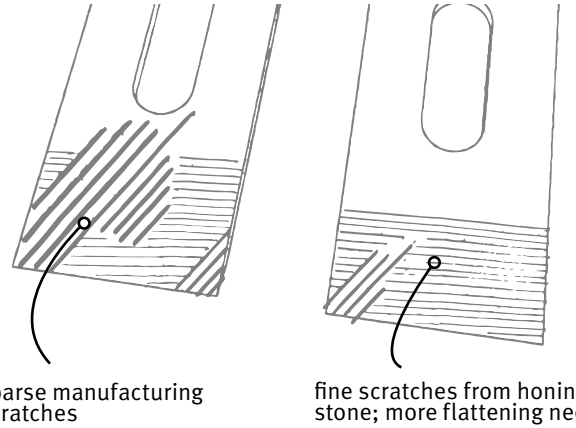


Fig. 18. Dressing the flat face of a tool can take seconds or hours, depending on how it was treated at the factory.

Remove the tool and look at the flat face. You will see fine scratches from the honing stone on the steel surface. If it is your lucky day, the scratches will extend all the way across the cutting edge of the tool (like Fig. 20). Likely, however, you will see scratches in only some areas (like Fig. 18). The tool needs more work.

Flattening the flat face takes patience. To assist your efforts, a heavy magnet stuck to the tool becomes a kinda-comfortable grip and a way to press the flat side against the stone with some force. I use an inexpensive magnetic base designed for machinist's tools. It has an on/off switch on the magnet to make it easy to remove it from the tool.

SET UP A NEW TOOL

Fig. 19. A magnetic base helps you apply downward pressure right where it is needed.

Keep the stone wetted and every few minutes clean off the black metal filings left behind. This keeps the stone cutting quickly. Keep working the flat side until the fine scratches from the honing stone extend to the tip of the tool.

If you have difficulty seeing the scratches from the honing stone, here are a couple tricks that help. Paint the flat side of the tool with a permanent marker.

After a few strokes on the honing stone, the low spots will remain colored by the marker.

Sometimes the colored marker comes off too easily. In those cases, paint the flat side with a machinist's dye

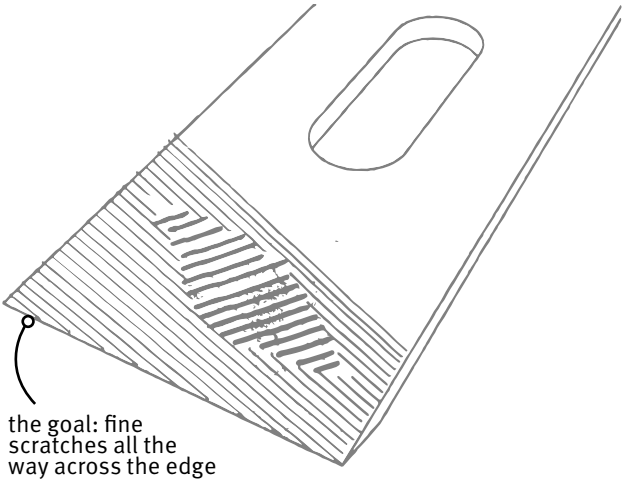


Fig. 20. The goal: scratches that extend all the way to the edge. This allows you to hone a zero-radius intersection.

(Dykem is a common brand). Then work the flat face until all the color has been removed.

At times you will find that no amount of work will get the scratches extending to the very tip of the tool. Perhaps someone has put a small bevel on the flat side.

In cases such as this you might have to grind the bevel to remove the steel that won't behave.

Once the fine scratches have reached the bevel, you have reached a milestone. The next step is determined by what sort of tool you are working on. If it's a plane blade or other cutter that is secured in a tool's body (such as spokeshave or scraping plane), then

you can stop work on the flat side and hone and polish the bevel (see Chapter 7).

But if it's a chisel, you have more work on the flat face ahead of you.

POLISH THE FLAT FACE OF A CHISEL

Unlike a plane iron, the flat face of a chisel should be both flat and polished. This is because the flat side of the tool rides against the wood in many instances.

To polish the flat side, perform the same motions you did on the honing stone. But this time do it on your polishing stones. If you have multiple polishing stones, begin with the coarsest one and work your way up to the finest one.

When I learned to set up my chisels, my teacher insisted we polish the entire flat side to a perfect mirror. This was a learning experience that took all day, but I don't think it's realistic or even necessary. Instead polish the flat face until you are simply sick of the process. Then hone and polish the bevel and get on with the woodworking.

Your chisel won't be perfect at the outset, but it will work fine. Chances are that the tool's edge will simply need honing more frequently. Every time you sharpen the tool, the flat face will gain a little more polish in the process, and the tool's edge will last a little longer. Eventually, the flat side will become a perfectly polished mirror, and the chisel will become a cherished companion with an edge that lasts and last.

6 MONTHS FREE TRIAL

ELEVEN TOOLS IN ONE

1. Coarse Grinder
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5. Chisel Attachment
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5. Polishing Shaft
6. Buffing Wheel
7. Polishing Wheel
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10. Scythe Stone
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We want every shop, factory, and tool-user to prove by 6 months' Free Trial, on your own tools, how this grinder saves time and money, makes work easier, saves and makes money. We will send this Mechanics Special on 6 months' Free Trial, and then, if you wish, send it back at our expense.

Luther Diamond Tool Grinder

Genuine Carborundum Wheels will not Draw Temper

The genuine Carborundum Wheels on this grinder cut hardest steel, as emery does soft copper, and does not draw temper—no water cooling necessary. You can do work in two minutes on this grinder that would take a half hour on the grindstone. With this grinder it is quick and easy work to keep tools bright and keen-edged, which means faster, easier general work.

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Special tool holders make it possible for any one to do difficult grinding, such as twist drills, chisels, etc. 2500 revolutions per minute—steel and malleable construction, enclosed gears, dust proof, bronze bearings, machine cut spur gears run in oil bath.

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Thirty Times Faster than Grindstone

We have received your special tool grinder with foot-power attachment and sharpening outfit. We have tried your grinder and our machinist is very much pleased with it and tells us that he ground a chisel on this tool grinder in two minutes, which would have taken an hour of his time on any other grinder. —The Sears & Nichols Co., Pentwater, Mich.

Elmwood Haynes, Pres. of Haynes Automobile Co., says: "I have found the Mechanics Special a most excellent device."

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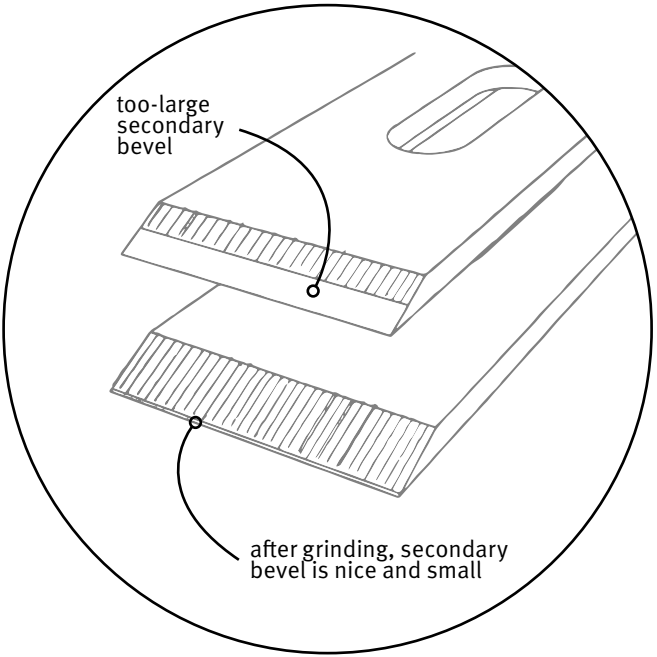

Fig. 21. Before grinding, the secondary bevel has become far too large. Grinding reduces the size of the secondary bevel, making future sharpenings easier.

6
WHEN & HOW TO GRIND

MANY BEGINNING WOODWORKERS inexplicably fear grinding. They think it's dangerous, difficult and that they are likely to ruin their tool in the process.

After I teach someone to grind, they almost always say: "Wait. That's all there is to it?"

Grinding tools with a spinning wheel is essential to taking good care of your tools. Grinding does many wonderful things to make tools easier to use. A few minutes on a grinder will:

1. Shrink a huge secondary bevel, leading to you getting a keener edge in a fraction of the time when honing and polishing.

2. Quickly remove damage from hitting a nail, knot or a concrete floor.

3. Change the angle of the bevel to make the tool work correctly.

4. Change the shape of an edge from straight to curved to make it do wonderful things in your hand-plane.

5. Fix a mystery problem. When you can't figure out why a tool isn't working correctly, grinding it fixes the problem most of the time.

WHEN & HOW TO GRIND

BYE-BYE, LIES

Before you can grind, you need a grinder. Luckily, for woodworking, you don't need anything exotic or expensive. Like every other aspect of the sharpening process, tool sellers, manufacturers and resellers have invented a lot of superfluous stuff.

Some straight talk: You don't need a special grinding jig or even an aftermarket tool rest. I've used my grinder's stock piece of L-shaped metal for more than 20 years and have never wanted for anything more.

You also don't need a water-cooled grinder[1] or a slow-speed (1,750-rpm) dry grinder.[2] Both machines are more expensive than a plain-old fast-speed (3,450-rpm) dry grinder or a hand-cranked grinder.[3] The slow-speed and water-cooled grinders are marketed by putting the fear of Ashley Iles into you that a fast-speed grinder will overheat the tool and ruin it.[4]

That is hogwash. A cup of water next to your cheap, fast-speed grinder keeps the tools cool as you work. Which brings us to drowning another myth: Yes, you can cool a hot tool in water without damaging it. You will find people who say you should never "quench" your tools in water because they will fracture. This is nonsense based on a misunderstanding of the temperatures used in grinding, plus a failure to understand the definition of the word "quench," which is accurately used to discuss a "state change" in steel (but I digress). When your tool heats up to the point where it is too hot to touch, dunk it in a cup of water to cool it

Fig. 22. After 20 years, my diamond dresser still works like new.

down. Then get back to work at the grinder.[5]

One more tip: You don't need an 8"- or 10"-diameter dry grinder. An inexpensive 6" dry grinder (fast-speed or hand-cranked) is fine for woodworking. People will try to frighten you by saying your edges will be weaker if you use a 6" grinding wheel. This is not true in a practical sense.

