Taunton's COMPLETE ILLUSTRATED *Guide to*

Sharpening

THOMAS LIE-NIELSEN




- Choosing a Sharpening System
- Sharpening Planes and Saws
- Touching Up Blades and Bits
- Shaping Turning Gouges
- Honing Carving Tools



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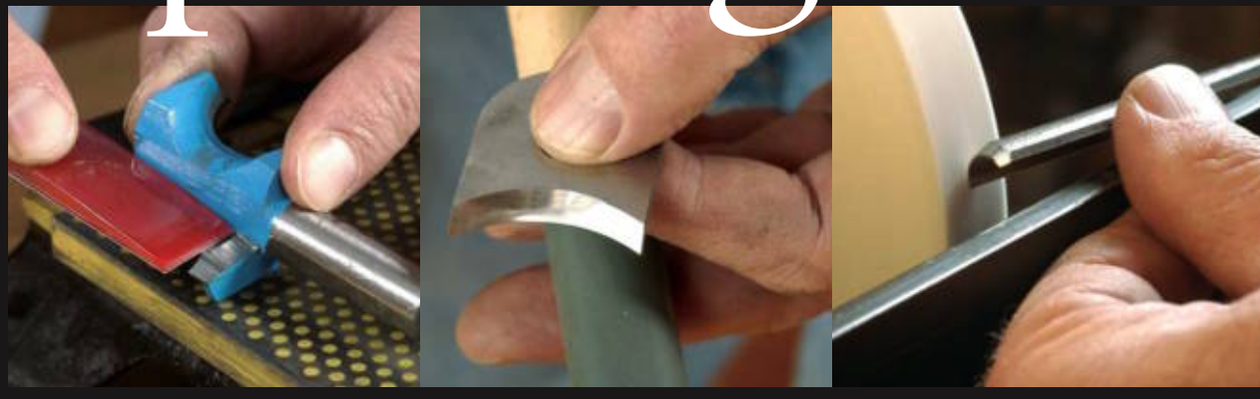

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About Your Safety: Working with wood is inherently dangerous. Using hand or power tools improperly or ignoring safety practices can lead to permanent injury or even death. Don't try to perform operations you learn about here (or elsewhere) unless you're certain they are safe for you. If something about an operation doesn't feel right, don't do it. Look for another way. We want you to enjoy the craft, so please keep safety foremost in your mind whenever you're in the shop.

Acknowledgments

There were many people at Lie-Nielsen Toolworks who helped make this project possible. Among them are Joe Butler, Sarah Ewing, Polly McGrory, Michelle Bodman, and George Jones.

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Introduction

Sharpening common woodworking tools is not a difficult or complicated process. You don't need a metallurgist's understanding of steel, or serve a long apprenticeship, to produce durable, razor-sharp edges. Woodworkers will find a large selection of good tools and materials on the market, and the methods of getting the job done properly are usually straightforward. A bit of practice is necessary, but much less than it would take to perfect your golf swing.

Don't worry about ruining a blade. Steel tools are forgiving, and many of the mistakes you inevitably make in the beginning are easy to correct. A blade that has been over-heated and scorched on a bench grinder can be ground back, and a lopsided bevel can be straightened and squared. Even if your early attempts at sharpening a blade actually ruin it, you can always buy a new one. The experience you gain will be worth the price.

It is important first to learn the difference between a properly sharpened tool and a badly sharpened one. Shiny surfaces are not enough if the cutting edge is uneven or rounded over. A plane blade whose back is not flat will never be truly sharp even if it is polished to a mirror finish. Think of a razor blade—straight and sharp. Use a magnifying glass and good light so you can really see what you're doing, and think in terms of simple geometry: the intersecting planes, lines an angles that produce a sharp working edge.

This book is not about turning sharpening into a hobby. Sharpening woodworking tools is a means to an end, and that end is woodworking. Your collection of sharpening tools and your work area should be arranged so it is convenient to use and designed to help you get accurate, predictable results in a minimum amount of time. If you succeed in doing that, you will be encouraged to sharpen often and not avoid it as people often do.

An inevitable question is just how sharp a blade really needs to be. Competitors in planing exhibitions try to make the longest, thinnest shavings they can (usually in a cooperative species of wood). This is a fascinating exercise, but the point of knowing how to sharpen your woodworking tools is not to make specimen shavings but to accurately dimension and smooth wood. Honing a blade until it can remove a shaving of wood no more than one-thousandth of an inch thick is overkill when all you want to do is remove the high spots from a rough board with a scrub plane. On the other hand, if you're trying to create a glassy smooth finish on hard maple with a handplane alone it will help to know how to prepare your blade. The trick is in knowing what kind of edge you really need.

To that end, it is helpful to keep things simple, to focus on results, and not to worry too much about theory or opinion. The best way to sharpen is the way that works for you.

How to Use This Book

First of all, this book is meant to be used, not put on a shelf to gather dust. It's meant to be pulled out and opened on your bench when you need to do a new or unfamiliar technique. So the first way to use this book is to make sure it's near where you do woodworking.

In the pages that follow, you'll find a wide variety of methods that cover the important processes of this area of woodworking. Just as in many other practical areas, in woodworking there are often many ways to get to the same result. Why you choose one method over another depends on several factors:

Time. Are you in a hurry or do you have the leisure to enjoy the quiet that comes with hand tools?

Your tooling. Do you have the kind of shop that's the envy of every woodworker or a modest collection of the usual hand and power tools?

Your skill level. Do you prefer simpler methods because you're starting out or are you always looking to challenge yourself and expand your skills?

The project. Is the piece you're making utilitarian or an opportunity to show off your best work?

In this book, we've included a wide variety of techniques to fit these needs.

To find your way around the book, you first need to ask yourself two questions: What result am I trying to achieve? What tools do I want to use to accomplish it?

In some cases, there are many ways and many tools that will accomplish the same result. In others, there are only one or two sensible ways to do it. In all cases, however, we've taken a practical approach; so you may not find your favorite exotic method for doing a particular process. We have included every reasonable method and then a few just to flex your woodworking muscles.

To organize the material, we've broken the subject down to two levels. "Parts" are major divisions of this class of techniques. "Sections" contain related techniques. Within sections, techniques and procedures that create a similar result are grouped together, usually organized from the most common way to do it to methods requiring specialized tools or a larger degree of skill. In some cases, the progression starts with the method requiring the most basic technology and then moves on to alternative methods using other common shop tools and finally to specialized tools.

The first thing you'll see in a part is a group of photos keyed to a page number. Think of this as an illustrated table of contents. Here you'll see a photo representing each section in that part, along with the page on which each section starts.

Each section begins with a similar "visual map," with photos that represent major groupings of techniques or individual techniques. Under each grouping is a list of the step-by-step essays that explain how to do the methods, including the pages on which they can be found.

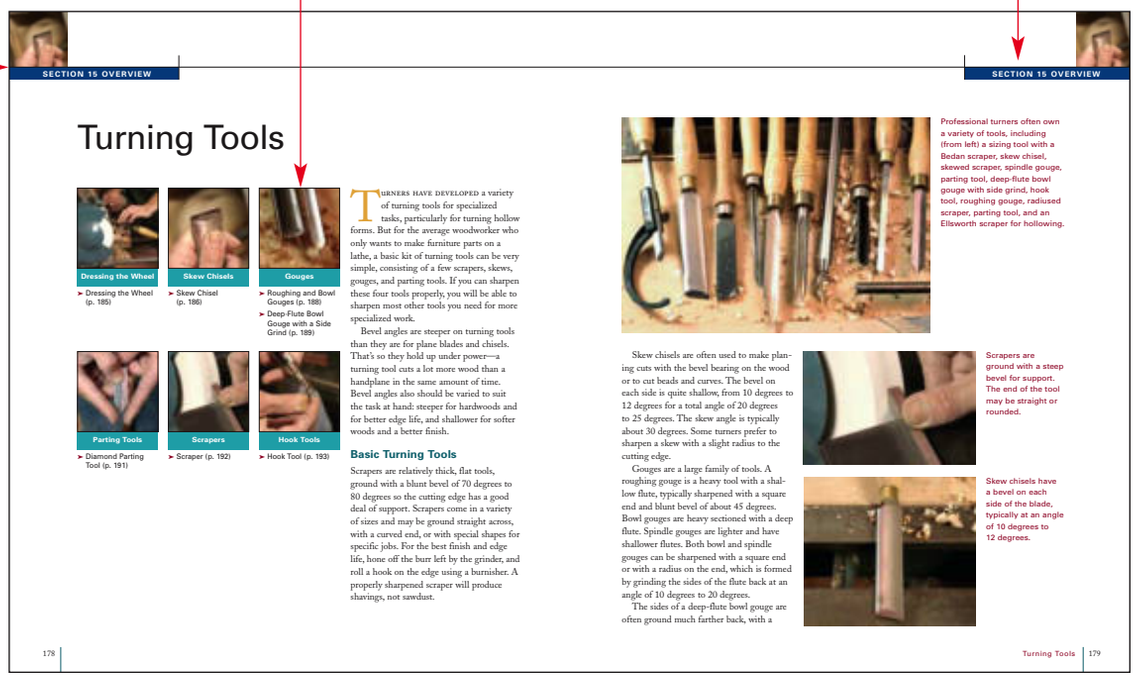
Sections begin with an "overview," or brief introduction, to the methods described therein. Here's where you'll find important general information on this group of techniques, including any safety issues. You'll also read about specific tools needed for the operations that follow and how to build jigs or fixtures needed for them.

The step-by-step essays are the heart of this book. Here a group of photos represents the key steps in the process. The accompanying text describes the process and guides you through it, referring you back to the photos. Depending on how you learn best, either read the text first or look at the photos and drawings, but remember, they are meant to work together.

The "VISUAL MAP" tells you where to locate the essay that details the operation you wish to do.

A "SECTION" groups related processes together.

The "OVERVIEW" gives you important general information about the group of techniques, tells you how to build jigs and fixtures, and provides advice on tooling and safety.



SECTION 15 OVERVIEW

SECTION 15 OVERVIEW

Turning Tools

Dressing the Wheel

- Dressing the Wheel (p. 185)

Skew Chisels

- Skew Chisel (p. 186)

Gouges

- Roughing and Bowl Gouges (p. 188)
- Deep-Flute Bowl Gouge with a Side Grind (p. 189)

Parting Tools

- Diamond Parting Tool (p. 191)

Scrapers

- Scraper (p. 192)

Hook Tools

- Hook Tool (p. 193)

Turners have developed a variety of turning tools for specialized tasks, particularly for turning hollow forms. But for the average woodworker who only wants to make furniture parts on a lathe, a basic kit of turning tools can be very simple, consisting of a few scrapers, skews, gouges, and parting tools. If you can sharpen these four tools properly, you will be able to sharpen most other tools you need for more specialized work.

Bevel angles are steeper on turning tools than they are for plane blades and chisels. That's so they hold up under power—a turning tool cuts a lot more wood than a handplane in the same amount of time. Bevel angles also should be varied to suit the task at hand: steeper for hardwoods and for better edge life, and shallower for softer woods and a better finish.

Basic Turning Tools

Scrapers are relatively thick, flat tools, ground with a blunt bevel of 70 degrees to 80 degrees so the cutting edge has a good deal of support. Scrapers come in a variety of sizes and may be ground straight across, with a curved end, or with special shapes for specific jobs. For the best finish and edge life, hone off the burr left by the grinder, and roll a hook on the edge using a burnisher. A properly sharpened scraper will produce shavings, not sawdust.

Professional turners often own a variety of tools, including (from left) a sizing tool with a Bedan scraper, skew chisel, skewed scraper, spindle gouge, parting tool, deep-flute bowl gouge with side grind, hook tool, roughing gouge, radiused scraper, parting tool, and an Ellsworth scraper for hollowing.

Skew chisels are often used to make planing cuts with the bevel bearing on the wood or to cut beads and curves. The bevel on each side is quite shallow, from 10 degrees to 12 degrees for a total angle of 20 degrees to 25 degrees. The skew angle is typically about 30 degrees. Some turners prefer to sharpen a skew with a slight radius to the cutting edge.

Gouges are a large family of tools. A roughing gouge is a heavy tool with a shallow flute, typically sharpened with a square end and blunt bevel of about 45 degrees. Bowl gouges are heavy sectioned with a deep flute. Spindle gouges are lighter and have shallower flutes. Both bowl and spindle gouges can be sharpened with a square end or with a radius on the end, which is formed by grinding the sides of the flute back at an angle of 10 degrees to 20 degrees.

The sides of a deep-flute bowl gouge are often ground much farther back, with a

Scrapers are ground with a steep bevel for support. The end of the tool may be straight or rounded.

Skew chisels have a bevel on each side of the blade, typically at an angle of 10 degrees to 12 degrees.

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Turning Tools 179

For efficiency, we've cross-referenced redundant processes or steps described in another related process. You'll see yellow "cross-references" called out in the overviews and step-by-step essays.

When you see this symbol, ⚠ , make sure you read what follows. The importance of these safety warnings cannot be overemphasized. Always work safely and use safety devices, including eye and hearing protection. If you feel uncomfortable with a technique, don't do it; try another way.

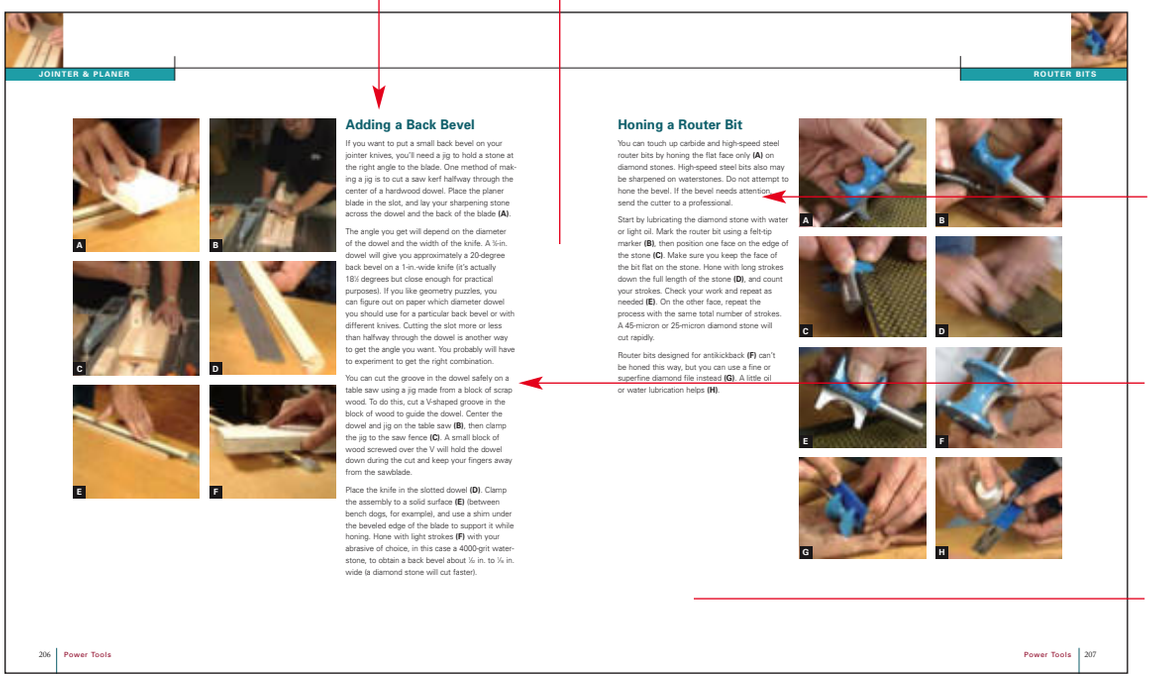
At the back of the book is an index to help you find what you're looking for in a pinch.

Finally, remember to use this book whenever you need to refresh your memory or to learn something new. It's been designed to be an essential reference to help you become a better woodworker. The only way it can do this is if you make it as familiar a workshop tool as your favorite bench chisels.

—The editors

"STEP-BY-STEP ESSAYS" contain photos, drawings, and instructions on how to do the technique.

"TIPS" show short-cuts and smart ways to work.



The "TEXT" contains keys to the photos and drawings.

"CROSS-REFERENCES" tell you where to find a related process or the detailed description of a process in another essay.

"WARNINGS" tell you specific safety concerns for this process and how to address them.

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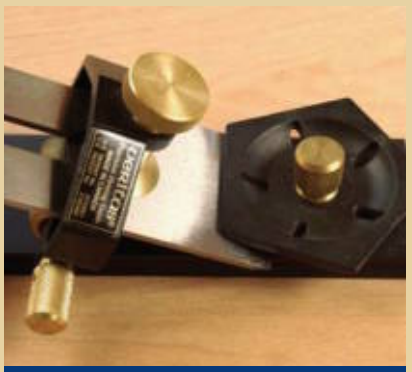

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PART ONE

Tools and Materials

GATHERING A COLLECTION of basic sharpening tools is a necessary part of woodworking. There is a tremendous variety of sharpening equipment on the market, including electric- and hand-powered grinders, files, guides for honing and grinding, and abrasive stones and paper.

Some equipment and supplies are essential, yet it doesn't take much to get started, and you can add more to your sharpening arsenal as your needs and experience suggest. Choose just a few sharpening tools when you start, and get to know them. Try to set aside a small space in your shop dedicated to sharpening. That keeps the mess away from your woodworking, and when your sharpening equipment is always available you are more likely to use it regularly. Make sure you have good light, and keep your sharpening equipment clean and in good condition.

Woodworkers tend to be dogmatic about their favorite sharpening methods, but there is no one right way of getting a sharp edge. In time, you will develop your own routines.

Steel

A manufacturer's choice of steel and the method of heat treating it have everything to do with how a tool should be sharpened and how frequently it will need attention.

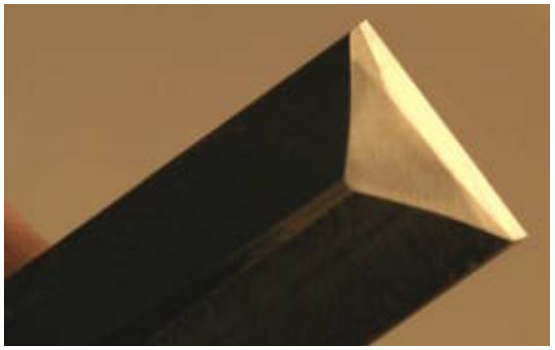
Any one of several types of steel will make a great blade, provided the steel is of good quality to begin with and it's heat treated properly. On the other hand, any given alloy that is improperly made or heat treated will not hold an edge as well as it should. The only way a woodworker can judge the quality of a tool is by using it and comparing it with other blades.

A key characteristic is the grain size of hardened steel, which is determined by heat treating. The manufacturer's goal is to create as fine a grain structure as possible, but there is no practical way for a woodworker to measure it. You can only make educated guesses based on how quickly the steel wears and whether it is prone to chipping.

Planes, chisels, and carving tools are generally sharpened with bevels ranging from 15 degrees to 35 degrees, depending on the nature of the wood and the task at hand. You should choose the lowest possible angle that resists chipping. The harder and more brittle the steel and the harder the material being cut, the larger the angle necessary for good tool life. Carbide is an extreme example of this. It's very hard, and tools made with it, such as router bits and table-saw blades, usually have very steep bevels or cutting edges. Japanese laminated steel plane blades and chisels also are much harder than Western tools, testing at 65 or so on the standard Rockwell C scale (see the sidebar on the facing page). Japanese blades sharpen easily on waterstones. Traditionally, Japanese craftsmen do not add a secondary bevel to plane irons or chisels. Even so, if you intend

Bevels on planes, chisels, and carving tools should be adjusted to suit different conditions, not ground to the same angle every time.

Carbide sawteeth have very high bevel angles because the material is very brittle as well as hard.



Laminated Japanese plane blades and chisels have very hard cutting edges held in softer steel for stability.

Japanese tools are traditionally sharpened on waterstones.

to work in hard woods, a higher bevel angle is better for edge life, and it's easier to hone a 5-degree secondary bevel than it is to rehone the full width of the bevel at a steeper angle.

Basic Tool Steels

Most plane blades and chisels are made from basic high-carbon tool steels such as O-1 and W-1, which are very similar in composition. Both are easy to sharpen with waterstones or oilstones. W-1 tends to remain softer in the middle and hard on the surface

THE ROCKWELL C SCALE

The exact hardness of tool steel is measured on the Rockwell C scale. The Rockwell hardness testing machine, a standard device in the industry, accurately measures the distance that a small diamond point is driven into the test material under a given weight. This produces a number on the Rockwell C scale (other scales are used for materials of different hardness ranges). The diamond leaves a telltale dent in edge tools. You may occasionally see one left by quality-control tests near the cutting edge of a tool.

Quality edge tools are generally in the 58–62 Rockwell range. Since there is a trade-off between hardness and toughness, the harder a blade is, the more brittle it becomes. Plane blades should be on the harder end, whereas chisels intended for hard use, such as mortise chisels, will be on the low end. Cheap chisels and poor-quality plane blades will be softer still. Japanese plane blades and chisels are harder at Rockwell 64 or 65. Files are about Rockwell 68.

The Rockwell hardness tester is an industry standard for precisely measuring the hardness of tool steels. It presses a stylus into the steel's surface under controlled pressure.

Quality-control marks left by a Rockwell hardness testing machine can sometimes be found on edge tools.

after heat treatment, which makes it a good choice for tools such as mortise chisels, where toughness is important. "Chrome vanadium" or "vanadium" steels are similar to O-1 and W-1, but they also have small amounts of chrome for hardness and vanadium to help control grain size during heat treatment. They sharpen about the same as W-1 and O-1 steels.

A-2 tool steel has about 5 percent chrome for hardness and long wear. A-2 has been around a long time but has recently been gaining popularity for plane blades because its superior abrasion resistance means blades hold an edge much longer. The large amount of chrome, which tends to form carbides during heat treatment and contributes to wear resistance, also means A-2 is more difficult to sharpen. Waterstones seem to work best because they cut faster.

There are other tool steels with greater wear resistance than A-2, but they are very difficult to sharpen except with diamonds and as a result are not the best choice for most woodworking hand tools. High-speed steel used in planer knives, router bits, and turning tools have about 4 percent chrome for hardness, 6 percent or more of tungsten for hardness and heat resistance, and about 5 percent molybdenum for heat resistance. High-speed steel can be honed with conventional abrasives, although turning tools are often used right off the grinder.

Spring steel used in handsaw blades is similar to W-1 but with a lower carbon content. Saw steel needs to be hard enough to hold an edge well but soft enough to cut with a file.

Traditional saws are made from hardened steel that can still be cut with a file. Induction-hardened sawblades can't be sharpened.

Heat Treating

One everyday miracle that is easy to take for granted is heat treating. It converts a combination of iron, other elements, and carbon into a hard material perfect for cutting tools. It's a complicated process, but in a nutshell the internal structure of steel changes when it is heated to a critical temperature and properly cooled or quenched. This temperature is about 1,500°F for O-1 and W-1, 1,750°F to 1,800°F for A-2 tool steel, and as high as 2,250°F for high-speed steel.

The critical temperature, or austenization phase, dissolves the alloying elements and transforms the steel to an austenite grain structure, which is coarse and irregular. Quenching steel in brine or oil triggers a transformation to martensite, the form of steel that is hard, fine grained, and useful for cutting tools. Some austenite doesn't make this transition (it's called retained austenite). Tools with the best properties of fine-grain structure, hardness, and toughness have the highest proportion of martensite to austenite.

This transformation is not necessarily complete when the tool steel returns to room temperature. Continuing to cool the steel below room temperature to subzero temperatures, a process known as cryogenics, further converts retained austenite to martensite. The more retained austenite in the steel, the greater effect cryogenic treatment has to produce a sharper, long-wearing edge. The most thorough cryogenic treatment involves cooling the steel to minus 300°F and holding it there for 20 hours or more before gradually returning it to room temperature and tempering the freshly created martensite.

The better the quality of heat treatment in the first place, the less effect cryogenic treatment will have. Some types of steels, such as A-2, respond more dramatically than others. Cryogenic treatment may even increase hardness by half a point or so on the Rockwell C scale.

Putting cryogenics aside, heat treating is a two-stage process. After quenching, the hardened steel is too brittle to be useful. It must be tempered, or softened, by reheating it to a specific temperature for a specific hardness. Various types of steel require different temperatures to reach a desired hardness. For example, it takes 400°F to temper A-2 steel to 60–62 Rockwell. A-2 would be as much as 65 Rockwell if it were left untempered.

Heat treating is to some degree an art, and the care with which it is practiced has as much impact on the quality of a cutting tool as the quality of the steel itself. Achieving a particular hardness by tempering is not difficult. Getting as fine a grain structure as possible, which is equally important for the finished tool, is more challenging. Distortion can also become a problem with some blades (see the sidebar below).

CONTROLLING DISTORTION

Thin, wide objects with holes and slots in them, such as plane blades, are apt to become distorted during heat treatment. One advantage of A-2 steel, which is heat treated in a controlled-atmosphere furnace and hardened throughout, is that it shows minimal distortion. O-1 and W-1 steels, on the other hand, are very apt to distort during heat treating, so often only the working end of W-1 and O-1 tools will be hardened.

There are several ways to do this. Heating one end of the tool with an electric induction coil is one. But the process doesn't lend itself to controlling grain size sufficiently for the best edge tools. A more reliable method is to heat-treat these steels in a bath of molten salt heated to 1,500°F. The temperature of the salt bath is easy to control, so overheating the steel is unlikely. Many old Stanley® blades were treated in a bath of molten lead.

Thin, wide steel tools, such as plane blades, need careful heat treating to stay flat.

Abrasives

Abrasives come in as many varieties as the tools they're designed to sharpen—from bench stones and silicon-carbide paper to grinding wheels and diamond paste. You won't need to stock everything, but understanding how abrasives work will help you choose the ones most appropriate for your workshop.

Grinding Wheels

Abrasive wheels made for electric bench grinders are a combination of abrasive particles and a binder. The size of the grit, or coarseness of the stone, is the first concern. But the character of the binder is critically important as well. A hard bond wears slowly, which sounds good. However, if it wears too slowly, the abrasive becomes worn—slower to cut and apt to generate more heat. Softer bonds break down faster, exposing fresh abrasive particles that cut quickly. This is true of both grinding wheels and sharpening stones, and it's the main reason why waterstones have become so popular. The down side is faster wear. Wheels and stones with softer binders should be dressed or flattened more often.

When you buy a bench grinder, the hard gray aluminum-oxide wheel that probably came with it should be considered a general-purpose stone, better for grinding softer steels than tool steel. A softer, friable, and porous wheel such as the Norton 38A aluminum-oxide wheel will cut more quickly and therefore stay cooler. Hardness is controlled by the manufacturer's choice of the ratio of grit to bond and is designated by a letter from A to Z. The Norton 38A wheel is a J grade; J or K are good grades for tool steels.

[TIP] Ring-test a new grinding wheel before using it. To do this, tap the wheel gently with a wood hammer handle. A sound wheel makes a clear ring. A dull sound indicates a broken wheel that should be discarded.

One 60-grit stone is adequate for grinding the primary bevel on plane irons and

A friable wheel is the best choice for grinding tool steels because it cuts fast and stays cool.

Coarse and very fine natural Arkansas stones: Washita and black hard Arkansas oilstones.

chisels, especially if you sharpen with a secondary bevel on honing stones after grinding. A finer stone might be useful for carving tools and turning tools where you won't be using a secondary bevel. You should dress a new wheel on the machine to true up the face before using it.

Oilstones

The most common natural oilstones today are Arkansas stones. The coarsest grade is Washita, followed by soft Arkansas, hard Arkansas, and black hard Arkansas. Good-quality Arkansas stones are getting harder to find. They last a long time, though, so if you find a used stone, chances are good that it will have a lot of life left in it.

WARNING Always protect your eyes when grinding! A dust mask is a sensible precaution, too. And use the guards on the grinder—they are there for a reason.

Crystolon ax stones and fine India oilstones are good for heavy stock removal.

Man-made oilstones include India stones®, which are an aluminum-oxide abrasive, and Crystolon®, which is silicon carbide. Fine India is the finest grade, but it is too coarse to be considered a finishing stone. You should use a hard Arkansas or black hard Arkansas stone after a fine India stone for a good edge. Oilstones are used with a lubricant of light oil or kerosene. People who like oilstones prefer the mess that oil makes to the mess involved with using waterstones. Man-made oilstones are inexpensive and are coarse enough to cut fairly quickly. But they are too coarse to provide a finished edge. Arkansas stones are expensive, and the fine grits cut slowly.