Now that I've saved you a ton of money, here's where you should spend a little cash: Buy a quality #60- or #80-grit grinding wheel that is soft, quite fria-

ble and designed for high-carbon steel (I use Norton 3X wheels in the "I" grade). These friable wheels are a little more expensive than bargain wheels.

Plus, buy a diamond bar grinding wheel dresser (unless you have a diamond or CBN grinding wheel; these don't need maintenance). These wheel dressers are inexpensive ($10 to $20) and last a lifetime. They are also essential to good work, as you will soon see.

DRESS THE WHEEL

Unless you have a diamond or CBN wheel, your grinding wheel needs to be regularly dressed to prevent it from glazing and to keep it the correct shape. I get about two or three tools ground between dressing sessions, on average.

The rim of the grinding wheel needs to be slightly convex. The convexity allows you to control the cut much more easily than with a flat wheel. Grinding a tool's flat bevel against a flat wheel takes a steady hand and eye. Grinding a blade of any shape against a convex wheel takes far less skill.

The convexity is small – maybe a 1/32" to 1/16" bulge at most. Create this convexity using a diamond bar dresser. Turn on the grinder. Touch the dresser to the wheel with a light touch, then add a little pressure at the corners of the wheel to create the convexity. This should take 5 seconds, max. There is no need to use the grinder's tool rest during this operation.

Fig. 23. The diamond dressing wheel requires a light touch to leave a smooth surface behind.

Fig. 24. A slightly convex wheel gives you enormous control over the shape of the tool's edge.

WHEN & HOW TO GRIND

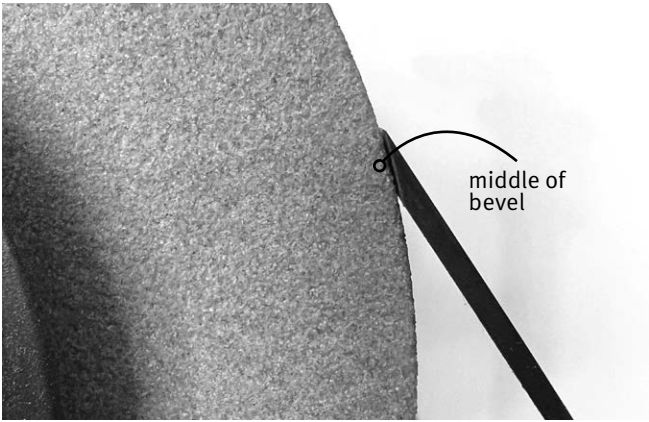

Fig. 25. If you want an accurate grind, aim the middle of the bevel so it touches the wheel as you set the tool rest.

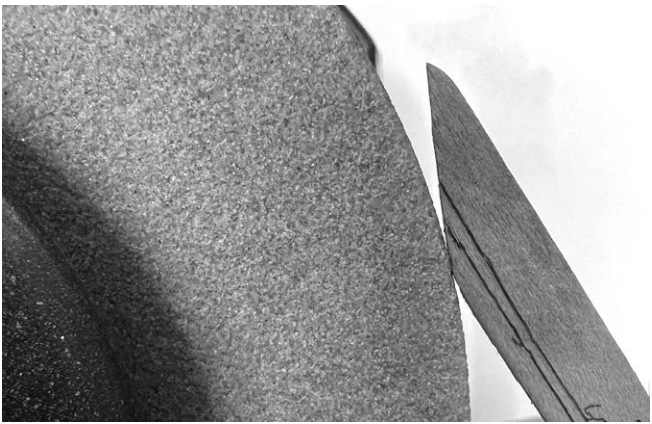

Fig. 26. Popsicle sticks help set the tool rest when you don't have a tool around with the desired bevel.

WHEN & HOW TO GRIND

SET THE TOOL REST

About 95 percent of the time, this is easy. Just use the tool's existing bevel to set the tool rest. You want the grinding wheel to contact the blade in the middle of the bevel – not at the tip or the heel.

If you want to change the angle of a tool, you need to tilt the tool rest. To set it to the proper angle, use Popsicle sticks that have the target angle cut on them (say 25° or 30°). Remember that the Popsicle sticks are wider than the thickness of the tool, so you need to keep that in mind (or mark it on the Popsicle stick) so you grind in the middle of the tool's bevel.

To keep my life simple, I grind all my tools at 25°. Historically, this is the all-purpose grind angle for woodworking tools. Some manufacturers grind tools with a 30° bevel to encourage you to use a 35° secondary bevel at the tip. As you'll see in the next chapter, I hone and polish all my tools at 35°. This combination: a 25° grind and a 35° secondary bevel works for just about every woodworking tool ever made. And it keeps sharpening simple.

MAINTENANCE: SHRINK A SECONDARY BEVEL

The most common operation on a grinder is to grind the primary bevel to reduce the size of a secondary bevel that has grown so large that honing and polishing have become a time-consuming chore.

Set the tool rest, as directed above.

WHEN & HOW TO GRIND

Fig. 27. Once the blade contacts the wheel, slide the blade left and right on the wheel, grinding its entire edge.

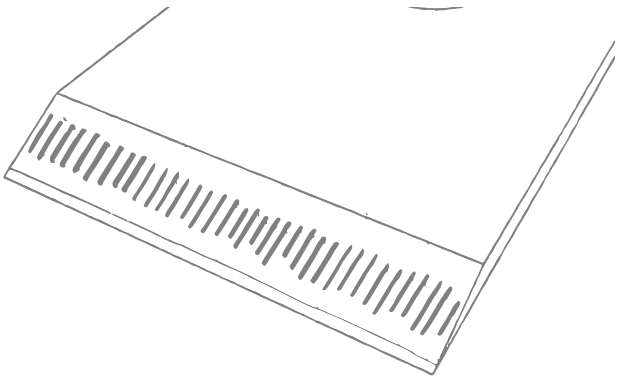

Fig. 28. If you have set the tool rest correctly, the grinding scratches will be in the middle of the bevel.

WHEN & HOW TO GRIND

Turn on the grinder or crank it up (please use eye protection plus the grinder's integral shields). Touch the blade to the grinding wheel with a light hand. Sparks should fly downward from the middle of the wheel only. This is the convex wheel at work. As soon as the blade contacts the wheel, shift it left and then right and grind across the entire bevel.

Remove the blade from the wheel and observe where the grinding scratches are located. If you set the tool rest correctly, the scratches should be in the middle of the bevel. If they are at the tip or heel of the bevel, adjust the tool rest.

Return the blade to the grinding wheel and grind the bevel some more, perhaps two or three passes of the bevel across the wheel.

Remove the blade and pinch the bevel with your fingers. If your fingers instinctually jump away, the blade needs to be cooled. Dunk the front half of the blade in a cup of water for 5-10 seconds. If the blade is merely warm, grind for another two or three passes and check its temperature again.

How quickly the blade heats up is controlled by how hard you push the blade against the wheel and how friable the wheel is. A friable wheel will slightly disintegrate as you use it, carrying the heat away from the grinding action.

Continue this cycle – two passes then check for overheating – until the secondary bevel is tiny, say 1/32" wide. Then stop grinding. There is no need to remove

the secondary bevel entirely if it is undamaged. In fact, you want to avoid removing it. That's because as soon as you remove the secondary bevel, the tip of the blade becomes quite susceptible to heat and can overheat in an instant.

If the blade overheats, it will become black-blue. This is not the end of the world. Set the blade aside to cool and repair. To repair it, use the procedure outlined below: Repair Damage: Large Nicks.

REPAIR DAMAGE: TINY NICKS

It's easy for the tip of your blade to get damaged during normal operations. If you hit a knot or even a bit of grit embedded in the grain, the blade will immediately become toothy. It will work slowly and leave ugly tracks in its wake. Stop work immediately because it will only get worse.

Remove the small nicks at the grinder. Set the tool rest as discussed above. Work the bevel until you get to the damage. Then switch tactics. Instead of taking two or three passes on the grinding wheel, take one. Then cool. Take one more pass. Then cool again. Repeat until the damage has been ground away and you have a clean, ground bevel.

Because you have now created a zero-radius intersection on the blade, you will have a large burr on the flat face of the blade. Before you hone and polish the blade, first remove the burr by rubbing the blade on your finest polishing stone.

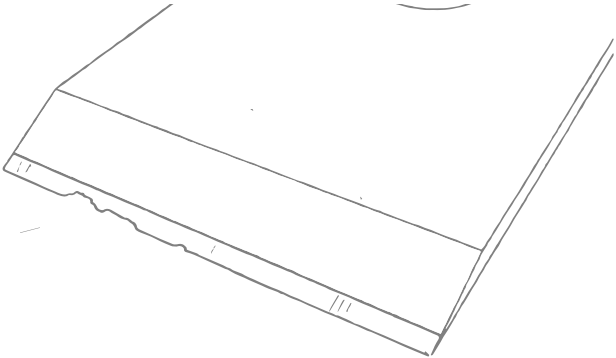

Fig. 29. Nicks can be caused by hitting a knot or even driving a chisel too hard with a mallet.

REPAIR DAMAGE: LARGE NICKS

When the damage is extensive, say a large chip out of an edge or a black-blue discoloration from overheating the edge, then a different strategy is in order. Turn the blade over so you are looking at its flat face. With a fine permanent marker, draw a straight line across the flat face of the blade behind the damage (use a small square to guide the marker).

Turn on the grinder. Hold the blade at 90° to the wheel and blunt the edge of the blade with light strokes against the wheel (no need to use the tool rest). This will go quickly. Work the edge until you reach your marked line. If there is a lot of damage, check the blade every two or three passes to see if it needs to be cooled.

WHEN & HOW TO GRIND

Fig. 30. A marker line tells you when to stop grinding and keeps the edge 90° to the blade's sides.

Fig. 31. Removing the tip of the blade prevents it from heating up. And it gives you a target to shoot for.

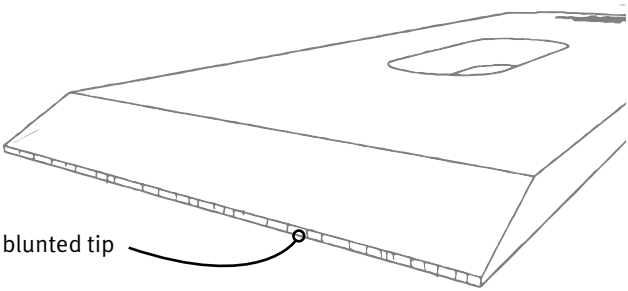

Fig. 32. With the damage removed and the tip blunted, you can grind the bevel to its new shape without too much worry about overheating the steel.

When you have worked to your line, your blade will have a blunted end. Now you can grind the bevel just as you did before (see Fig. 27). Set the tool rest and begin work. Work until you have a tiny flat at the tip. Again, avoid cutting a zero-radius intersection if you don't have to. Aim for a flat that is tiny – maybe 1/64".

Then remove the flat by honing and polishing the bevel on your sharpening stones.

CHANGE THE BEVEL ANGLE

Set the tool rest to the desired angle. If you are lowering the angle, simply begin by grinding the bevel. Most of the work will be at the heel of the bevel. As you reach the tip, stop right before you have cut a zero-radius intersection. Finish the edge on your honing and polishing stones.

WHEN & HOW TO GRIND

When you raise the angle of the bevel using the grinder, take a slightly different strategy. The work begins at the tip. So first blunt the tip, just like you would if the tool were damaged. Make a blunt that is small – less than 1/16". Then grind the bevel to the new angle. Watch the blunted tip and make sure it isn't ground away. If it looks like you are going to grind it away, you can make the flat slightly bigger.

After the new bevel is finished, remove the flat/blunted tip using your honing and polishing stones.

TO CHANGE THE SHAPE OF THE EDGE

One of the small miracles you can perform on a grinder is to change the shape of the blade's edge from a straight line to a convex curve. This is typically done for a jack plane or a scrub plane. A jack plane's blade should have a curve between an 8" and 10" radius. A scrub plane blade has a tighter radius (3" or 4").

To do this, make a template from a scrap of wood or posterboard. Use a compass to scribe the desired radius on the template. Then cut the curve on the template. Use the template to mark the curve on the flat face of the blade in permanent marker. Put the template away for future use – you will need it.

Now use the grinder to blunt the edge of the blade down to the marker line. Do this by holding the blade 90° to the wheel. There is no need to use the tool rest for this operation. If the work is slow-going, be sure to check the tool for overheating.

Fig. 33. A wooden template helps you reestablish the curved edge after dozens of honings and polishings.

Once the curve is established, set the tool rest to the desired angle and grind the bevel (see Fig. 27).

Grinding a curved edge is like imitating the action of your windshield wipers in the rain. Swish the blade back and forth, keeping the cutting action on the center of the tool (as much as possible) and the center of the wheel.

Check the blade every two or three passes for overheating. Cool the steel in a cup of water if it becomes too hot to touch.

When the flat at the tip of the blade becomes tiny – about 1/64" to 1/128" wide – then stop grinding and

WHEN & HOW TO GRIND

Fig. 34. Create the blade's new shape by blunting the tip of the tool. Then grind the bevel to match that new shape.

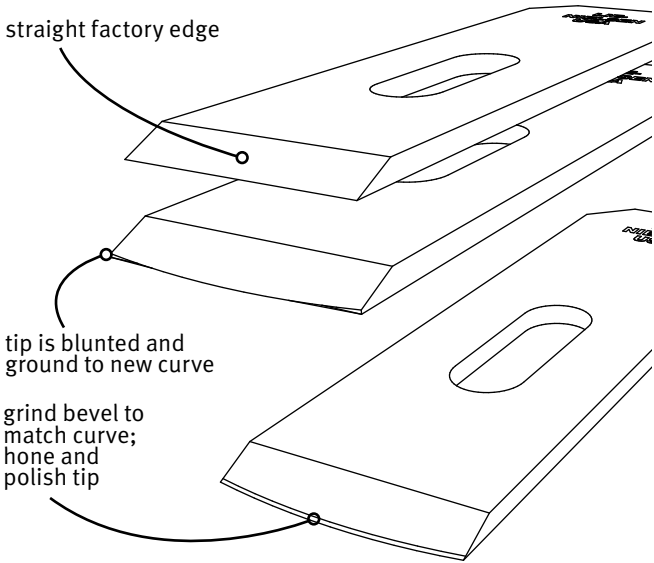

Fig. 35. The stages of changing the shape of an edge.

remove the remainder of the flat using your honing and polishing stones.

ENDNOTES

[1] Yes, there are good reasons to buy a water-cooled grinder, especially if you maintain a wide variety of tools with odd shapes. But if you mostly grind chisels and plane irons, an inexpensive 3,450-rpm grinder with a 6" wheel is the ticket.

[2] I have yet to find a use for a slow-speed dry grinder in woodworking (other than giving more money to the tool dealer). I'm sure there is a valid reason they exist and I'm just a moron.

[3] Hand-cranked grinders are mostly a lifestyle choice. Honestly, 6" fast-speed electric grinders are so ubiquitous that used examples are about the same price as a used hand-cranked grinder. Still, I adore my hand-cranked grinder because it is fun to use.

[4] There also are grinders that use sandpaper (either discs or belts). On the one hand, I like these because they work as fast as an electric fast-speed grinder. But they are expensive to buy and maintain.

[5] It's best to keep the temperature of your steel below the boiling point of water (212°F/ 100°C). If the water bubbles and sizzles when you dunk the tool in it, try to cool more often.

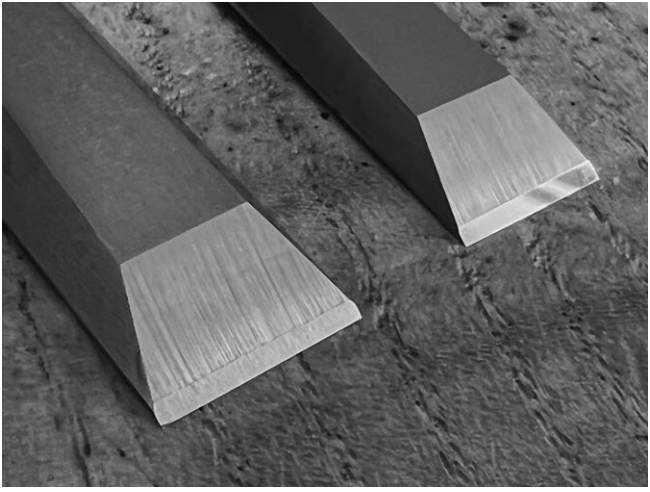

Fig. 36. Honing (left) creates a burr that you can feel. Polishing requires a keen eye (or simply a point at which you decide to go back to work).

7
HONE & POLISH

IN WOODWORKING, most of your sharpening will be honing (creating a new edge) and polishing (making that edge smooth and durable). Though you'll do this a lot, the process is not time consuming. Once you get things set up, honing and polishing a tool takes less time than listening to a pop song on the radio.

A quick review: Honing uses a coarse abrasive (12 to 35 microns across) to remove the old edge and cut a new zero-radius intersection. This process takes seconds[1] if you do it correctly.

Polishing is using progressively fine abrasives (10 microns to 0.5 microns across) to remove minute scratches in the steel to refine the zero-radius intersection so it is smooth and durable. Polishing can take time, depending on how fine an abrasive you wish to use.

Most woodworkers I know have one honing stone (you need only one) and two polishing stones. Typical setups might be a 1,000-grit waterstone for honing plus a 5,000- and 8,000-grit waterstone for polishing. Or a Washita oilstone for honing plus a hard black Arkansas stone and a strop for polishing. You can use the chart in Chapter 3 to devise your own system.

HONE & POLISH

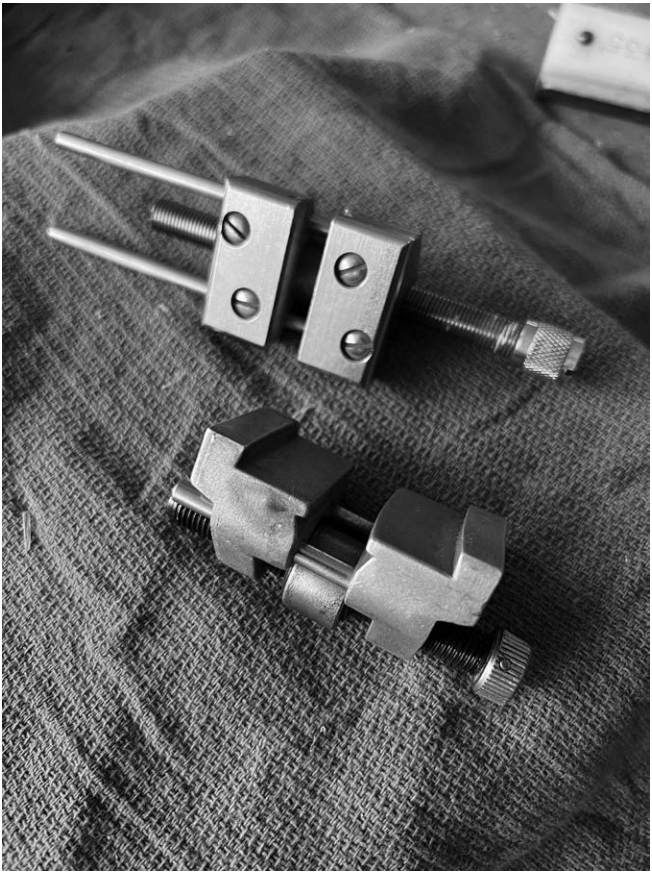

Fig. 37. Honing guides – sometimes called "Eclipse" guides – can be inexpensive and make your sharpening accurate and fast.