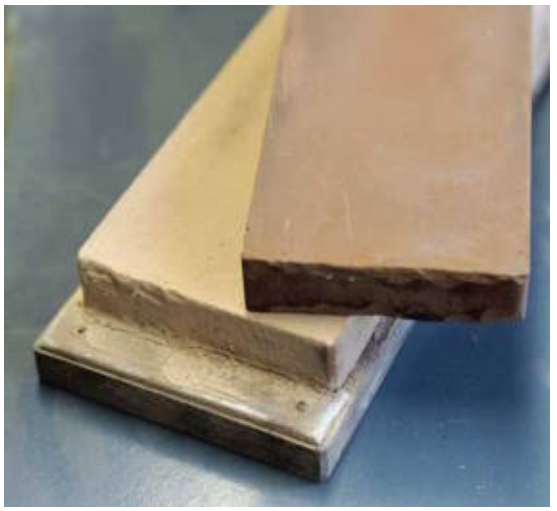
Waterstones

Almost all of the waterstones on the market today are man-made. Available in a wide range of grits, they cut quickly but must be flattened regularly. Hollowed or scalloped stones can't produce a straight cutting edge. Waterstones are often stored in water so they're ready for use when you need them.

Japanese Waterstones

Japanese waterstones have become popular with Western woodworkers because they cut faster than oilstones and produce an excellent edge. They should be soaked in water before use, and the surface of the stone should be kept wet by using a spray bottle while honing. Make sure to dry and oil your blades after honing so moisture doesn't cause rust.

Many varieties of Japanese waterstones are available. Some are natural, quarried stones, but the majority are man-made. Binders used in man-made stones vary; some are vitrified or fired ceramic bonds, while others are resins. Man-made waterstones are intended to mimic the relatively soft, fast-cutting natural waterstones, so the binders constantly break down during use to expose fresh, sharp abrasive particles. Because of this characteristic, they also wear



Man-made Japanese waterstones cut fast and are a good value, but they must be flattened regularly.

out of flat quickly and should be flattened regularly.

There is a large selection of grits and sizes of Japanese waterstones available. Get the largest one you can for plane blades. Man-made Japanese waterstones are the best value of all sharpening stones, and you can get a lot done with just two grits, 800 and 6000, especially if you use a Nagura stone with the 6000-grit stone.

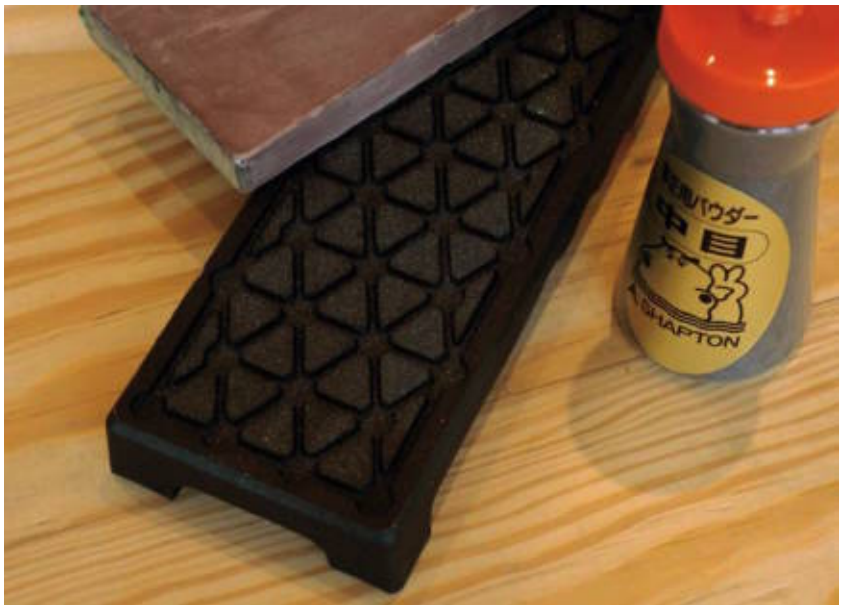
If you store your waterstones in a bucket or pan of water, make sure it isn't exposed to freezing temperatures because the stones will crack.

Shapton® Waterstones

The Shapton Japanese waterstones (or ceramic whetstones) are made with a hardened ceramic abrasive powder in a resin binder, resulting in a fast-cutting, long-wearing stone. A wide selection of grits is available, starting at 120. Stone grits are color-coded. A good selection for woodworkers includes 1000-, 2000-, 5000-, and 8000-grit stones. The Shapton stones are larger than most other Japanese waterstones at 2¾ in. by 8¼ in. by ½ in. thick. They are packaged in plastic storage cases that also hold the stone while you use it. An optional lapping plate comes with a rubber cover that

Shapton's storage box doubles as a stone holder for sharpening.

Shapton waterstones, in grits of 1,000, 2,000, 5,000, and 8,000, cut quickly and wear well.



Shapton's lapping system for flattening waterstones includes a steel plate and abrasive powders.

The Shapton lapping system can be used to hold stones for sharpening.

Shapton's superfine 15000-grit stone (far right) is more than most woodworkers will need, but it produces a mirror finish.

can also be used to support the stone in use. The finest stone, 15000 grit, is not necessary for most people, yet it produces a mirror finish. Like all waterstones, Shapton stones need to be flattened regularly, but they wear better than other Japanese stones because they are harder. Shapton offers a system that includes the lapping plate and abrasive powders that make it easy to keep the stones flat.

[TIP] Grooves filed in the surface of a fine stone help prevent blades from sticking.

One of the advantages of Shapton stones is that they do not have to be soaked in water. Just spray the surface of the stone before using, and keep it wet while honing. Soaking, in fact, will damage the resin binder. Blades may stick to some of the finest-grit stones. A light crisscross pattern of grooves cut with a triangular file eliminates this problem. That's a trick that can be used on other types of stones as well.

These stones are more expensive than most other waterstones. They are a conveniently large size, and the packaging and lapping systems are designed to make maintenance and storage easy.

Nagura Stones

Nagura stones are small pieces of chalky mineral that are rubbed on the surface of a finishing waterstone to build up a paste. This fine abrasive paste polishes the steel and adds a fine finish. They can be used with any waterstone.

Norton Waterstones

Recently introduced, Norton waterstones were designed with the needs of Western woodworkers in mind. Norton makes four types of color-coded waterstones—220, 1000, 4000, and 8000. Three combination stones are also available (220/1000, 1000/4000, 4000/8000). They are a good value.

Norton stones are an aluminum-oxide abrasive in a vitrified binder, except for the 8000, which has a resin binder. These stones measure 3 in. by 7⅞ in. by 1 in thick. The binder is harder than that used in traditional Japanese waterstones, so they wear more slowly but still cut quickly. Norton stones are soaked in water like conventional Japanese stones, except for the 8000-grit stone, which only needs to be sprayed during use.

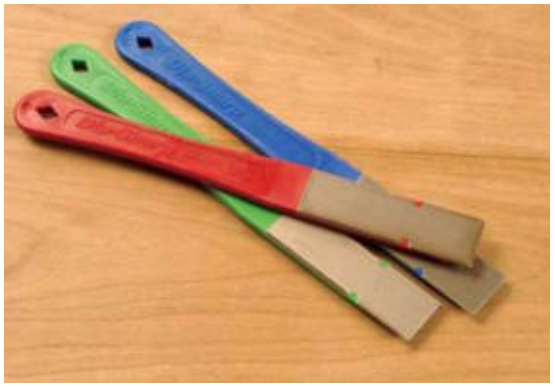
Nagura stones make a paste on fine waterstones for polishing an edge.

Ceramic Stones

White fused-alumina ceramic stones are very hard stones usually used with a water lubricant. They cut faster than oilstones but not as fast as waterstones. They produce excellent finishes and are reasonably priced. Flatness can be an issue, however, and they are hard to flatten (it takes a diamond abrasive to cut them). Check a ceramic stone with a straightedge before using one. Ceramics are made into slips and other shapes for carving tools and serrated knives.

Norton's waterstones come in grits of 220, 1000, 4000, and 8000. They cut quickly and wear well.

Ceramic stones cut more quickly than oilstones but not as quickly as waterstones.



Diamond files are handy for sharpening and deburring.

Curved diamond files are useful for sharpening shaped tools.

Diamond paste, used after diamond, oilstones, or waterstones, produces the finest edge.

Diamonds for Sharpening

Several manufacturers offer diamond stones, which cut aggressively and are good for sharpening woodworking tools made from high-speed steel. Using a variety of grits, you can create an edge faster than with waterstones. The finest diamond stone leaves a serviceable edge but one that really needs more work. For the best edge, you should follow up by using diamond paste or the finest-grit waterstone or oilstone. Diamond stones are extremely hard, and they are unlikely to wear as a waterstone will. But there is no practical way of flattening one if that should happen or if the stone is not flat to begin with.

Diamond stones are made by bonding diamond grit to a steel base with a nickel-plating process. Monocrystalline diamonds are block-shaped single crystals that are better for bonded applications, such as sharpening stones, than more friable polycrystalline diamonds. Polycrystalline diamonds fragment more readily into smaller particles, so they are better for polishing. Lubricate the stones with water. Diamond stones are expensive, but they last a long time. They can be used for flattening waterstones, as well as for sharpening very hard materials such as carbide or flattening ceramic stones.

Diamond files are handy for sharpening, deburring, and honing, while curved diamond files are useful for sharpening gouges and other shaped tools. Diamond paste is available in finer grades than diamond stones or files—down to 1 micron. Very small quantities of this oil-based paste are used on a substrate of glass, leather, iron, hardwood, or medium-density fiberboard.

For woodworkers, a small, flat block of hardwood or MDF works very well. The diamond paste will become embedded in the wood, and the block can be reused many times if stored carefully to avoid contamination with other grits of diamond paste or other abrasives. Diamond paste is great for carving tools and other difficult to hone shapes because it cuts quickly, leaving a good finish, and it can be applied to shaped wooden slips that can be made easily to fit the tool exactly.

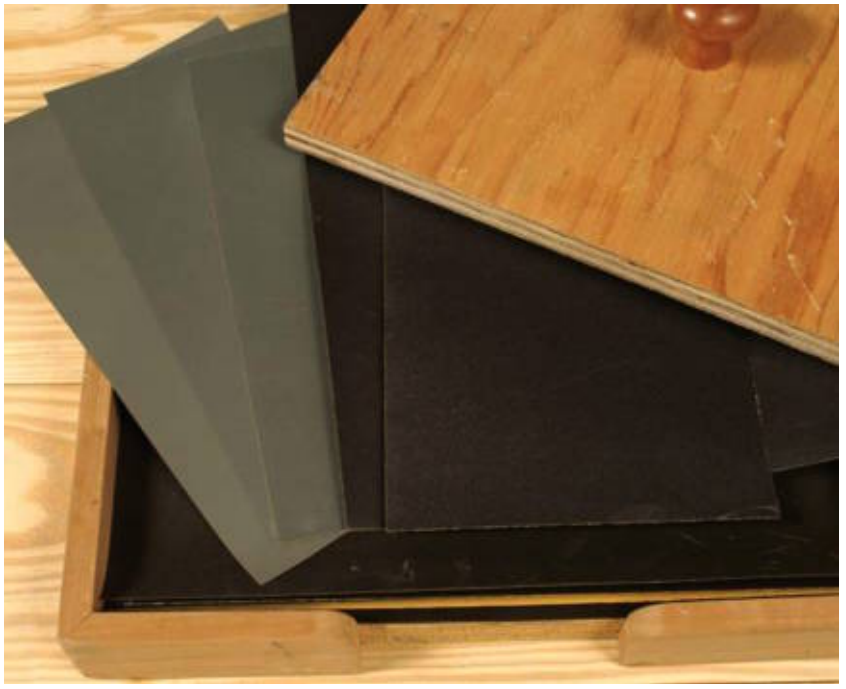
Working with diamond stones and following up with a couple of grades of diamond paste will give an excellent edge. Diamond paste also can be used after oilstones or waterstones.

Methods for manufacturing diamond particles and ceramic abrasives have been developed that give these products a very uniform size. These types of abrasive particles are generally graded in microns (a micron is one-millionth of a meter; about 25 microns equal one thousandth of an inch). Compared with standard mesh sizing, 600 grit is about the same as 25 microns, 1,200 grit is about 9 microns, and 3,000 grit is about 6 microns.

Conventional abrasives such as aluminum oxide are typically graded according to mesh size: 100-grit or mesh abrasive paper is made with particles that pass through a screen that has 100 openings per inch. However, the abrasive material may be larger than 100 grit in one dimension and smaller in another. For larger abrasive materials that's not a problem, but very fine abrasives used for polishing, higher than 1000 grit, produce a better finish if the particles are more uniform in size.

Abrasive Paper and Other Sharpening Aids

Abrasive papers of any kind can be used for sharpening, but the best choice is silicon carbide wet/dry paper. Various grits can be fixed to a flat metal or glass surface with spray adhesive or simply by spraying the back with water and using water as a lubricant. Grits of 220, 600, 1000, and 2000 will cover most sharpening needs. Get a few sheets of several grits at an auto-supply store even if you intend to do all your sharpening with stones; they will come in handy. Abrasive papers are much less expensive than stones, but they wear out quickly. It's probably not economical in the long run to do a lot of sharpening by using only abrasive papers.



A selection of wet/dry silicon-carbide abrasive papers can be used in place of abrasive stones to sharpen edge tools.

Chromium-oxide honing compound is used for final honing on strops or felt wheels.

Felt buffing wheels treated with honing compound will quickly bring an edge to a mirror finish.

Chromium-oxide honing compound comes in small bricks and is useful for honing and stropping all sorts of tools. It also can be used on felt wheels for machine honing.

Scotch-Brite® abrasive deburring wheels or Norton Bear-Tex™ wheels, widely used in industry for polishing, may not be your first thought for sharpening, but they can be used for axes, carving tools, or other shaped tools, especially for deburring and rust removal. They are made from a nonwoven nylon material impregnated with fine silicon-carbide grit. Even the hardest are soft compared with grinding wheels, so you have to be careful not to roll the edge over when using them. But they cut quickly and give a good finish. Scotch-Brite wheels come in several grades of hardness and fineness, such as 7S fine or very fine, where 7 is the density on a scale of 1 to 10. A 7 or 8 fine or very fine wheel would be suitable for sharpening some woodworking tools. You can then follow up with honing compound or diamond paste for a better edge or use as is. You'd have to go to a 3M® distributor to find them, though.

Flattening Waterstones

Waterstones wear quickly, and they need to be flattened frequently in order to perform properly. For example, if you try to prepare the back of a new handplane blade on a waterstone that is not flat, you will produce a curved surface instead of a flat one, and you may very well ruin the blade. You also need a flat surface to hone a straight edge on planes and chisels.

You may want to flatten your waterstones several times during an extended sharpening

Scotch-Brite abrasive deburring wheels are effective for use on curved tools but will round over an edge if you're not careful.

Waterstones can be flattened on silicon carbide wet/dry paper mounted on a piece of float glass. Whatever surface you use, make sure it's dead flat.