THE CASE FOR A HONING GUIDE

Simple side-clamp honing guides are a godsend for quick and repeatable work when it comes to chisels and plane irons. I do sharpen freehand a lot of unusually shaped tools, but when it comes to plane blades and straight chisels, I am happy to let the honing guide do the work.

Side-clamp honing guides can be had for a song – inexpensive ones cost less than $20.[2] And I have found no valid downside to using them.

Critics of honing guides deride them as "training wheels" or as a crutch that slows you down. I have regularly challenged these people to sharpening contests for speed and fineness of edge – the winner determined by a judge who doesn't know whose blade is whose. I have never lost – not because I'm a great sharpener but because the honing guide is an enormous asset.

While I do love my honing guide, my love has limits. I don't use the endless attachments that allow honing guides to be used for oddball tools or skewed tools or short tools or extra thick tools. For those tools, the honing guide and its accessories slow me down. So I stick with the base model, which works well for chisels and plane blades.

So if you stick with the base-model honing guide, you are five minutes away from being a speedy sharpener. All you need is a simple block of wood that sets the blade at the proper angle in the guide so the steel

Fig. 38. The plastic block sets the blade's location in the jig.

at the tip of the blade immediately touches the sharpening media perfectly. Which brings us to a discussion of sharpening angles.

HONING ANGLES – THE ARGUMENT FOR FEWER (OR ONE)

Most sharpening experts steer you toward using a wide variety of angles for different jobs in the workshop. Lower angles for paring tools. Higher angles for chopping tools. And soon you are engraving all the sharpening angles on all your tools and doing more sharpening than woodworking.[3]

In my experience, the sharpness of the edge is more important than the angle (within reason). A 25° paring

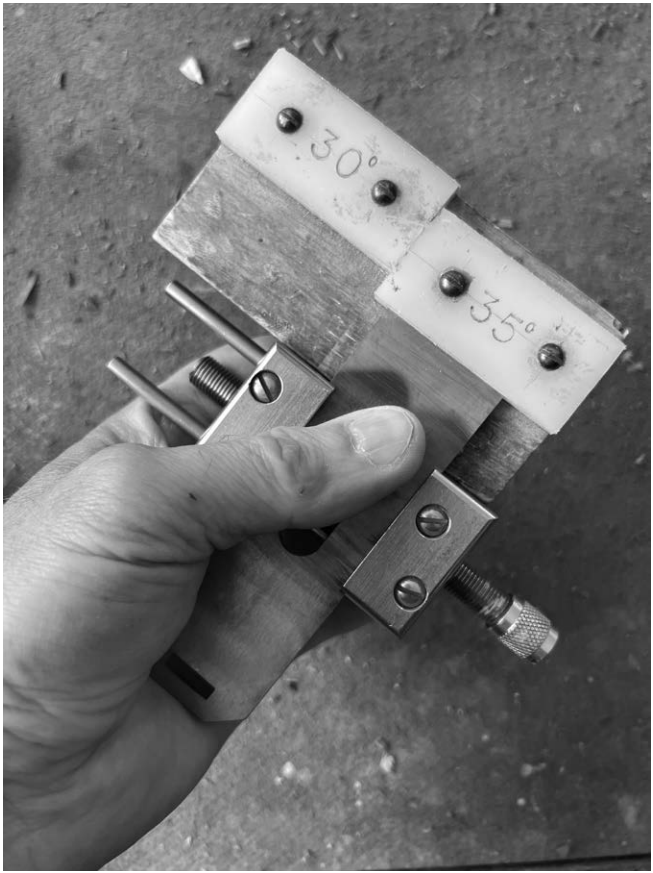

Fig. 39. Setting the tool is simple. Slap it in the guide, press the guide against the block and press the blade to the stop. Tighten the guide. Done.

chisel and a 35° paring chisel will both do a fine job when really sharp.

When I realized this, I decided to see if I could hone and polish all my tools at 35° and be happy. That was about 10 years ago, and I remain committed to this simple approach. I am sure there are tools out there on the fringes that won't work with a 35° hone and polish, but I have yet to encounter them.

So I have a block of wood with a stop on it. I put the tool in my honing guide, I press the guide and blade against the stop block, then I tighten the guide. I am ready to sharpen. (Making a setting block is simple. Use a school protractor to set the blade to the correct angle in your honing guide. Then screw a stop to a block of wood that matches that projection.)

HOW TO HONE STRAIGHT BLADES

Chisels are straight-bladed tools that need sharpening all the time. Put the tool in the honing guide, use a stop block to set it to the correct angle and tighten the guide.

Add the lubricant/wetting agent to your honing stone. Start at the top of the stone (the end of the stone that is farthest away from you). Put firm downward pressure on the blade and pull the tool toward you.[4] Release the downward pressure and roll the tool back up to the top of the stone. Take two more strokes like this (at most).

Lift the tool and guide from the stone and gently[5]

Fig. 40. In general, my hands only gently touch the guide. Most of my hand pressure is on the blade.

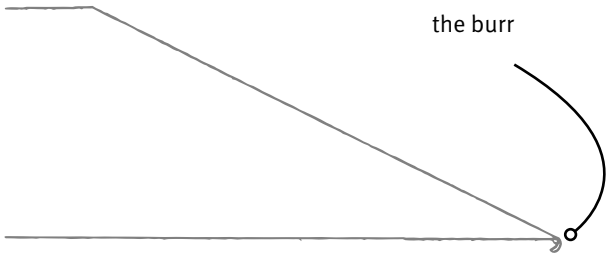

Fig. 41. The burr is a tiny curl of metal that forms at the tip when you cut a new zero-radius intersection. Honing will reduce its size. But it needs to be polished away at the end of the sharpening process.

brush the pad of one finger up the flat side of the tool and off the edge. You should feel a small burr that has formed at the tip of the flat side. This burr is the indication that you have cut a zero-radius intersection with your honing stone. If the burr extends all the way across the edge, you are done with the honing stone.

(A warning: Sometimes pitch will build up on the flat face of a handplane's cutter, right where the chipbreaker meets the flat face. It often feels like a burr. So look closely at the flat face for this line of pitch before you start sharpening.)

If you can't feel a burr, try a few more strokes on the honing stone. If a burr doesn't appear, it is likely that you are not honing at the tip of the tool. Paint the bevel with a permanent marker, then take a few more strokes on the honing stone. That will show you where the error is.

Perhaps the tool shifted in the guide as you tightened it. Or the tool is ground incorrectly or irregularly. If it's the latter, grind the bevel to clean things up and try honing again.

If you feel the burr, you are done with honing. Proceed to polishing.

What if you have a tool that doesn't fit in a honing guide? Then you must grasp the tool at the proper honing angle, and this takes practice. I sharpened freehand for many years (it was how I was taught). There are lots of ways to learn. Here's how I do it.

Press the bevel flat to the stone with two fingers.

Fig. 42. Press the bevel flat to the stone. Raise the handle of the tool 1/8" (no more). Pull the tool backward.

With your other hand, raise the handle (or back end) of the tool 1/8" and no more. Then pull the tool backward and watch the swarf (metal filings) form on the stone to let you know where things are cutting.

Raising the tool 1/8" is the trick. Most beginners raise the tool too much and end up with a 45° or 50° secondary bevel. Feel for a burr. When you have one, move onto polishing.

Freehand honing isn't difficult. It's just slow. Plus, sometimes you will have a bad day and will sharpen too low of an angle or too high.

HONE & POLISH

Fig. 43. The unused edges of a sharpening stone are a great place to do the dirty work of rounding the corners of the iron.

HOW TO HONE SLIGHTLY CURVED BLADES

The blades for my smoothing plane, jointer plane and block plane have slightly curved edges so that the corners of the iron do not dig into the wood and create "plane tracks." Plane tracks are the ugly ridges left behind by the cutter's corners.

To create a slight curve, begin with a blade that has been ground straight across. The curve is generated on the honing and polishing stones.

The first step is to round over the corners of your blade. I do this on the edges of my honing stone.

Why the edges? Because this process cuts a deep gouge in the stone, so the stone's edges are a good place for it.

The result is that the corners are rounded over with a small radius – about 1/16" radius.

Now install the blade in your honing guide. To create the curve for the first time on a straight edge, mentally divide the edge into five "stations" along the tool's edge. One station is in the middle of the edge. One at each corner. And two more between those points.

With the tool on your honing stone, put firm finger pressure on one of the corner stations and take 12 strokes. Then put firm finger pressure on the opposite corner station and take 12 strokes. Now put your finger pressure on one of the intermediate stations and take six strokes. Switch to the other intermediate station and take six more. Finally, put your finger pressure on the center station and take two strokes.

Remove the tool from the honing stone and check for a burr. If you have a burr, hold the tool up in front of your face with a strong backlight. Place a small straightedge on the tip of the edge to see if the edge is curved. If you cannot see a curve, there's a fair chance your stone isn't flat; it's convex across its width. Flatten the stone (see Chapter 9) and try again.

How much of a curve should there be? It depends on the width of the iron and the angle at which the iron is bedded. If you see a curve, continue onto polishing.

Put the tool to use and see if the curve is working

HONE & POLISH

Fig. 44. For most plane irons, I divide them into five stations. Narrow blades (such as block plane blades) have three stations.

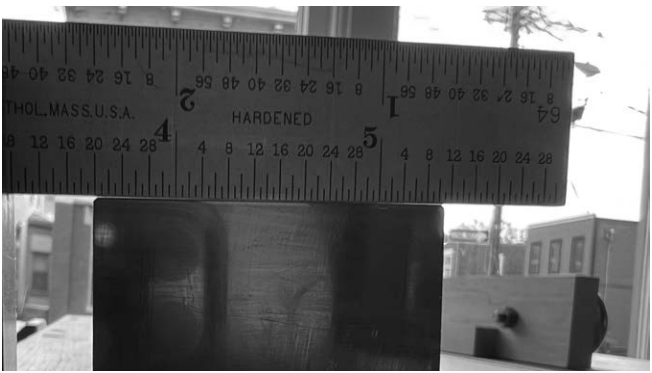

Fig. 45. The curve on a No. 3 smoothing plane. In short order you will get a feel for how much curve each tool requires.