Working one waterstone against another waterstone will flatten both surfaces. Working a waterstone against a diamond stone flattens only the waterstone.

session, which means you want a system for flattening them that is quick, easy, and reliable. And, by the way, it's a good idea to check the flatness of new stones before using them.

How flat do they need to be? That depends on how flat you want your blades. If you are flattening the back of a plane blade or chisel, the stone needs to be as flat as you can make it. Checking a stone with a straightedge against a strong light should allow you to see an even line of light under the straightedge. To minimize wear, you should try to use as much of the stone's surface as possible when honing.

One effective way to flatten waterstones is to use 150-grit wet/dry sandpaper on float glass. Lubricate with water, and check the stone with a straightedge when you're done. The 220-grit Norton waterstone prepared this way can be used to flatten other waterstones and especially to touch them up during use.

Keep checking the color and texture of the stone you're trying to flatten. When the surface is consistent, without any obvious low spots, the stone is flat.

If you use a diamond stone to flatten a waterstone, check it with a straightedge before you start, and lubricate it with water.

As you work the two stones together, try to keep even pressure and contact so the full length of the waterstone is flattened evenly.

Check the stone frequently. This one needs more work.

Another method is to use a medium-grit diamond stone, such as the large DMT® series. Check the diamond stone with a straightedge before use and lubricate with water. Check the waterstones frequently to see that the low spots are being cleaned up. If necessary, make pencil marks on the stone's surface so you can tell where the high spots have been leveled out. When you are done, check with a straightedge.

An iron lapping plate also works well. The Shapton system includes a grooved baseplate and fine and coarse abrasive powder. The plate is flooded with water and charged with abrasive powder. Lap the stone using the full surface of the plate until the stone is true.

Shapton stones are flattened on an iron lapping plate with two grades of abrasive powder.

Start by wetting the surface of the plate with water. An inexpensive spray bottle is helpful.

Even an iron lapping plate will wear over time. It may need to be flattened itself once in a while, which you can do by using wet/dry abrasive paper on a flat surface. The results are only going to be as flat as the surface you are using to prepare your waterstones, so it's a good idea to make sure that whatever system you use is flat to begin with and maintained properly.

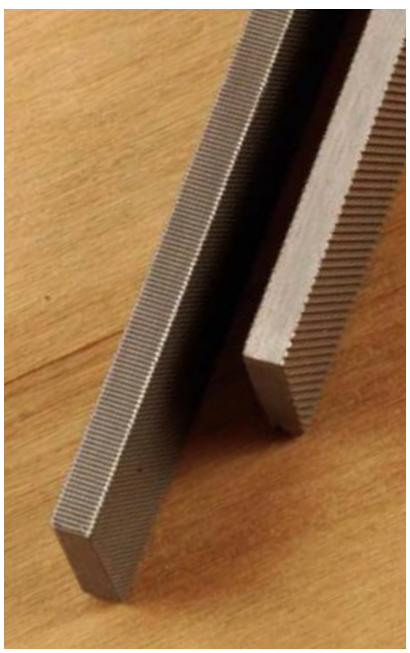
Flattening Oilstones

People seem more concerned about flattening their waterstones, but oilstones also wear, although much more slowly. If you pick up a secondhand oilstone, however, it's a good idea to check it for flatness and true the surface if necessary. Any of the methods for flattening waterstones can be used for oilstones as well; it's just going to take a lot longer. Any stone is properly flattened when a straightedge shows an even line of light when laid on edge across the length and width of the surface.

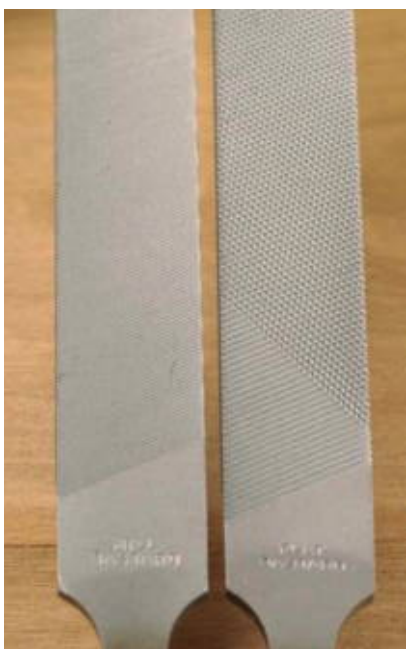
Sprinkle the abrasive evenly over the surface of the plate. You don't need much.

Work the stone evenly over the lapping plate until the surface shows an even texture and color, meaning that it's true.

A collection of files makes a valuable addition to most any workshop. They have many uses in shaping wood and metal as well as sharpening tools.



A safe edge on a file has no teeth.



Single-cut and double-cut files. A single-cut file leaves a better finish.

Varieties of rectangular files: flat, mill, and hand files.

Files

Files are valuable additions to a sharpening kit and essential for making your own cutters for beading tools and molding planes. There are only a few files you really need for sharpening common woodworking tools, but having a wide selection on hand is never a waste of money. It's hard to own too many. Metalworking files also come in handy for woodworking.

Rectangular files are the most useful for sharpening scrapers, easing and deburring sharp edges on tools, and other miscellaneous tasks. There are several varieties. Flat files taper in width and are double cut, meaning they have two rows of diagonal teeth. Both edges have a single row of teeth. Mill files also taper in width but are single cut with one row of teeth. Hand files have parallel sides and a double-cut pattern. They have one safe edge (without teeth) that can ride against an adjacent surface without marring it. A single-cut file cuts more slowly but leaves a better finish than a double-cut file of the same length and grade.

Files are further classified by how coarse or fine they are. Bastard is the coarsest, followed by second cut and smooth. These terms are relative and have to do with the length of the file. A 6-in.-long bastard file is much finer than a 10-in. bastard. For sharpening, a second-cut mill file 8 in. or 10 in. long is a good place to start.

An auger-bit file is handy for many jobs, not just for sharpening auger bits. These small files have safe edges on one end and safe faces on the other, so you can file right up to an inside corner without damaging the adjacent surface. They are about 7 in. long.

Triangular files are used mostly for saw sharpening. Edges form 60-degree angles.

An 8-in. or 10-in. second-cut mill file will handle most jobs.

From coarse to fine: bastard, second-cut, and smooth files.

Because an auger-bit file is small and narrow, it can do a lot more than sharpen auger bits.

Triangular files are used mainly to sharpen Western saws.

Six-inch triangular files come in several standard sizes, including regular taper, slim taper, extra slim, and double extra slim.

Triangular files are single cut, taper in length, and are classed by length and width: regular taper, slim taper, extra slim, and double extra slim.

For fine-tooth saws such as dovetail saws, choose a 4-in. or 5-in. slim taper. File selection for other saws can be made by the size of the sawtooth. When the file is in the tooth, only about one-half of the file should be in the gullet. That way, when one edge begins to dull, you rotate the file to use a fresh edge. But use the smallest file you can. If the file is too large for the saw, the corner will be too round, or blunt, to file the gullet properly.

When choosing a triangular file for saw filing, check to see that it is straight. Files for fine-tooth saws should have sharp, well-formed corners so the gullet between teeth will be shaped correctly. Many small files made today are not precisely made, so look carefully before you buy.

In addition to these standards, there also are a variety of specialized files. They include feather files, which have very thin edges for sharpening Japanese-saw teeth, and round files, which are used for sharpening chainsaw blades and making beading-tool cutters.

Diamond files are good for sharpening, deburring, and honing hardened steel, which regular files won't cut. They are sold in coarse, medium, fine, and extra-fine grades and are relatively inexpensive.

When any file wears to the point that it no longer cuts well, it is time to get a new

Feather files are used to sharpen Japanese saws.

Diamond files are handy for honing hardened-steel tools, especially odd shapes.

Round files are graded by diameter. They are useful for sharpening chainsaws as well as making custom knives for bead cutters.

A file card is used to clean debris from the teeth of a file.

one. Meanwhile, clean clogged file teeth with a file card. A bit of chalk rubbed in the teeth will help keep soft materials from clogging a file too quickly. Files are very hard (higher than R-65 on the Rockwell scale), so treat them like edge tools and store them carefully, preferably in a rack or tool roll so they won't bang against one another.

And, unless you'd like to risk getting a hole in your palm, any file with a tang should not be used without a handle, even if the handle is just a length of dowel with a hole drilled in the end. A handle also makes a file easier to use with accuracy.

Machines for Sharpening

An inexpensive bench grinder may not last as long as a costlier model, but it will still be invaluable for rough-shaping many edge tools.

Friable grinding wheels are better suited for grinding tool steel than are the stock wheels that come on many bench grinders.

It's not absolutely necessary to have any machinery to sharpen woodworking tools. Coarse stones or sandpaper are fine for the rough shaping of tool edges, but bench grinders and belt sanders speed up the process considerably. There is a variety of specialized equipment to choose from, with costs ranging from less than $50 to about $400.

Bench Grinders

An inexpensive bench grinder turning at a standard 3,450 rpm can be purchased for less than $50. You probably will want to replace the stock abrasive wheel with one made from a softer compound better suited to grinding hardened-tool steel. One 60-grit wheel, which costs about $20, will be enough, but you also can add a 120-grit wheel for about $30. A finer wheel makes a smoother surface when grinding drill bits and other tools that are typically used straight from the grinder without any additional honing.

Tool rests that come with most grinders are virtually useless. Most of them are not well made, and they are not precise enough to give good results. A good rest makes it much easier to get a square edge with the correct bevel angle because it provides adequate support for the tool or grinding fixture. In addition, a rest should be long enough to allow you to traverse the full width of the stone with a wide blade. An

Tool rests found on bench grinders are usually inadequate for accurately grinding plane blades and chisels. An aftermarket rest can help.

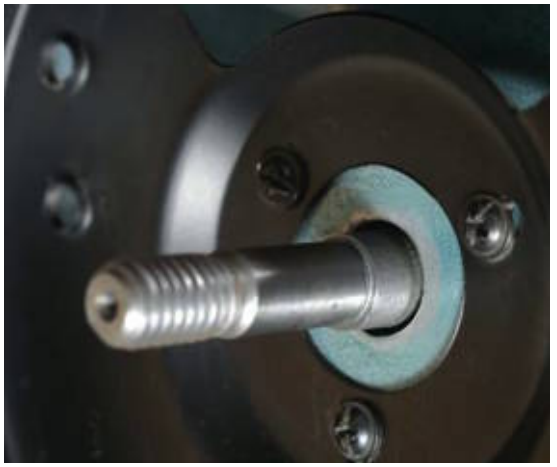
Fast Trak tool rests provide sturdy support for grinding jigs that hold edge tools.

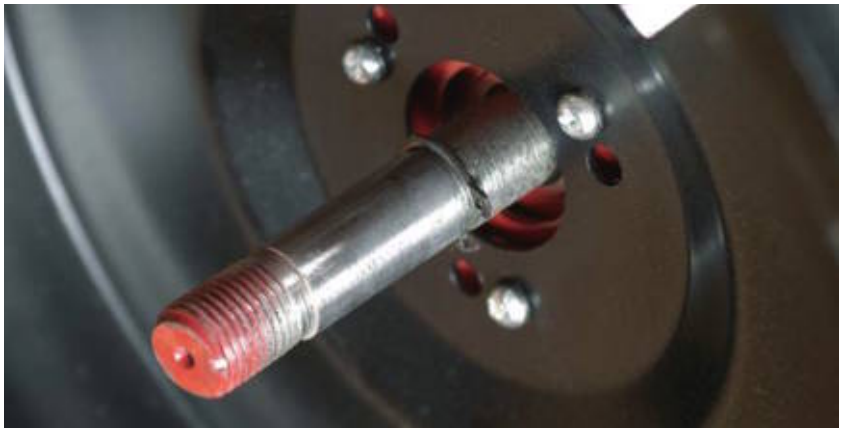
A Wolverine tool rest has an angle adjustment and can be used with or without a grinding jig.

aftermarket tool rest from Veritas, FastTrak™, or Wolverine, will cost from $40 to $90. Or you can make your own. A grinding jig is about $15. Getting set up with a basic grinding system doesn't have to cost more than $150, including a diamond dresser for keeping the face of the wheel true. If you have more to spend, consider a slow-speed,

A good-quality diamond dresser does the best job of maintaining abrasive grinding wheels.

On better grinders, the grinding stone is registered against a shoulder machined on the shaft (far right).





Snap rings found on some less expensive grinders can make it difficult to dress a stone accurately.

8-in. grinder, which turns at 1,725 rpm. With good abrasive wheels and tool rests, it will cost about $250.

[TIP] Even the right wheel can burn tool steel. If you do burn an edge, put the tool down and let it cool gradually. Don't try to remove all the discoloration at one time. Regrind a bit of the burned area, then hone the blade. You can remove more of the discoloration the next time you grind.

An inexpensive grinder is a great place to start, but it may have a few shortcomings. It probably won't last as long as a more expensive machine, and the manufacturer may have taken a few production shortcuts to keep costs down. For example, instead of a machined shoulder on the shaft to catch the back of the grinding wheel, some economy grinders are equipped with snap rings. Although the snap rings prevent the wheel from drifting on the shaft, they don't offer as much support. As a result, the wheel will not run as true as it would on a shaft with a machined stop.

Even so, inexpensive machines still can grind a good edge, and if you decide to upgrade your grinder later, you can keep your old one and set it up with buffing wheels, Scotch-Brite wheels, or wire wheels for other jobs around the shop.

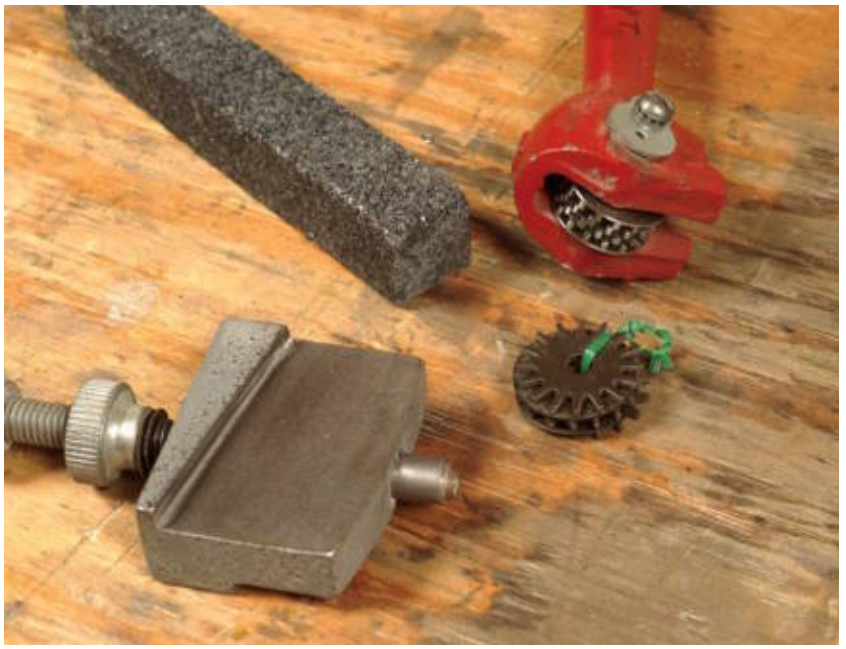
Prairie's hand-cranked wet grinder has been around a long time, and it still works well. It comes with a 10-in. by 1¼-in. vitrified aluminum-oxide wheel, which runs in a water bath, and it costs about $130. It is portable and requires no electricity (although you also can buy a motor for it), so it is a good choice for taking to a job site where there's no power. It has a large, flat tool rest that can be used to sharpen tools freehand or with a grinding fixture. A grinding fixture helps because it can be difficult to hold a blade or chisel with one hand and turn the crank with another.

A hand-cranked grinder is a good choice for occasional use or to take to a job site that doesn't have any power.

The gearbox on this small grinder can turn the stone fast enough to burn tool steel.

Smaller dry grinders also are available. Some models have internal gearing that makes it easy to produce relatively high grinding speed by turning the hand crank slowly. But because of the higher wheel speed, you can definitely overheat blades. To minimize the risk, you can replace the standard wheel with a cooler-cutting white wheel.

Dressing a grinding wheel helps to keep the face of the stone flat and square to the sides (see the sidebar on p. 343.) It also exposes fresh abrasive, making sharpening faster and more efficient. There are various dressers available. The common star-wheel type will work, but a diamond dresser is better because, when used correctly, it leaves a much smoother surface. Carbide dressing sticks will freshen up the abrasive surface, but they are not good for truing the circumference, or face, of the wheel.



Shown above are a star-wheel dresser, a silicon-carbide dressing stone, and a diamond dresser. The diamond will give the best results.

DRESSING A GRINDING WHEEL

A diamond dresser that references off the tool rest is very accurate. With the grinder off, rotate the wheel by hand, and advance the dresser until you can hear the diamond just touch the wheel. Put on your safety glasses.

Move the dresser tip off the wheel, and turn on the grinder. Take a pass to check. Advance the diamond into the stone by turning the knob about an eighth of a turn, then move the dresser across the face of the stone with a light touch and smooth motion. Listen for the sound the dresser makes, and learn to judge how much material you are removing by the way it sounds.

When the face of the wheel looks square and clean, take one final pass, nice and slow, at the same setting.

Smoothly move the dresser across the face of the wheel to true the surface and expose fresh abrasive particles.

Tormek's wet grinder rotates at just 90 rpm, so burning tool steel is just about impossible.

The Tormek™ machine is one of the most expensive grinding options, starting at just less than $400. It's solid and well built, and a variety of well-designed jigs are available for grinding and sharpening, including a built-in leather stropping wheel and a silicon-carbide dressing stone. The 2-in. by 10-in. wheel runs at only 90 rpm in a water bath, making it virtually impossible to burn a tool. The slower cutting action makes it easier to control the grinding angle and the amount of material you are removing. The standard wheel is 220-grit aluminum oxide, and optional wheels include 800-grit and 4000-grit waterstone wheels. The 4000-grit

Jigs for grinding plane blades, chisels, knives, scissors, and planer blades are available for the Tormek system.

The optional 4,000-grit wheel for the Tormek is expensive but produces an excellent finish.

wheel leaves an excellent edge but, of course, is too fine for rapid stock removal.

Horizontal-Style Grinders

Horizontal waterstone grinders also are cool cutting and leave a good finish. The outside of the wheel tends to cut faster than the inside because it's spinning faster, and that can make it difficult to grind a wide plane blade square. Use a good grinding jig to hold the blade firmly, and compensate by applying more pressure on the inside of the blade. The wheels on these grinders need to be dressed regularly.

The Veritas system is also a horizontal machine. Abrasive-coated platters are

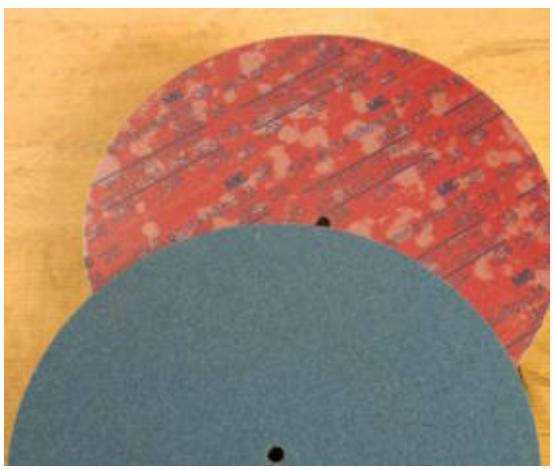
Horizontal waterstone grinders can be used for sharpening most edge tools, but they require a little more attention in use.

The Veritas sharpening machine is a horizontal system. Abrasive disks never need dressing.

Abrasive-covered platters on the Veritas machine allow you to change from coarse to fine grits quickly.

mounted on an aluminum turntable that rotates at 650 rpm. Four grades of pressure-sensitive adhesive (PSA) disks are supplied with the machine: 80-grit zirconia for aggressive stock removal, 150-grit (100-micron) aluminum oxide for sharpening, 320-grit (40-micron) aluminum oxide for lapping the backs of chisels and plane blades, and the finest 1200-grit (9-micron) aluminum oxide for the final edge. The two coarsest disks are fixed on a platter 4 mm thick and the finest two on a 3-mm-thick platter.

After working on the 80-grit or 150-grit platter, changing to the thinnest platter will automatically create a 1-degree micro bevel. It only takes a few seconds to achieve a finished, mirror edge on the 1200-grit (9-micron) abrasive. This edge is as much as



Pressure-sensitive adhesive disks are applied to removable platters, giving four choices of abrasive.

The Veritas tool holder and guide make it easy to hold the blade to get the exact bevel angle you want.

most woodworkers need, but you also can buy an extra platter, glue a piece of cloth to it, and use it with honing compound. The tool guide and tool holder are well designed for convenience and accuracy. The price is about $300.

Belt Sanders

Woodworkers also should consider a belt sander for sharpening. Any belt sander can be used to sharpen tools. I've sharpened many blades on a 6-in. by 48-in. stationary belt sander with a homemade tool rest and jig to position the blades over the flat platen. It gives a nice, flat bevel rather than a hollow-ground bevel. If you have access to a stationary sander, consider using it for sharpening.

A 1-in. belt sander is not as convenient for wide chisels and plane blades but it's great for sharpening other tools. Wilton™ makes a solid 1-in. belt sander with a cast-iron frame and a well-made, adjustable table

A belt sander is a useful addition to a woodworker's sharpening arsenal.

This well-built machine has an adjustable table that can be used with or without a grinding jig.

that deserves to be better known. It is relatively expensive—about $250. Cheaper ones work fine, too, although they rattle a lot and it's harder to get the belt to track properly. One of the nice things about belt sanders is the wide selection of abrasives that can be used on them. It's easy to change from one to another, which greatly increases the range of work these machines can do.

An old treadle grinder can still be used for many sharpening jobs. Once common, they are now much harder to find.

If you find an old sandstone treadle grinder in good condition, consider yourself lucky. It is not necessarily useful for planes and chisels, but you can use it to sharpen many other tools. True the surface of the wheel with a silicon-carbide dressing block, and take good care to empty the water trough after use and to protect the wheel from freezing weather.

Sharpening Kits

A starter kit for sharpening would include a honing guide, silicon-carbide abrasive paper, a combination waterstone, spray adhesive, and a sheet of float glass.

You don't need to make a big investment right away to keep your woodworking tools sharp. A good starter kit would consist of a 1000/4000-grit combination waterstone or a selection of wet/dry silicon-carbide abrasive paper and a flat steel plate or ⅜-in.-thick float glass, a can of spray adhesive, and a honing guide. All of that should be available for less than $100.

Getting Started

A combination waterstone is the most economical way to start, especially if you won't be using it that often. People who do a lot of sharpening usually prefer having a selection of single-grit stones. It's mostly a matter of convenience. Combination stones are made from the same materials—so they do just as good a job—but it's easier to set up stones of successively finer grits than it is to flip a combination stone back and forth as you sharpen different tools. Get the largest stone you can.

Glass is a good base for wet/dry abrasive paper used both to sharpen tools and to flatten waterstones when they become cupped or unevenly worn. Float glass is the flattest glass made, so it's better for sharpening than plate glass. The glass doesn't need to be very big as long as it's wider than the widest blade you have and at least as long as a sharpening stone. If it is bigger, you can fix several grits of paper to it, which is more

Adding a bench grinder, several single-grit stones, steel and diamond files, a wider selection of abrasive paper and honing compound makes a more versatile sharpening kit.

A top-of-the-line sharpening kit also includes a 1-in. belt sander and several grades of diamond paste.

convenient. You can get the glass from a glass supplier and the abrasive paper at an auto-parts store or from woodworking catalog companies. A good selection would include 220, 600, 1000 and 2000 grits. You can do all your sharpening on abrasive paper, or use it first and hone a final edge on a waterstone.

A Step Up

A more versatile selection of sharpening tools would include a selection of single-grit waterstones ranging from 220 to 5000 or even 8000 grit, a bench grinder (preferably a slow-speed, 1,725 rpm grinder with an 8-in. soft white wheel), an aftermarket tool rest, and a diamond grinding-wheel dresser. In addition, pick up a couple of steel and diamond files and a block of honing compound. With these tools, you will be able to handle just about any sharpening job in the shop. The enhancements will add about $200 to the cost of the starter kit. A top-quality bench grinder will be more, and if you choose the Tormek system for grinding, you will have to spend an additional $400.

A Complete Set

From there, depending on your needs and pocketbook, you might add one or two combination diamond stones, several grades of diamond honing paste, and a 1-in. belt sander with a selection of abrasive belts. The large 10-in. by 4-in. combination diamond stones cost about $120 each. A 1-in. belt sander will cost from $125 to $250.

Other Supplies

A few other necessary supplies include oil for honing with oilstones, and for protecting blades and tools from rust. Tools should be thoroughly wiped down after sharpening and then protected from rust. Camellia oil is nontoxic and won't interfere with finishes should some residue get on your woodwork. When it dries, it leaves a film on metal surfaces so it makes an ideal oil for protecting tools from rust. Wet/dry abrasive paper can be fixed to the float glass or steel plate by

Blades should be oiled after sharpening to prevent rust.

A set of magnifiers or a magnifying glass is a big help in sharpening some tools, such as handsaws, as well as for inspecting finished edges.

A dedicated sharpening station won't take up much shop space, and it makes tool maintenance much more convenient.

wetting the back with a spray of water, but if you prefer, use a spray adhesive such as 3M Super 77.

Good light is essential, and magnification of some kind is very helpful. A protractor is necessary for checking angles, but a simple plastic one will do. Having a sink in the shop is ideal, but lacking that, set up your sharpening station so that you can easily clean up any mess and so that water from waterstones won't be a problem.

A small bench built from 2x4s and plywood fixed to the wall makes a sturdy work surface. A good height for honing is about where your knuckles are with your arms at your side. You will probably want the bench grinder a bit higher—you can mount it on a separate base to raise it up. Clamp the base to the bench. That way you can also remove the grinder from the sharpening bench when you want to.

A compact sharpening station doesn't take up much room in your shop, and it more than repays your trouble by making it much easier to keep your tools good and sharp.

Jigs and Fixtures

Waterstone Holder

- Making a Waterstone Holder (p. 50)

Skew Plane Jig

- Jig for Skewed Plane Blades (p. 52)

Honing Jigs

- Spokeshave Blade Holder (p. 55)
- Jig for a Large Scraper Plane Blade (p. 55)

Saw Vise

- Making a Saw Vise (p. 56)

Some woodworkers think honing guides are unnecessary. They may even scoff at those who use them. It is certainly true that with practice you can learn to do a good job of honing freehand, and you may even grow to prefer this approach. It's easier to feel the blade on the stone when you hold it in your hands, so you can correct an out-of-square blade by exerting more pressure on one side of the blade than the other, or hone in camber on a plane blade by rolling the blade slightly as it moves the length of the stone.

Even so, there is a lot to be said for using a honing guide. The good thing about a guide is that it allows beginners to get precise results consistently. Even some experienced woodworkers find the level of precision they get with a good honing guide is a big advantage, especially when it comes to honing accurate secondary bevels. It is fairly easy to lay the bevel of a blade flat on a stone and hone it without a guide but much more difficult to raise the blade slightly for a secondary bevel and to maintain that position for a consistent edge.

There is no one guide that will do everything well. Each has its advantages and disadvantages, and some are especially good for a particular kind of tool. You might also consider making some of your own honing guides. I've included a few examples below.

Honing Guides for Planes, Blades, and Chisels

There are many styles of honing jigs on the market for these tools, but not all of them can be used to sharpen skew chisels. If this is a consideration, check carefully before buying.

Eclipse Guide

Eclipse makes this side-clamping jig (see the photo on the facing page), but unnamed

copies from other manufacturers are commonly available. It is useful for plane blades and most chisels. Because blades are clamped on their edges, it is easier to keep the edge square to the tool as you sharpen it. Chisels are clamped in the narrow space between the two sides of the guide. Narrow plane blades also can be clamped in the chisel groove.

Plane blades are held in the top part of the jig. The bevel angle is set by adjusting the amount of blade that projects from the front of the guide: A shorter projection creates a steeper bevel angle, while a long projection makes a lower bevel angle. Metric dimensions embossed on the body of the tool give approximate projections to produce various angles. This serves as a good start, but it may not be exact, so it's a good idea to double-check the angle setting. Eclipse guides work for chisels from 3/16 in. to 1½ in. wide (except for some very thick Japanese blades and chisels that will not fit in the clamping mechanism) and plane blades up to 2¾ in. wide. There does seem to be some variation in how these jigs are made, however, and some will open wide enough to take a 3-in. blade.

This honing guide has a relatively narrow roller that rides on the surface of the stone. Keep the roller clean to avoid a buildup of grit. Some woodworkers prefer a wide roller, but the narrow roller has an advantage in some circumstances. For example, if you want to hone a cambered edge instead of a straight edge on a plane blade, it's easier to rock a narrow roller slightly. A narrow roller might contribute to some wear on the surface of the stone, but fingertip pressure should be focused on the cutting edge of the blade and not on the roller. In reality, the edge of the blade contributes more to wear, and waterstones need to be flattened regularly anyway. So any disadvantage to the narrow roller is not serious. This type of jig will not accommodate skewed blades.