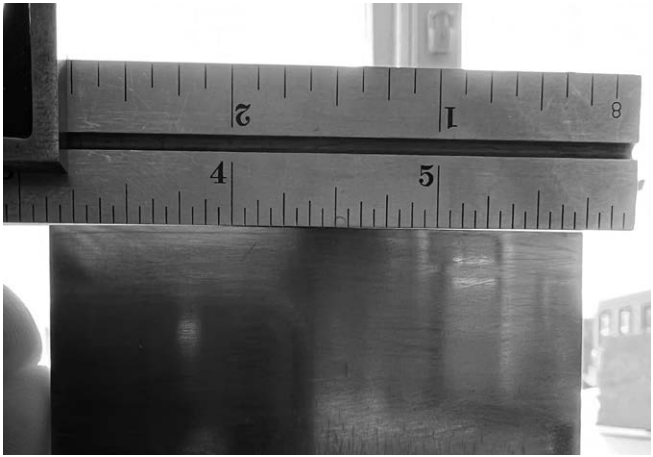

Fig. 46. The curve on a No. 8 jointer plane. Aggressive handplanes require more curve.

(meaning there are no ugly plane tracks). If the curve is too shallow (plane tracks, argh), hone the iron with more pressure at the corners to increase the curve.

If the curve is too pronounced (where the iron will take only a narrow, thick shaving in the middle) then hone again with more pressure at the center station.

For freehand sharpening of curved blades, I press one corner of the bevel to the stone. Then I raise the back end of the tool 1/8". As I pull the tool toward me, I also shift the pressure on the bevel to the center of the edge and then to the other corner.

HONE & POLISH

HOW TO HONE VERY CURVED BLADES

The blades for jack planes and scrub planes are radically curved and require a slightly different approach. Secure the iron in your honing guide. Then put the tool on your honing stone.

Put pressure on one corner of the blade, tipping the honing guide over on its wheel. Begin working up and down the stone with all the downward pressure on that corner. Gradually shift the pressure toward the center of the blade and then to the other corner. Spend equal time at each corner. Go from corner to corner two times. Then lift the tool off the honing stone and feel for a burr. You should have a consistent burr all along the edge. If not, repeat the same motions.

The curve of a jack plane's blade is an 8" or 10" radius, which you can see with the naked eye.

If the second round doesn't produce a burr, paint the bevel with permanent marker and rub the bevel on the stone to make sure you are cutting at the tip. There's a chance that the blade shifted forward or back in the honing guide, or your grinding was off. Figure out the problem and either reset the blade in the guide or re-grind the blade.

Note that the bevel and the secondary bevel don't have to be beautiful to work well. You just need a curve. Not a perfect curve. Perfection comes later.
Once you have a burr, move onto polishing (below).

Fig. 47. Putting pressure on the corner should tip the guide on its wheel. Unfortunately, some guides have really wide wheels. Avoid these.

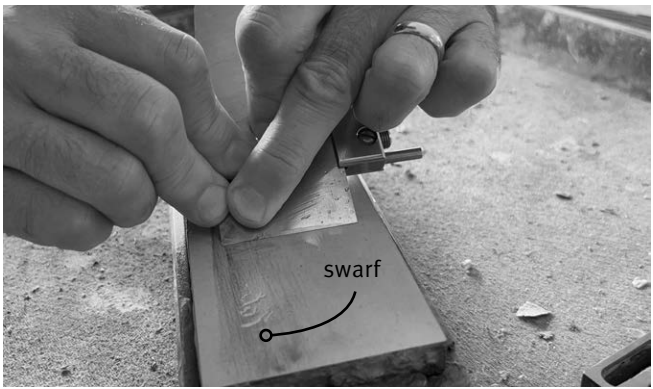

Fig. 48. When you put all the downward pressure on one station at the corner, you will remove steel only at the corner.

HONE & POLISH

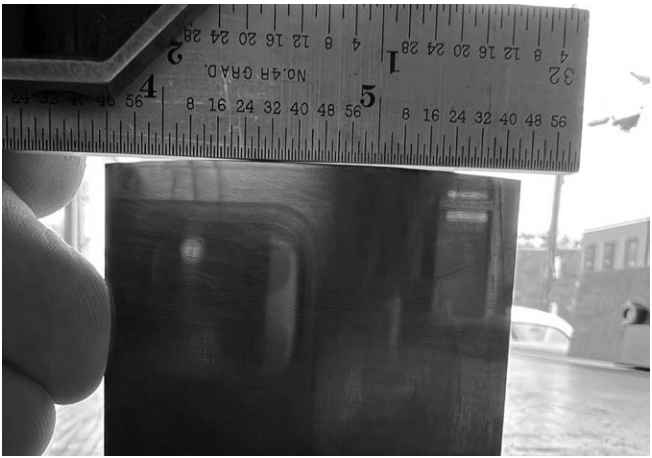

Fig. 49. The curve of a jack plane's blade is an 8" or 10" radius, which you can see with the naked eye.

POLISHING AN EDGE

This is the simplest part of the process, but it can be the most time consuming. Before polishing, wipe off the tool and the wheel of the honing guide with a rag to remove any lubricant and grit. You don't want to transfer those to the polishing stone.

Now place the tool on your coarse polishing stone and repeat the motions you did for honing (use the same motions for either a straight, slightly curved or very curved blade). Polish the edge for about 10 or 15 seconds, then remove it from the stone, wipe it clean and observe the secondary bevel.

The coarse grinding scratches from the honing

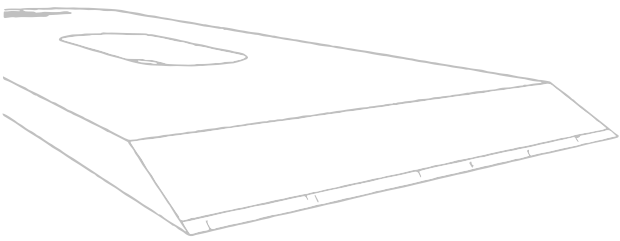

Fig. 50. Chasing a few scratches while polishing can be a fool's game. Set a time limit for polishing.

stone should be replaced with fine scratches from the polishing stone. If you see a couple errant coarse scratches, return the tool to the polishing stone and repeat your motions. Look at the tip again.

If there are still deep scratches, try one more time to remove them on the polishing stone. If that fails, move to the next-finer polishing stone anyway. Chasing a few scratches is madness. An errant scratch or two won't affect the edge much. Likely it will only make the edge a little less durable.

Repeat the polishing process on the next finest stone. Allow yourself only three cycles on the finer stone to remove scratches, then move on. If you have stones that are even finer, continue on, though you likely will start to miss woodworking at some point.

Deciding when you are done is the hard part. I set rules for myself (three cycles on each polishing stone)

so I don't chase one deep scratch for 30 minutes. You might want a different routine with fewer or more cycles. It is, after all, your shop and your edge.

ENDNOTES

[1] Most people hone too much. Deneb Puchalski and I once did an experiment to see how few strokes we could take on a #1,000-grit waterstone and cut a new edge. The experiment ended quickly because you can do it in one stroke when the secondary bevel is tiny and the stone cuts quickly.

[2] In many ways, I prefer side-clamp honing guides that are vintage. The old ones, made in the U.K. by Eclipse, are cheaper and better made than some of the new ones in the $20 range. Look for the Eclipse 36.

[3] And god help you when you make a mistake and hone a new 35° bevel on a 20° tool and need to undo that mistake.

[4] Always pay attention to the black marks appearing on the stone as you work. This is the steel you have removed from the tool. If the black marks are consistent, that's good. If they are appearing only on one side, trouble is ahead.

[5] It's almost like a caress. If you use force, you might just flick the burr off the tool, which isn't good.

8
POLISH THE FLAT SIDE

ONCE YOU HAVE POLISHED the cutting edge of the tool, there is one last task that needs be done before you can go back to work. You need to remove any remnants of a burr on the flat side of the tool using your finest polishing stone.

This process not only removes the burr, it also polishes the flat side of the tool. This is important because a good cutting edge is two intersecting surfaces. If one of the surfaces is polished (the bevel) and the other side is not (the flat face), then the edge will be poor.

Removing the burr and polishing the flat face is quick and easy. But there is a right way and wrong way to do it. The approach you take also depends on the type of tool you are sharpening.

CHISELS & TOOLS THAT HAVE BEEN LAPPED

There are some tools that are manufactured with the flat face of the tool lapped flat at the factory. These tools usually cost more and the instructions for the tool will tell you that the back has been lapped.

There are other tools where the user needs to flatten

POLISH THE FLAT SIDE

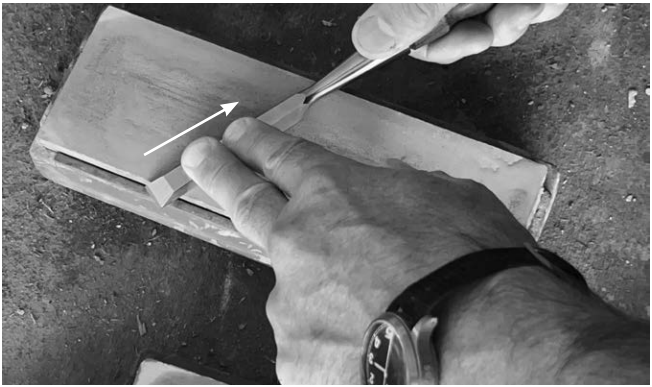

Fig. 51. The tip of the tool begins off the stone. Then you pull it onto the stone so that the burr falls away harmlessly.

Fig. 52. Though polishing the flat face can be done in 5 seconds or so, I usually spend some extra time in polishing the flat face to keep it clean and polished.

and polish the flat face because it is important to the way the tool is used. The most common example of this sort of tool is a bench chisel. The flat face is often used to guide the tool.

With tools that have a polished flat side, removing the burr is easy. Use your finest polishing stone. Lay the tool on the stone so the tip is slightly off the stone. Now – with downward pressure – move the tool so the tip is on the polishing stone. This movement removes any burr at the cutting edge and prevents the burr from getting embedded in the stone. (This would wreak havoc on future polishing efforts.)

Now you can stroke the tool on the polishing stone some more to add a little polish to the flat face. If the tool is a narrow chisel, I do this by plunging the tool in and out on the stone. For wider plane irons, I swipe the tool up and down the stone with about 1-1/2" of the tool on the stone.

This additional polishing helps remove any sap or other junk that is clinging to the tool. And it helps maintain the polish on the flat face. This little bit of additional polishing isn't for long – maybe 15 seconds.

PLANE IRONS THAT HAVEN'T BEEN LAPPED

For tools when the flat face hasn't been lapped or polished flat, there is a different strategy to remove the burr and add polish. This strategy uses a thin 6" steel ruler that you can buy at almost any hardware store.

POLISH THE FLAT SIDE

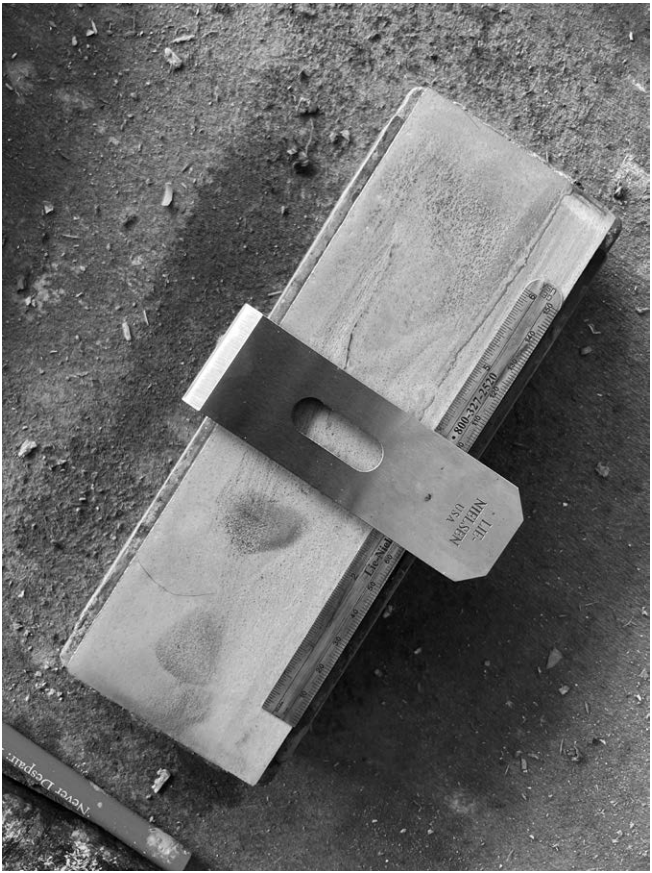

Fig. 53. When you use the ruler trick, start the tip of the tool off the stone.

POLISH THE FLAT SIDE

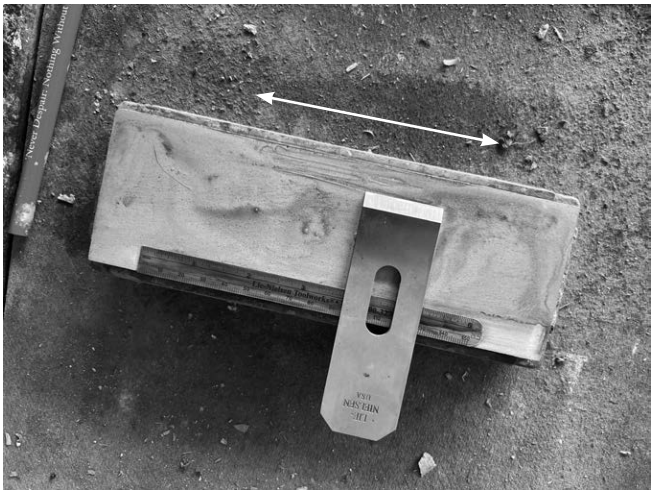

Fig. 54. Only allow the tool to come onto the stone about 5/8" to keep the polishing at a low angle.

It is called the "ruler trick," and it was invented by David Charlesworth, a sharpening expert from Devon who I was very fond of.

Put the ruler down on one edge of the polishing stone. Place the tool across the ruler and the polishing stone with the tip of the tool off the stone. Begin moving the tool up and down the stone and drift the tool onto the stone as you move it up and down. Drift onto the stone about 5/8", then drift off and on the same way a few times.

The ruler raises the back of the tool about 0.018", the thickness of the ruler, so just the tip of the tool

contacts the polishing stone. As a result, only the tip is polished – not the vast acreage of steel behind the tip that doesn't cut wood. The ruler trick also polishes a small back bevel on the tool. This back bevel does not affect the tool's cutting action in any meaningful way. Nor does it interfere with how the chipbreaker/cap iron of a plane fastens to the iron. In fact, I can find no downside to the ruler trick – other than having to buy a cheap ruler.

For the most part, the ruler trick is a time-saver. You don't have to lap the flat face of your plane irons dead flat and polished before you get to work. You have only to get them flat enough that the ruler trick will work. Like all woodworking tricks, the ruler trick can be abused to the point where the tool has two bevels, like a knife edge. A knife edge on a plane iron can cause problems. This is not the intent of the ruler trick.

The last thing to say about polishing (and sharpening in general) is that it is an ongoing process. Your bevel and your flat face might not be perfectly polished the first time you sharpen the tool. But through months and years of honing, polishing and regular grinding, the tool will become a fine and sensitive instrument that you know as well as your spouse's hand.

9
FLATTEN YOUR MEDIA

SHARP TOOLS are the result of good habits that include regular grinding, frequent (but gentle) honing, polishing and taking care of your sharpening gear.

When it comes to your sharpening stones, that means keeping them flat and removing any glazing that has built up on the surface of the stone. (With sandpaper sharpening, maintenance means changing the paper before it starts cutting irregularly. With diamond sharpening stones, that means keeping them clean.)

There are woodworkers out there who insist you can keep your sharpening stones flat by simply working the entire stone evenly when you sharpen your tools. In other words, use your tools to keep the stone flat.

You might be able to do this. I know a couple sharpeners who managed it for years. But this approach doesn't address glazing, which is what happens when swarf (metal filings) and lubricant (oil, usually) gum up the cutting surface of the stone.

Oilstones are easily glazed by oil and swarf. Waterstones are easily glazed by sharpening tools without enough water (or no water). Diamond stones don't get

glazed easily as long as you clean them – but they lose their diamonds over time.

You can slow the glazing in several ways. With oilstones, soaking them in kerosene helps float away a lot of the oil and keeps the stones cutting fairly well. With waterstones, keeping them wet while you use them helps expose fresh cutting material. And soaking diamond stones in kerosene or other solvents can reduce glazing.

The other way to approach the problem is to flatten your waterstones and oilstones regularly so they never become dished and they never glaze. (Diamond stones come flat and should stay flat.)

With waterstones, I flatten them every time before I put them away. A typical sharpening session involves honing and polishing three or four tools. Then I flatten my waterstones, clean them off and put them away (in a plastic boot tray under my workbench). For oilstones, I flatten them every couple months. Or as soon as I think: "These stones aren't cutting as well as they should."

DIAMONDS ARE USUALLY THE ANSWER

With both oilstones and waterstones, I use a diamond plate to flatten them. This isn't a diamond plate you would typically use for sharpening steel. It is quite coarse (about 130 microns, give or take) and expensive. There are cheap alternatives out there, including bricks that claim to flatten sharpening stones. But I have never

had success with them. Mostly, I find that they add to a stone's glazing.

If you cannot afford a diamond lapping plate, to flatten waterstones use #100-grit wet/dry sandpaper stuck to a flat ceramic tile, lubricated with water. Use a coarser grit of wet/dry paper (#70- or #80-grit) and kerosene to flatten oilstones. Then save your money for a diamond stone as they can last for more than a decade, even under heavy use.

HOW TO FLATTEN STONES

Stones don't have to be flat like a board. If they have a dish or a bump in the middle, that's bad, and your efforts to sharpen tools will be quite vexing. However, if the stone is slightly convex or concave along its length, that usually won't affect sharpening much.

However, I do try to keep my stones as flat as possible.[1] Here's how. When flattening a set of stones, I begin with the finest one and work my way down to the coarsest one. While I wipe off the diamond plate between each grit, I don't want to deposit coarse abrasive on my finer stone. By working from fine down to coarse, then I can only contaminate my coarse stones with fine abrasive – which is no big deal.[2]

Place the sharpening stone on the bench. Add your lubricant/wetting agent.

Place the diamond stone on the sharpening stone, skewed 90° to the sharpening stone.

Run the diamond stone left and right on the center

FLATTEN YOUR MEDIA

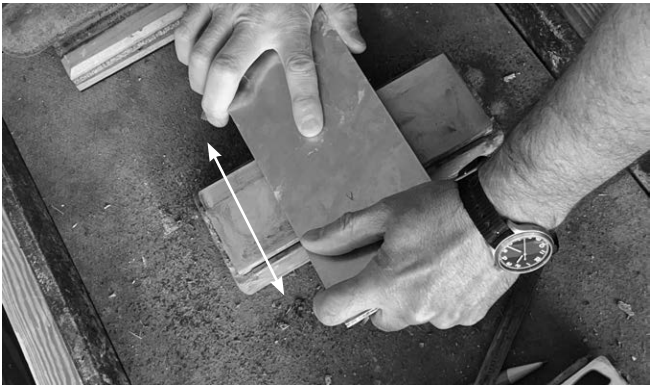

Fig. 55. By working out the middle of the stone first, you can help ensure the stone will end up flat.