An Eclipse jig clamps blades from the side, making it easier to hone a square edge.

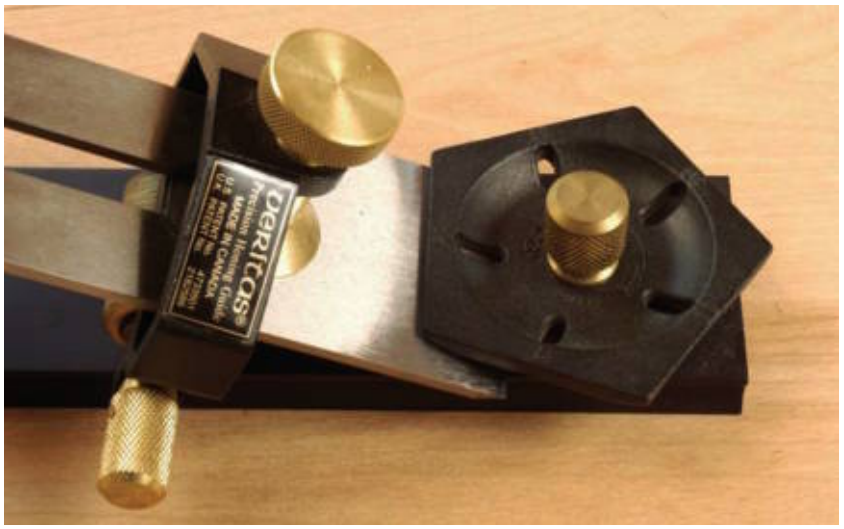
Veritas Honing Guide

The Veritas honing guide will hold plane blades up to 2⅜ in. wide, and unlike many guides, it will handle skewed blades. Blades are held in place by a large swivel-foot screw. The screw must be tightened firmly so the blade will not pivot as it is being honed. Veritas also sells a companion device used to set bevel angles. Bevel angles also can be set by measuring the projection of the cutting edge from the front of the honing guide, as they can with any honing guide. You will have to determine the length for a particular bevel angle by trial and error and make a note of it for future reference, or set up a measuring block.

A unique aspect of this honing guide is a spring-loaded cam that raises the jig to alter the bevel angle up to 2 degrees for honing a secondary bevel without having to reset the blade in the guide. The Veritas guide has a wide brass roller that rolls on the surface of the stone. It should be cleaned after use and lubricated occasionally.

A large swivel-foot screw holds blades securely in the Veritas honing guide.

A companion device from Veritas sets blades in the honing guide to one of several specific angles.



Stanley Jig

Stanley® makes a stamped-steel honing guide with plastic rollers, which is useful for holding very short blades, such as spokeshave blades, up to 2½ in. wide. Firm clamping pressure is required to keep the blade secure in the jig, but with care this jig will do a nice job. Bevel angles can be set with the projection method. A small plastic device on the jig with bevel angles marked on it can be flipped forward to measure

This Stanley jig is especially useful for holding short blades, but it's awkward for full-length plane blades.

A Kell honing guide works for chisels up to 1 in. wide.

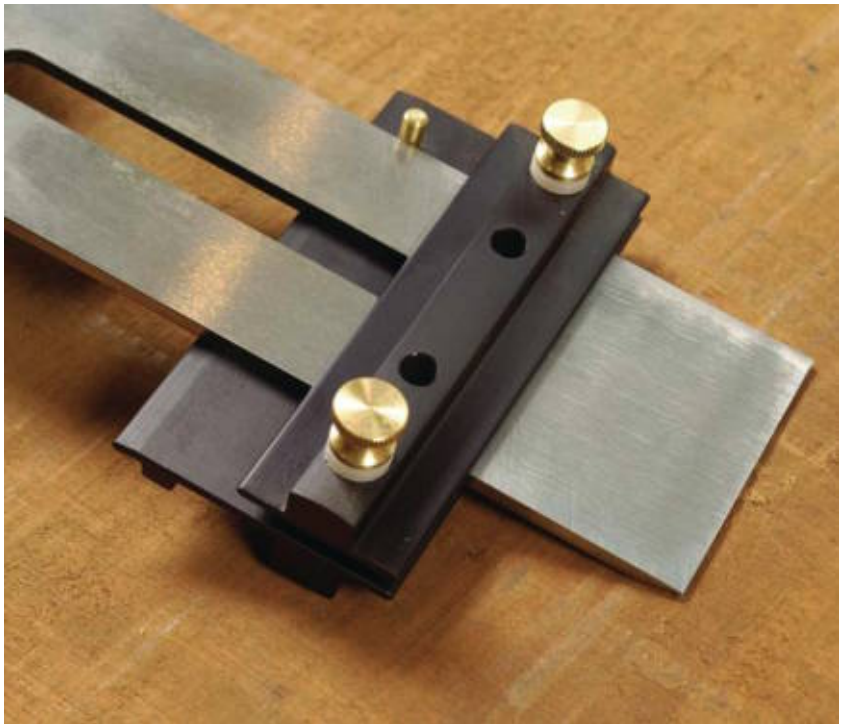
blade projection. This jig is awkward to use for standard-length plane blades and doesn't seem to clamp chisels firmly.

Kell Chisel Honing Guide

The unique design of this jig makes it suitable for chisels up to 1 in. wide. The chisel registers with the flat side under the guide rods. Side clamping helps to keep the edge of the chisel square. Rollers made of Delrin plastic won't damage sharpening stones. Bevel angles can be set by measuring the projection of the blade from guide rollers. Keep the rollers and threaded rod clean and lubricated.

Jigs for Grinding Planes and Chisels

Using a jig to sharpen plane blades and chisels on a grinder increases accuracy. Some of them also can be used to hone a finished edge with a stone.



An alignment pin on the Veritas grinding jig helps keep blades square but also can be used with skew blades.

Veritas Grinding Jig

The Veritas grinding jig is convenient for accurately grinding chisels and plane blades up to 2¾ in. wide on a bench grinder. A moveable alignment pin can be used to register plane blades and chisels at 90 degrees, and can be used for holding skew blades as well. The tool is simply clamped in the jig with the blade projecting the correct distance to grind a specific angle. This distance can be determined by adjusting the blade until the bevel lies on the face of the stone. This type of jig is designed to slide across the bench-grinder tool rest and works best with an aftermarket tool rest.

Tormek

The Tormek wet grinder comes with a standard jig for grinding straight-edged tools such as plane blades and chisels, and optional jigs for grinding scissors, axes, and jointer knives. The straight-blade jig clamps the blade with the bevel side registered on the fixed surface of the jig. The jig itself slides on a support bar positioned above the rotating stone. Setting up the tool for use is straightforward: Position the blade in the jig so the bevel contacts the face of the stone. Slide the blade across the face of the stone with moderate pressure.

Jigs for Both Grinding and Honing

Jigs allowing you to grind and hone without adjusting the position of the blade are convenient. There are a couple of them on the market. The maker of the grinding jig

A Tormek grinding wheel turns very slowly through a water bath, making it almost impossible to overheat a tool.

Tormek offers a variety of accessories that can be used to sharpen everything from pocketknives to plane blades and chisels.

shown below apparently wishes to remain anonymous, as there is no manufacturer's name stamped on the tool. Highland Hardware catalogs it as a "Dual Use Grinding Jig and Honing Guide." It is quite similar to the Veritas design, except that it includes a roller that can be screwed to the bottom of the jig, transforming it into a honing guide. You will have to experiment to determine how far to set your tool rest from the grinding wheel and to tinker with the proper blade projection since no information comes with the jig. Once you have the adjustments dialed in, make a note of the correct distances for future reference. Set up correctly, the jig will let you grind the blade at 25 degrees and go directly to honing at the same angle, or a higher angle for a secondary bevel, without removing the blade from the jig.

This jig can be used for both honing and grinding, making it more convenient than a single-purpose jig.

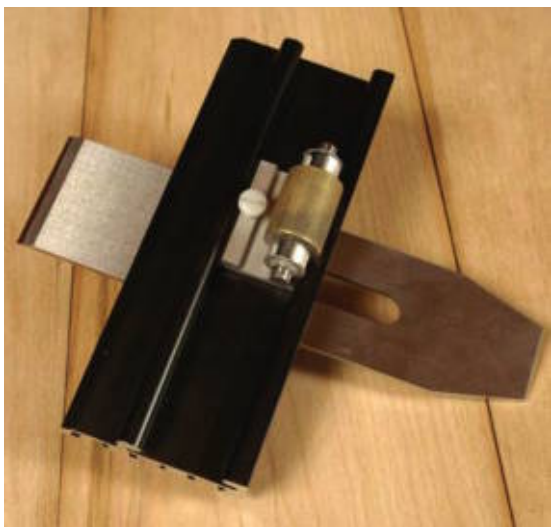
Lines on the jig help you to square up your blade, but it is not as positive as the Veritas jig. If the roller attachment were designed differently to snap on and off quickly, this jig would be much more useful.

MAKING A TOOL REST

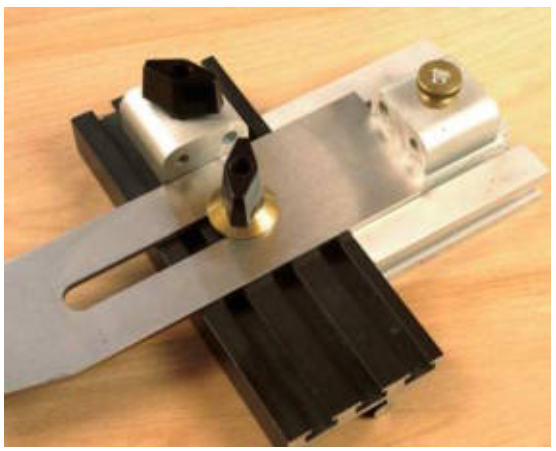
Most tool rests that come with bench grinders are completely inadequate—too short and often not parallel to the stone. The FastTrak system comes with a very nice aftermarket tool rest. Veritas makes an articulated grinder tool rest. Both of these are excellent accessories, as is the Wolverine platform rest available with the Wolverine grinding system. It's also a simple matter to make your own rest using a dowel, a piece of pipe, or a piece of electric conduit to support a grinding jig. The rest should be slightly above the center line of the grinding wheel. The rest in the photo below is made from scraps of plywood and hardwood dowel and will do the job nicely when used with a commercial or shopmade jig for holding a plane blade or chisel.

The FastTrak system also allows a tool to be taken from a grinder to a stone without repositioning.

A brass roller attaches to the bottom of the jig to make the conversion from grinding to honing.



An adjustable aluminum stop block that comes with the FastTrak system makes it easy to set a specific angle for grinding and honing.



FastTrak Jig

The FastTrak sharpening system can be used with any standard bench grinder or Tormek grinder. An adjustable alignment block guarantees the blade will sit in the jig squarely. Slotted blades are held firmly with a large washer clamped to the T-slot in the extruded aluminum body. Chisels and blades without slots are held with a clamp, one side aligned against the stop block. If you set this jig up to grind a 25-degree bevel, you can also proceed directly with honing your blade without removing it from the jig by attaching a brass roller to the underside of the jig. The roller is designed to produce a honing angle of 30 degrees. The FastTrak system also comes with an adjustable aluminum stop block that can be used to accurately set the projection of the blade in the jig.

Dedicated Jigs

Other types of sharpening jigs are more specialized, intended for one type of tool. Here are some examples.

DMT/Veritas Jointer/Planer Blade Honing Guide

This strange-looking contraption by DMT (see the photo at left on the facing page) is designed for honing jointer/planer knives on diamond stones or abrasive papers. The knife is installed bevel up and clamped firmly in the jig. The jig is then turned over, with the knife bevel on the abrasive surface, and the jig is adjusted for the correct bevel angle. Knives are honed by moving them back and forth across the abrasive. Adjustments can be made for secondary bevels, if desired, by resetting the height adjustment. Veritas makes a similar jointer/planer knife jig.

Jointer/planer knives can be sharpened on abrasive paper or sharpening stones with the help of this jig from DMT. Veritas makes a similar device.

These jigs are good for touching up knives in the workshop, but you should still send knives out for a professional regrind every now and again.

Oar Jig for Carving Tools

This clever jig (shown in the top photo at right) is designed for honing carving tools, and is especially effective for gouges. It also will handle carving chisels and Vee tools. The rounded shape of the jig allows the tool to be rotated smoothly as you move it on the stone, a very useful feature for honing an edge on a rounded tool. It works best on medium- to large-size tools. There may be some difficulty in holding very small tools in this jig without grinding the tip of the clamp screw so it fits the inside of the tool.

General Jig for Drill Bits

This style of grinding jig (see the bottom photo at right) has been around for years. It's useful for sharpening ordinary twist drills on the side of the bench-grinding wheel. You can adjust it for various tip angles. One side of the drill bit is ground at a time; the drill is then turned 180 degrees in the jig, and the other edge is ground. This jig will not grind the more complex brad-point or split-point drills.

The rounded bottom of this Oar jig allows curved tools such as carving gouges to be honed accurately.

General's drill-grinding jig is an old favorite for sharpening twist drills on the side of an abrasive wheel, but it can't grind more complicated brad-point and split-point bits.

Shopmade Sharpening Jigs

With some ingenuity, you can create useful jigs and fixtures from scrap wood, including jigs for blades that are otherwise difficult to hold. Here are a few of my favorites.


A


B


C


D


E

Making a Waterstone Holder

It's handy to have a way to hold your waterstones securely while you are using them. This very simple jig will hold one or two stones. It can be clamped in your bench vise or to a bench with a bar clamp. It is made from a scrap of plywood, 11 in. to 12 in. long and 9 in. to 10 in. wide. The stones are held between two ¼-in. by 1-in. hardwood strips. Stones can be held in place with thin wedges **(A)**. Leave a space for them. Another way to hold the stone is to cut the back strip at a slight angle so the stone will wedge itself in snugly as you push on it. One or two strips of hardwood on the bottom of the jig can be used to clamp the jig in a bench vise. Two strips **(B)** spaced correctly can hook the jig over a tool tray at the back of a traditional woodworking bench (protect your bench from water).

To make one, mark the hardwood strips and cut them to length **(C, D)**. You can use the first piece to set a stop block for cutting the others **(E)**.

Chamfer the edges of the plywood board **(F)**. Apply glue **(G)**, and tack the first strip in place **(H)**. Use the waterstone to mark the position of the second strip **(I)**, and nail that in place **(J)**. You may find your waterstones vary in length. If that's the case, and some of them will not fit in the jig you've just made, you can dress them on a belt sander so they're all the same size. Finally, chamfer the sharp edges **(K)**, and the jig is ready to use **(L)**. A coat of finish is a good idea.