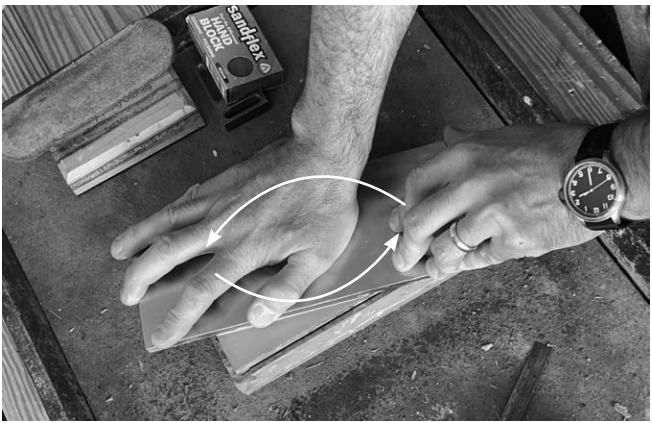

Fig. 56. This motion is vaguely elliptical to spread the diamond plate's cutting action out on the sharpening stone.

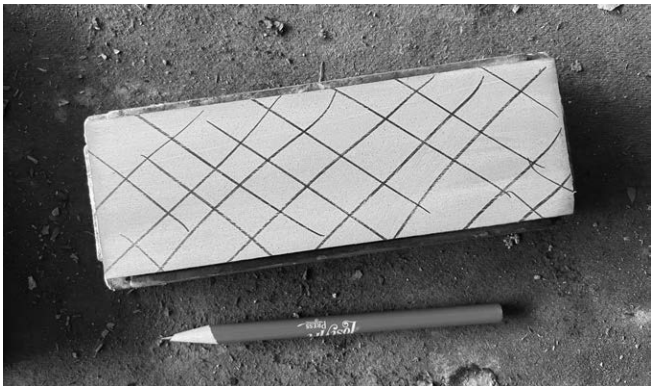

Fig. 57. A quick pencil grid can help point out the low spots on a stone. A low corner, for example, can usually be ignored.

of the sharpening stone. This creates a slight hollow in the dead center of the stone and it quickly eliminates any dishing there.

Now rotate the diamond stone so it is almost parallel to the diamond stone and take several up-and-down passes with a somewhat circular motion. The circular motion helps spread the wear on the diamond plate.

For a waterstone that gets flattened after every sharpening session, this is about all that is necessary to flatten the stone. With oilstones, the procedure is the same. It just takes longer.

In time you will be able to feel when the sharpening stone is flat. Until then, you can check your work. Take a coarse pencil and draw a grid of crosshatchings across the surface of the sharpening stone. Now

run the diamond stone against the sharpening stone as described above. Look at the surface of the sharpening stone. Low spots will still be covered in pencil. Keep working until the pencil marks are gone (or gone in the critical areas; the far corners of a stone aren't used much).

ENDNOTES

[1] I had a student who owned winding sticks that he made specifically to check his sharpening stones. He kept the winding sticks in a velvet bag. Another student used a surface gauge to check his stones for flatness. It's easy to go overboard.

[2] Some woodworkers are a bit over-zealous about cross-contamination (Now take your blade to the #8,000-grit clean room....). If you think a stone has become contaminated with coarse grit, take it aside and flatten it and clean it off by itself (outside of the regular flattening cycle). This almost always fixes the problem.

10
SHARPENING IS NOT A SPORT

IF YOU EVER FIND YOURSELF talking to fellow woodworkers and someone starts nattering on about the "unicorn bevel," "Edge-On-Up scores" or (worse) the "Kawai/Kato films," you might want to start edging toward the door. You are in the company of sharpening enthusiasts.

There is nothing wrong with embracing sharpening as a hobby. But it has little to do with making furniture – just as molecular gastronomy has little to do with home cooking.

For furniture makers, sharpening is maintenance, like adding lubricant to the grease points of a machine or flattening a workbench top that has a big low spot in the middle. Anyone can do it well with basic equipment and a rudimentary understanding of the process.

Sharpening is like brushing your teeth. Do it because you know that bad things will happen if you don't do it twice a day.

Sharpening is like eating oatmeal instead of an oatmeal cookie. Like getting an oil change for your truck instead of new rims for its tires. Like cleaning your

shower's P-trap instead of doing almost any other activity imaginable.

It is not something that needs to be intellectualized.

And so when I teach students to sharpen, I ask them to please, please try to do more sharpening than reading about sharpening. Or talking about sharpening. Or (worse) arguing about sharpening.

Talking about sharpening quickly becomes like "dancing about architecture" (a humorous statement often attributed to comedian Martin Mull). It gets you nowhere meaningful.

But here's what can.

If you want to be a better woodworker, you need to learn to sharpen. If you want to be a better sharpener, you need to stop paying so much attention to tertiary bevels and carbide formations in steel and start paying attention to the wood. If the wood is cut cleanly, then your tools are sufficiently sharp. If the wood is torn out and covered in tiny scratches, then you need to sharpen up your tools.

And then keep sharpening your tools until you get the desired results.

It can be tough to stay on this practical path. Every woodworking catalog and discussion forum is packed with new equipment and ideas to create better edges. It's tempting, especially as a beginner, to try some of the interesting sharpening approaches that float around the internet. Or to sample some exotic new diamond-impregnated paper.

SHARPENING IS NOT A SPORT

What can it hurt? And what if it helps?

Indeed, even at my age I get the occasional itch to buy an expensive new stone or a stick of sub-micron polishing compound that just might propel my edges to new heights. But after years of falling for that self-delusion, I know that the real answer is to just sharpen my tools more frequently with the gear I already own.

And here's the other thing that keeps me grounded: I think about want I want to leave behind when I'm gone. Is it a chest filled with immaculately cared-for tools and a few nice pieces of furniture? Or do I want to leave behind hundreds of pieces of furniture that demonstrate – through an iterative process – that I grew in my ability to harness beauty and bring it into this world? (Plus, a chest of tools that are in serviceable shape.)

If you are in the latter camp, here are your marching orders for when you put down this book.

1. Pick a sharpening system (any system)
2. Stick with that system for a full year before making any changes or additions
3. Focus on getting better edges with the gear you have in your shop.

Once you have the gained confidence from a year of sharpening, it's OK to think about changes you might want to make. You might dislike the mess that waterstones make. Or how quickly sandpaper becomes useless. Or how easily oilstones get gummed up.

So sample another system. Chances are, however, that it won't make your edges spectacularly (or even

noticeably) better. I remember the first time I tried a #30,000-grit stone. The edge wasn't perceptibly better than my edges sharpened with an #8,000-grit stone. But trying new systems will help you see the upsides and downsides of your existing system.

And perhaps reassure yourself that you were already on the right path.

APPENDICES

1: ABOUT SHARPENING MEDIA, ADVANTAGES & DISADVANTAGES

FOR THE MOST PART, rocks are rocks. Big ones cut steel quickly and coarsely. Little ones polish out the scratches left by the big rocks.

If you want, you can dive deeply into how the rocks fracture, and how that affects their cutting action. And how they are bonded to each other. Or you can spend your time studying furniture.

As someone who has stood at the polycrystalline fork in the road, here is all you need to know about sharpening media if you are a furniture nerd: All the sharpening systems work. Each has small downsides and upsides.

OILSTONES

Oilstones are the traditional choice. They cut smoothly and somewhat slowly. But they wear slowly and require less maintenance. You can sharpen tools with them anywhere – on your workbench, in the kitchen, on the porch. Put a little oil on the stone and go to work – they don't make much of a mess. And the tool is lubricated by the oil and the sharpening process, so there is no serious concern about rust.

APPENDICES

Oilstones are a romantic choice. The stones are natural – modern ones are cut from mines in Arkansas and each one is different. So, they are like wood in that each one is unique and can be marked with different colors. Because of their natural origin, they also can have somewhat magical properties. There are some near-perfect stones out there that cut beautifully and leave a stunning edge. And some crap stones that you don't hear much about from their owners.

Note that we call them oilstones now, but historically they could have been lubricated with other liquids. Also good to know: This class of stone can include many kinds of stones, not just novaculite from Arkansas or the Middle East (these were called Turkey stones).

Any rock hard enough to cut steel could be called a sharpening stone. And so many other kinds of minerals (typically quartz) were mined and used to sharpen tools. Many old maps of the United States call out the locations of veins of sharpening stones.

In addition to natural oilstones, there are manufactured ones available. These oilstones are typically quite coarse. And they are used more on carpentry jobsites than in furniture shops. I used one of these India stones as my honing stone for many years, so don't dismiss them entirely.

WATERSTONES

Waterstones refer mostly to a class of stone that came from Japan, first as a natural stone and now as

a manufactured one. Waterstones are sharpening media that cut quickly and wear quickly. Water is the typical lubricant, though other liquids have been used.

Natural waterstones are quite rare, especially in the West. But they have all the same magical properties/downsides as natural oilstones.

Manufactured waterstones have become quite technological. And thanks to certain special (read: expensive) binders, you can spend some extra cash to buy waterstones that cut fast and wear more slowly than other waterstones. Plus, they don't need to be soaked in water before working with them.

Mostly, waterstones are a horrific mess. And I say this as a daily user of them. Water and rusty water are bad things to have flying around a workshop for so many reasons. So it's difficult to use them at your workbench. I manage it, but sometimes my mess spills onto the benchtop anyway.

So it's best to have a dedicated area of the shop for waterstone sharpening. If you don't have a lot of space in your shop, then oilstones, sandpaper or diamond stones might be your better choice.

Waterstones need a lot of water. So you need a big bucket of it in your workshop. Or a slop sink with running water.

DIAMOND STONES

Diamond stones are a manufactured sharpening medium. Industrial diamonds are bonded to a steel

plate using a nickel binder. These stones cut fast and wear fast during a break-in period. After that they cut slow and wear slow.

One important difference between diamond stones and other traditional stones (such as oilstones and waterstones) is that the diamond stones never go out of flat. This feature is remarkable as the maintenance for these stones is almost non-existent. You just have to keep them clean (we run them through the dishwasher when they get gummed up).