F


G


H


I


J


K


L


A


B


C


D


E


F


G


H

A Jig for Skewed Plane Blades

This jig holds a skewed plane iron at the correct sharpening angle and has a large bearing surface on which to register the stone. Something similar could be made for square blades as well. You can make the parts for the jig on a table saw, but here I'm using hand tools. First, mark off a piece of hardwood about 5 in. wide, 4 in. long, and 1 in. thick **(A)**. Measure the angle of the skewed blade with a protractor **(B)**, and lay out a line, in this case at 18 degrees, on the board **(C)**. Align the blade with the line, then mark out the second side for a slot that will house the blade **(D)**. Cut the block to length **(E),** and add square lines at both ends of the block that meet the angled layout lines **(F)**. Set a marking gauge for ⅜ in. **(G)** and scribe a line marking the depth of the slot **(H)** on each end of the block. Using a protractor again, scribe two

lines with a marking knife **(I)** to make it easier to start the sawcut accurately. Saw to full depth, being careful to stay at the 18-degree angle **(J)**. Using a shoulder plane or rabbet plane, plane material to the full ⅜-in. depth **(K, L, M)**. Test to see that the blade sits flat on the bottom of the groove **(N)**. Next, lay out a 25-degree angle (or whatever angle you wish to hone the bevel at) **(O)** on both ends of the block, and mark a line across the face **(P)** where the bevel will end.

(Text continues on p. 54.)

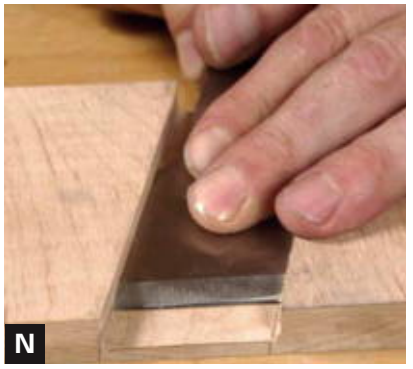

I


J


K


L


M


N


O

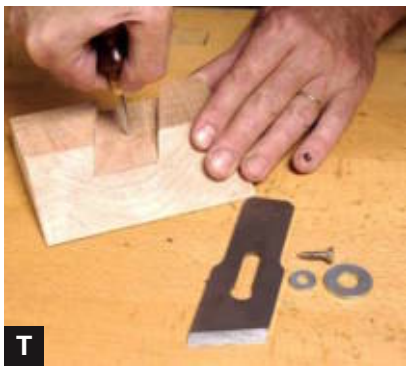

P


Q


R

Plane down to the line **(Q, R)** and test your blade again **(S)**. A slotted blade can be held in the jig with a screw and washers. Start the hole with an awl **(T)**. Drill a pilot hole for the screw **(U),** and lock the blade in place **(V)**. A blade without a slot or hole can be held in the jig with a wooden strap and let into the jig face **(W)**. The completed jig can be held in a vise.


S


T


U

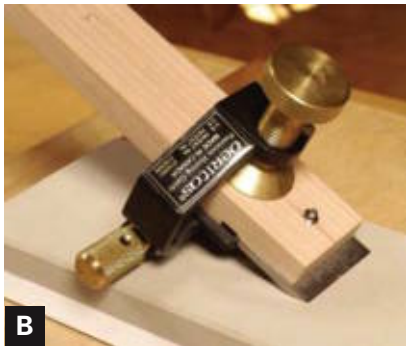

V


W

Spokeshave Blade Holder

An easy way to hold small spokeshave blades for honing is to cut a notch the thickness of the spokeshave blade on the end of a scrap of hardwood. Screw the blade in position with the bevel facing up **(A)**. The entire unit can then be held firmly in a honing guide **(B)**. For grinding small spokeshave blades, a similar arrangement can be made from a scrap of wood with an additional notch to slip over the tool rest when you're grinding **(C)**. Spokeshave blades or other small blades without a hole or slot in them can be held by cutting a slot in the end of a scrap of hardwood to accept the blade and using a screw or a bolt for clamping pressure.


A

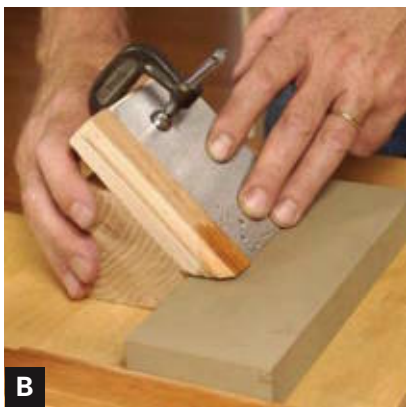

B


C

Honing Jig for a Large Scraper Plane Blade

The 2⅞-in.-wide scraper blades for large scraping planes will only fit in some commercial honing guides. The best one for them is the side-clamping or Eclipse-type jig. But not all side-clamping jigs open far enough, and there seems to be considerable variation in the way these jigs are made. An effective setup can be made from scraps of wood **(A)**. Start with a block of wood, and cut one face at 45 degrees. Add a rest made from plywood or a thin piece of hardwood, and attach a fence to keep the blade square. Clamp the blade to the jig and stone the edge, but take care not to wear a groove in the stone by honing it in the same place for too long **(B)**.


A


B


A


B


C


D

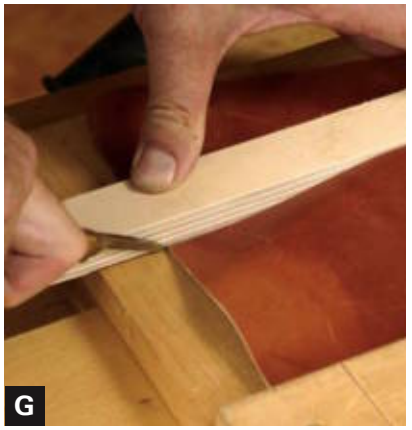

E


F

Making a Saw Vise

It is essential to have good support of the saw-blade when filing. A simple wooden saw vise that clamps in a machinist's vise or bench vise **(A)** is easy to make. Use scraps of plywood or hardwood, and adjust the length and depth to fit the saws you plan to sharpen. This one is suitable for dovetail saws and tenon saws that are about 15 in. long and 6 in. deep. It consists of two pieces of plywood sized for the blade, two ½-in. square strips at the top that grip the blade, and a pair of ½-in. by 1-in. spacer strips at the bottom.

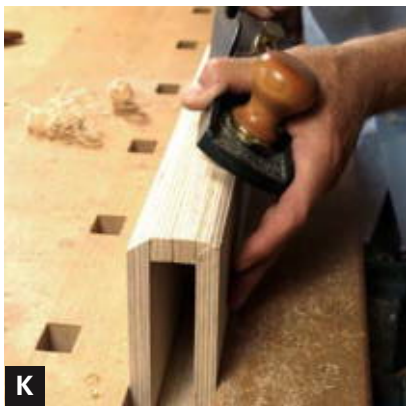
Cut out the two large pieces on a table saw. Crosscut the strips 15 in. long on the table saw or by hand. A stop block clamped to the bench, used with a miter box or a bench hook, makes this quick and easy. Use one of the pieces of plywood to adjust the position of the bench hook **(B)**, then cut the strips to length **(C)**. Chamfer the edges **(D, G)**, apply glue **(E)**, and assemble with brads **(F)**. Cut a strip of scrap leather **(G)** for the hinges **(H)**. Trim the hinges to fit **(I, J)**. Finally, bevel the top edges **(K)**, and your saw vise is ready to use **(L)**.


G


H


I


J


K


L

PART TWO

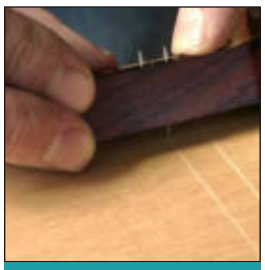
Sharpening Tools

All edge tools, new or old, need regular sharpening to work as they were designed. Even tools that come from the manufacturer ready to use eventually will need attention. Learning how to sharpen woodworking tools is not difficult, but it does take some practice and a willingness to experiment.

The more you develop your sharpening skills, the easier it will be to adapt your tools to your way of working and the type of wood you are using. There's no reason to sharpen a tool in exactly the same way for every job when a slight adjustment can bring out the very best in your tools and your work.

The practical techniques explained in these pages will help you get a sharp edge on just about any hand tool and several types of cutters for power tools. And the job doesn't have to take forever. These approaches will help you get the job done quickly and efficiently.

Gauges and Knives



Marking Gauges

- Wheel Marking Gauge (p. 64)
- Pin Marking Gauge (p. 65)
- Cutting Gauge (p. 66)
- Modified Pin Gauge (p. 67)

Layout Knives

- Marking Knife (p. 68)
- Japanese Marking Knife (p. 69)

Kitchen Knives

- Single- and Double-Bevel Kitchen Knives (p. 70)
- Serrated Knife (p. 71)

Drawknives

- Drawknife (p. 72)
- Hook Knife (p. 74)
- Router Plane (p. 75)
- Small Scorp (p. 76)
- Travisher (p. 77)
- Inshave (p. 78)

Scissors

- Scissors (p. 80)

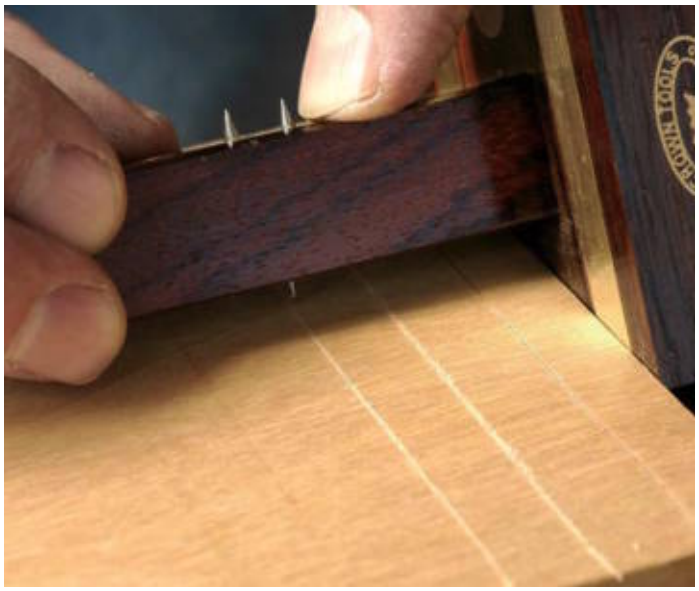
Marking and cutting gauges come in a variety of styles, but all are used to scribe clean lines with and across the grain.

This large family of tools includes single-bevel and double-bevel blades, as well as wheels and pins that require specialized sharpening techniques.

Marking Tools

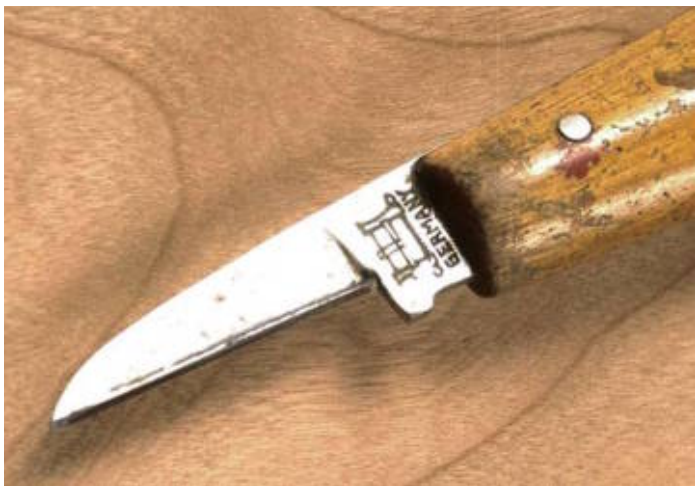
There are many kinds of marking and cutting gauges that are used to scribe lines with and across the grain. All of them, particularly those used cross-grain, will work much better if they are kept very sharp. Dull pins or blades tear wood fibers, which is no help when you're trying to lay out a precise furniture joint. Wheel-type marking gauges are generally ready to use out of the box and only need occasional honing. New pin-

The very sharp, beveled edges of wheel-gauge cutters scribe crisp lines across the grain.



Pins on standard marking gauges will leave a ragged line when used across the grain unless they are filed to a knife edge.

A double-bevel Japanese marking knife has a hollowed back just like a Japanese chisel or plane iron.



A small chip-carving knife honed to a razor edge makes an efficient marking knife.

marking gauges will work much better if you spend a few minutes to reshape and sharpen the pin with a file.

Single- or double-bevel marking knives need to be maintained like plane blades or chisels. That is, get them very sharp and then do a little honing frequently rather than wait until they're dull before going back to your sharpening stones. It will save a lot of time in the long run.

Waterstones or oilstones will do most of the work in keeping these tools sharp. But one or two small, fine files, such as an 8-in. smooth file or an auger-bit file, plus a coarse and fine diamond file also are helpful.

Cutting and marking gauge knives, including wheel-type cutters, are typically beveled only on one side. Sharpen the flat side. You may want the blade mounted with the bevel toward or away from the fence part of the tool. Mounted toward the tool, it will tend to pull the fence into the wood and help make a straight line going with the grain. But since a single-bevel cutter makes a cut that is flat on one side and tapered on the other, consider the sort of line you are laying out. It is usually best for the bevel to be on the waste side of your cut.

This Japanese kitchen knife has a single bevel to sharpen. The back of the knife is flat.

Knives and Scissors

If you are going to acquire the means to sharpen shop tools well, do yourself and the cook in your house a favor by getting some practice with your kitchen knives. You'll use the same techniques and stones. Bevel angles can be quite low, 5 degrees on Japanese knives. Follow the original bevel angle, unless you intend to modify it for a good reason: more bevel for a stronger edge and tougher work, less bevel for thin slicing. Some Japanese knives have a single bevel but will need to be honed on the flat side as well. Serrated knives also have a single bevel and can benefit from sharpening with slipstones, diamond slipstones, or ceramic rabbit-ear knife sharpeners.

For the best edge, use waterstones or oilstones (you can use nontoxic camellia oil on your oilstones) and hone up to a fine Arkansas or 8000-grit waterstone. You can use a butcher's steel to touch up and burnish the knife edge; the tooth it leaves can be helpful for some cutting jobs. Ceramic knife sharpeners are also great for touching up an edge, but a quality knife carefully sharpened on waterstones or oilstones will cut like a razor for a long time.

Even inexpensive scissors are worth sharpening. Grind or file them for a serviceable edge, or follow up with fine diamond hone or sandpaper on a flat stick for better sharpness. While you are at it, sharpen up your pocketknife (every woodworker should have one).