Diamond stones do have a downside, and that is they don't last as long as a traditional oilstone or waterstone. The diamonds break loose in time or break down to the point where their cutting action is intolerably slow. With a diamond sharpening stone, we might get two or three years of regular service in our shop. For a manufactured coarse waterstone, I plan on five to seven years. I have yet to wear out an Arkansas stone. Diamond stone manufacturers will tell you a different story – that the stones will last almost forever. Don't believe it.

SANDPAPER

In a lot of ways, sandpaper sharpening is like using diamond stones. At first, the abrasives cut fast and wear fast. Then they cut slow and wear slow. Obviously, sandpaper stays as flat as the medium you stick it to, which is nice.

The downside is the long-term expense. You can get

started in sandpaper sharpening for less money than other systems. But the paper wears out fast. And in time, sandpaper sharpening becomes quite expensive.

At times, however, sandpaper is the best solution. You can wrap it around dowels to sharpen odd profiles. And you can take an entire sharpening kit with you into a place where you don't know if you'll have access to oil or water for your stones.

MIXING & MATCHING

Mixing sharpening systems can make your life miserable. But in some workshops, it's a necessity. We use all of the above systems in our workshop, which is also a classroom at times, and at other times a laboratory for woodworking techniques. Here's what that looks like.

For my personal tools – chisels, plane irons, scrapers – I use waterstones. Mine are non-porous stones that don't have to be soaked in water before using them. This feature makes them expensive, but even more hard-wearing than a typical manufactured waterstone. I keep my stones flat with a heavy diamond plate designed for the task.

For student tools, we have diamond stones plus a #10,000-grit waterstone. Students are hard on tools and sharpening gear, so we went with a system that had low maintenance. The #10,000-grit waterstone is for final polishing. It is quite dense and doesn't require much maintenance.

For sharpening moulding planes and other tools

with odd profiles, I use sandpaper wrapped around dowels and small slipstones (oilstones) for dressing the bevels. I keep the flat faces of these tools polished with my polishing waterstones.

2: SHARPENING COMPLEX PROFILES

MOULDING PLANES look like a sharpening nightmare. How do you sharpen the bevel of a square ovolo or Roman ogee? Do you need a special stone designed for each profile in your tool chest? No.

The sharpening regimen is different for moulding planes compared to chisels. Here's what it looks like. After I use a beading plane or complex moulding plane for anything more than a quick cut, I remove the iron from the body of the plane.

I polish the flat face of the iron on my finest polishing stone for a couple minutes. Then I wipe the iron with a little oil and put it back in the tool. This little bit of maintenance lasts a good long time. But eventually the bevel gets gunked up with sap or beat up to the point where you need to dress the bevel.

When this happens, remove the iron and dress the bevel using sandpaper wrapped around dowels and little slips of a hard wood. I use #150-grit sandpaper and work the bevel until I get a burr on the flat side. Then I polish the bevel, either with finer sandpaper or a slipstone lubricated with oil.

Then I remove the burr on the flat face on my polishing stones.

Fig. 58. Stoning the flat face of the iron will keep the edge fresh for a long while.

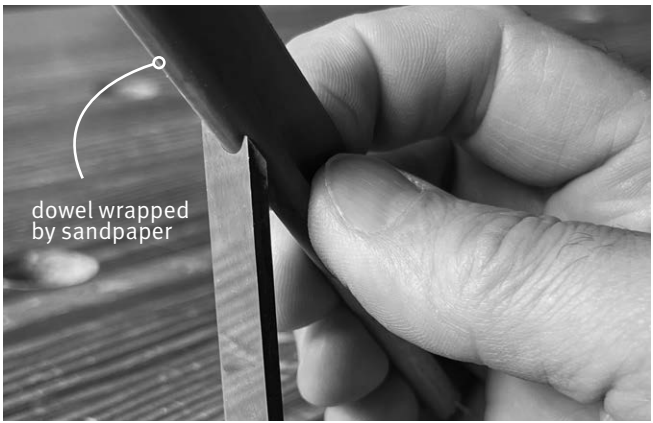

Fig. 59. Eventually you need to dress the bevel. I use sandpaper (#150, #320 and #600) wrapped around dowels. Plus small bits of flat wood that are also covered in sandpaper.

If you keep up this maintenance, you might not have to grind your irons – unless you are in the moulding business. I have moulding planes that are 16 years old that have never required grinding and that work well in hardwoods and softwoods.

3: ALL YOU NEED TO KNOW ABOUT STEEL

IN ADDITION TO MAKING FURNITURE and writing books, I also make woodworking tools. So I have to know a little bit about steel and its properties to make good tools. But I don't encourage woodworkers to become steel experts.

The truth is that the different steels in woodworking tools all work quite well with minimal differences. Plus, the type of steel in a tool doesn't tell you anything about how the raw material was heated, treated and tempered. It's a lot like food. A steak sandwich from a gas station might taste totally different than one from a food truck or a French restaurant – even though on paper they have the same ingredients.

Also, you cannot underestimate the skill of the tool's maker. I would rather own an aluminum foil chisel made by blacksmith Barr Quarton than a fancy powdered metal tool stamped out in a factory that I've never heard the name of.

So with all that preamble, here's what you need to know. Traditional high-carbon steel, what some people call O1, works in every woodworking hand tool

I've ever used. It sharpens easily and, when properly heat-treated, keeps an edge for a respectable length of time.

Many woodworking toolmakers have switched to using A2, an alloy steel. A2 takes a little more time to sharpen, but its edges last longer. When you push A2, the edge can get a little toothy as it wears, so some woodworkers avoid it for tools that leave a finished surface, such as a smoothing plane.

Powdered metals are proprietary high-tech mixes of steel and alloying agents that can give the steel some unusual properties, such as a steel that sharpens quickly and wears for a long time. The downside is expense. Powdered metals almost always cost more than old-fashioned high-carbon steel or A2.

There are a few steels out there to avoid. A few manufacturers use alloys such as D2, which needs diamonds to get it sharp. Stay away from steels that need special tools to sharpen them. It's generally not worth the hassle.

Honestly, I don't get too worked up about the type of steel in a tool. I get much more worked up about the manufacturer and its reputation for quality. I don't know or care what sort of steel Kevin Drake uses in his Tite-Mark cutting gauges. Kevin has an outstanding reputation for making quality tools and he knows what he is doing. If I have a question or a problem with a tool, I know Kevin will set things right. And that fact is worth more than becoming a self-taught metallurgist.

APPENDICES

4: SHARPENING SCRAPERS

WOODWORKING SCRAPERS seem like the great exception when it comes to sharpening. They require a different tool (a burnisher) and some different hand motions to get them to work. But in the end, the same rules apply to scrapers that apply to all tools.

A sharp scraper has a zero-radius intersection at its cutting edge. And the more polished the two intersecting surfaces are, the longer the tool will go between sharpenings.

STEP 1: REMOVE ANY EXISTING BURR OR HOOK

The first step for me is always – always – to burnish the faces of the scraper to eliminate any existing burr or hook. The burr could be the result of manufacturing. Or it is the remnants of the hook on the tool you've been using.

Place the scraper down flat near the edge of the workbench. Press the burnisher dead flat on the scraper. Press down – hard! – and glide the burnisher across the face of the tool. Five or six good strokes will do. Repeat on the other three faces.

STEP 2: STONE THE NARROW EDGES

To get perfect 90° corners, use a block of wood as a guide and stone the long edges of the tool. Shift the block of wood around so you don't wear a groove in your stone. Use the sharpening stone that you use to

Fig. 60. Remove any burr or old hook using the burnish as shown.

Fig. 61. Stone the long edges of the scraper using a block of wood as a guide.

begin your typical honing process (a #1,000-grit waterstone or a soft Arkansas oilstone, for example). Seven or 10 strokes should be enough to stone away any extra metal. (Note: There is no need to hone the short ends of the scraper, though some people do.)

If, however, this is a new scraper, you might need to stone the edges on a coarse stone for a few minutes to ensure the edges are dead 90° to the faces and consistent. Future stonings will go faster once the tool is set up.

Repeat this process with the block of wood on a polishing stone, such as a #5,000-grit waterstone or a hard Arkansas oilstone. Look closely and continue the work until the edge is consistently polished. The first time you do this on your tool it might take a few minutes. Subsequent sharpenings will require only 10 strokes or so.

STEP 3: BURNISH THE FACES

Wipe a little oil on the scraper and the burnisher. Place the scraper flat on the bench again and repeat the same burnishing process you used to remove the burr. Remember: Use hard downward pressure (yet the burnisher should still glide across the face of the tool).

This burnishing polishes the face of the scraper (much the way a hard bone will burnish soft wood) and push a little steel up on the tool's edge. This step improves the durability of your hook and makes the hook easier to turn.

Fig. 62. Tilt the burnisher and turn a hook on one edge.

Fig. 63. Tilt the burnisher the other way to turn a hook on the adjacent edge.

STEP 4: BURNISH THE EDGES

Secure the scraper in a vise with one edge upright. Wipe a little oil on both the scraper and the burnisher to make your work easier. Hold the burnisher parallel to the floor and burnish the edge with moderate downward pressure (a bit less than you used on the faces). Five or six smooth strokes will do.

Tilt the burnisher about 5° to the right and burnish one corner of the scraper with five or six smooth strokes. Run your fingers up the scraper to feel if you have turned a hook. The hook is slight and subtle, much like the burr you turn on the backside of a chisel when honing it.

If the hook is not there, repeat with more strokes with the burnisher tilted at 5° to the right until a hook appears. Try adding more downward pressure to see if that helps.

When you have a hook, tilt the burnisher 5° to the left and repeat the burnishing process for the other edge. When you have two good hooks, flip the scraper over in the vise and repeat Step 4 for the second edge.

Clean the scraper with an oily rag and get to work. To improve the longevity of your burr, store the tool in a cardboard or paper envelope. The hook is as fragile as the edge on a paring chisel.