Drawknives and Related Tools

Drawknives, inshaves, scorps, travishers, and hook knives all have blades with a single bevel. Sharpen the bevel from 15 degrees to

Because of their design, serrated kitchen knives (far left) often go years between honings, but eventually they will need attention.

Even an inexpensive pair of scissors will benefit from grinding or filing the cutting edges.

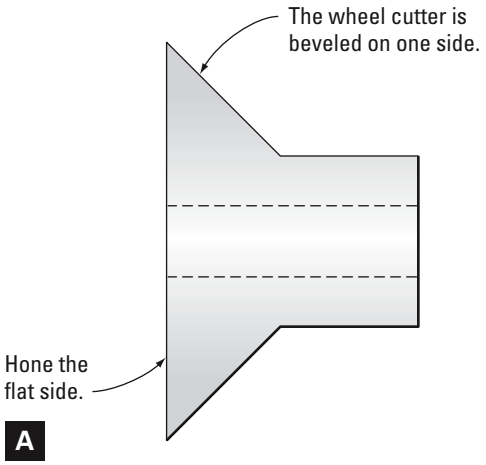
25 degrees—higher for harder woods and longer edge life, lower for softer woods and better cutting. A small back bevel on any of these tools will slightly alter the cutting characteristics and may make the tool easier to control in shallow cuts.

Drawknives may be used bevel up or bevel down. Some people have distinct preferences, but let experience be your guide.

You can use several different approaches for sharpening curved-bladed tools. For the inside radius, large gouge slipstones and regular slipstones are helpful. You can substitute self-adhesive abrasive paper wrapped around a dowel or a piece of pipe instead. For aggressive grinding of tight inside radii, a 1-in. or 2-in. drum sander mounted in an electric drill works well. Use 50- or 80-grit sleeves. One or two grades of diamond compound applied with a dowel works great to finish-hone the inside of a small scorp.

A 1-in. belt sander is a great tool for working outside curves. Use 80, 100, or 150 grit for shaping and finer grits up to 320 to finish. You can also use one to sharpen axes, scissors, and knives, as well as carving tools. Other options include using waterstones or oilstones and strips of abrasive paper on wood backing. Scotch-Brite deburring wheels are another alternative for steps in between grinding and finishing. Of course, the Tormek strop system can be used for some of this work as well, especially for the small scorp, but be careful not to round the edge with any stropping or buffing system.

Experiment with whatever sharpening tools you have at hand to see which method works best for you and for a particular sharpening job. As is the case with all kinds of sharpening, spend enough time on the coarse grits to properly prepare the way for final steps. Be careful to do a good job, but don't be afraid to get started. You can always resharpen if you don't get it right the first time.

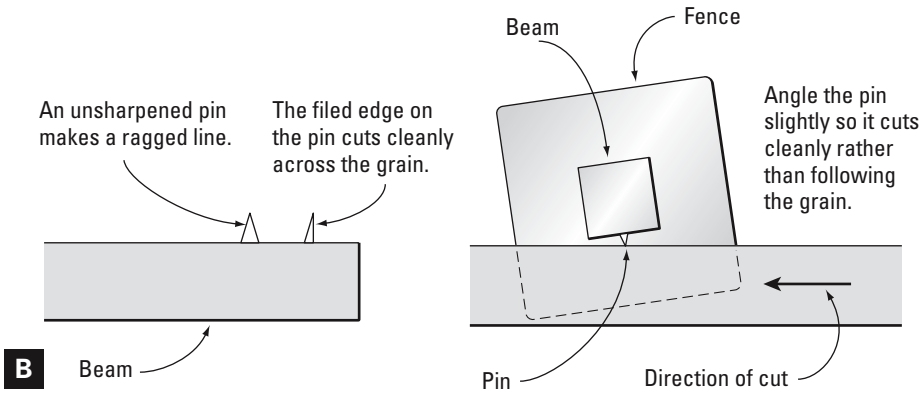


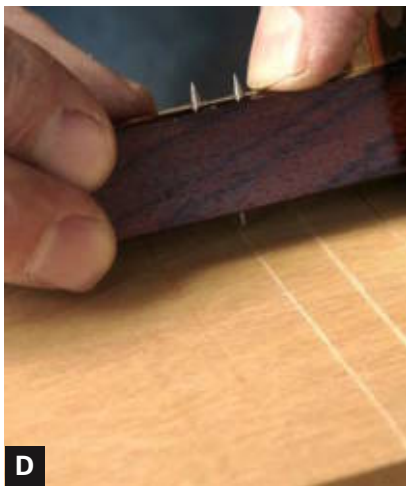
Wheel Marking Gauge

The beveled cutter on a wheel-type marking gauge **(A)** should cut cleanly across the grain to mark the baseline for dovetails or the shoulder of a tenon **(B)**. A single machine screw holds the cutter to the end of the beam. When the gauge no longer cuts a clean line, remove the cutter and hone the face on an 8000-grit stone **(C)**. If the cutter is very dull, start with a coarser stone, but hone only long enough to smooth and polish the face **(D)**.

Pin Marking Gauge

A traditional marking gauge uses a pointed pin to scribe a line. It may work well when used with the grain, but an unsharpened pin can leave a ragged cut when used across the grain because it tears wood fibers. For a precise line, file this pin flat on the side nearest the head of the gauge **(A)**, and bevel the outside for a knifelike edge **(B)**. Use a file with safe edges so as not to mar the beam. Angle the pin slightly so that the head of the gauge is pulled snugly against the end of the board as you pull the gauge toward you **(C)**. The gauge should incise a clean line **(D)**. You should touch up the pin with a file whenever it begins to tear wood fibers.






A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F


G


H


I

Cutting Gauge

A cutting gauge uses a small knife, instead of a pin, that is held in the beam with a metal wedge **(A)**. It may have one or two cutting edges, but it should be honed razor sharp for a clean cut. Hone the back of the cutter through an 8000-grit stone **(B)**, then hone the bevel. Resting the bevel on the stone, draw the cutter back **(C)**. If the cutter is too hard to hold, clamp it in a vise and run the stone flat across the bevel to sharpen it **(D)**. Keeping the bevel flat is easy since it should take only a few strokes on each grit to get a sharp edge **(E)**. Deburr the back after the bevel is sharp.

If you have a new gauge, it's a good idea to clean up the wedge, which may still have some rough spots. Flatten the back on sandpaper **(F)**, and chamfer the edges lightly using a file **(G)**. Reassemble the gauge, then give the wedge a light tap with a hammer **(H)**. You can set the blade with the bevel toward or away from the fence, depending on where you want the waste side of the line to be. Orienting the bevel toward the inside (facing the fence of the gauge) will pull the gauge into the work **(I)**.

Modified Pin Gauge

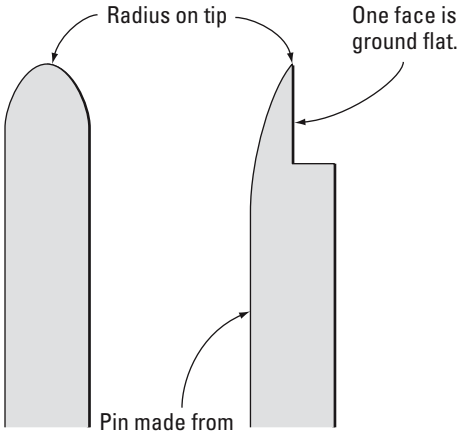
Colen Clenton, an Australian, makes a beautiful gauge with a more sophisticated pin than a standard marking gauge **(A)**. The pin is ground with a flat face, then beveled by grinding a radius on the outside **(B)**. English furniture maker David Charlesworth uses this approach to modify the pins on factory gauges. Or you can make your own pin with a hardened ⅛-in. steel pin. To do this, grind half the diameter away **(C)**, then shape the radius on the outside **(D)**, and use a diamond hone to finish shaping the edge **(E)**. Install the cutter with the bevel inside. This type of cutter is sharpened by honing the face flat **(F)** and then the radius. Rock the cutter on the stone to cover the entire face **(G)** on a fine stone—4000 or 8000 grit—to get a finished edge. You can also use the strop on a Tormek grinder or a fine Scotch-Brite wheel. You are looking for a smooth, polished surface **(H)**.


A


C


E


G



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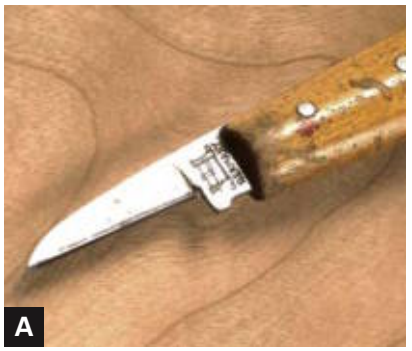
A


B


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D


E

Marking Knife

Marking knives may have a double bevel **(A)** or a single bevel. The single-bevel knife is easier to use for accurate marking against a straightedge or square. To sharpen a double-bevel knife, start by honing the back, then work the bevel on a series of grits (220, 1000, 4000, and 8000) until it is razor sharp **(B)**. A bevel angle of 20 degrees to 25 degrees is fine. Grind the edge only when the knife is badly nicked or worn. An easy way to restore the edge is to use a diamond file **(C)** until sharp **(D)**. Test the knife by cutting cross-grain on a piece of wood **(E)**. Hone the blade frequently to keep it in top shape.

Japanese Marking Knife

Japanese marking knives have hollow backs and may have either one or two bevels. Start by honing the back flat **(A)**. Color the back with a marker before you start so you can check your progress easily **(B)**. As you work the back, the marker will slowly disappear **(C)**. Continue until the back has a fine polish, just like a plane blade or chisel **(D)**. You can hone the bevel by hand or, if you prefer, with a honing guide **(E)**. Start with as coarse a stone as necessary and work through an 8000-grit stone **(F)**. Use a marker to help set the knife at the right angle in the jig and to check progress **(G)**.


A


B


C

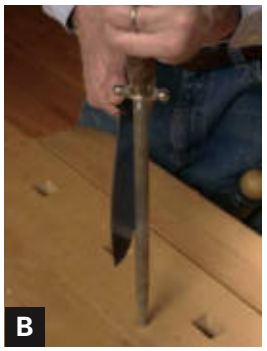

D


E


F


G


A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I

Single- and Double-Bevel Kitchen Knives

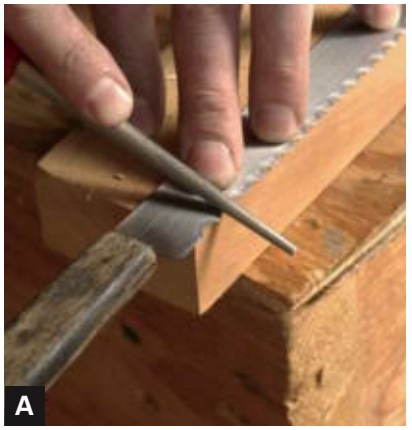
There are many ways to sharpen knives. You can even keep kitchen knives sharp by using a steel file or a checkered file. These tools leave fine serrations on the edge that make slicing easy. For a razor edge, hone the knife on waterstones. Hold the bevel on the stone **(A)**, and keep the tip of the knife from flexing by applying pressure with your fingers. A straightedge is easy to hone and keep sharp. You can use a sharpening steel to keep the blade sharp **(B)**, but because it removes very little material, a steel can't be used to sharpen a dull knife.

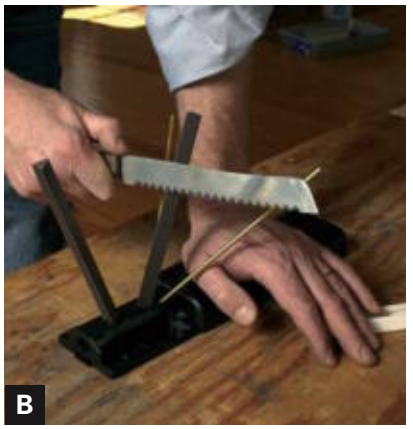
DMT makes a jig for knives to help you maintain a consistent bevel **(C)**. Pivot the curve of the blade against the stone **(D)** as you work the edge. Although this jig is intended for use with DMT's diamond stones, it works equally well when you're using waterstones or oilstones **(E)**.

Some Japanese stones have only one bevel **(F)**. To maintain these, hone the back flat on an 8000-grit stone **(G)** until it's polished **(H)**. It is easy to register the wide bevel on a stone while honing the edge sharp **(I)**.

Serrated Knife

You may not consider sharpening serrated knives because they seem to cut for a long time without attention. But a serrated kitchen knife or pocketknife will cut better if it's kept sharp. You can hone the scalloped edge using a diamond hone **(A)** or use a sharpening jig such as the one made by Spyderco, a Japanese knife manufacturer. This jig uses two triangular ceramic rods that make touching up a serrated knife easy. Lay the flat side of the blade against the rod and stroke downward **(B)**. Set the other rod to correspond with the bevel angle of the knife, then hone the serrated edge by holding the blade vertical while stroking the edge downward against the rod until it's sharp **(C)**. The edge of the ceramic rod will follow the contours of the blade. You can use this tool to sharpen other knives to a reasonable edge, but do not use it on laminated Japanese knives or you will chip the edge **(D)**, which will require a lot of work with a waterstone to repair **(E)**.


A


B


C


D


E


A


B


C


D


E


F

Drawknife

Drawknives **(A)** are not difficult to sharpen, just a bit hard to hold on to. Start by flattening the back. You can grind a shallow hollow in the middle of the back to make this go more quickly **(B)**. Do not use a bench grinder to create a hollow because it will be too pronounced. A slow-speed Tormek works well **(C)**, but if you don't have this tool, just skip the hollow. Check your progress frequently, and stay well back from the cutting edge.

You can start honing with something like an ax stone **(D)**, a circular stone made from silicon carbide. Work until flat, then move up to a finer stone, such as a 220-grit waterstone **(E)**. After you've removed the scratches left by the coarse stone, continue with finer grits **(F)**, and finish with a 4000- or 8000-grit stone.

Grind the bevel at 25 degrees for general use. You could arrange some kind of jig to use on a high-speed bench grinder, but it is difficult to get good results because a drawknife is awkward to hold and it is easy to grind too much. Often, there is a gentle curve to the blade. With a small belt sander, you have less risk of damaging the blade. Mark the bevel **(G)**, then run the bevel across the belt **(H)**, using very little pressure. Check your work, and repeat a few times until done **(I)**.

Clamp the drawknife firmly to hone **(J)**, and blacken the bevel with a marker. Rest the end of the stone on the bevel, then raise or lower the other end until the stone sits flat **(K)**. Hone through successive grits, and use the marker occasionally to help you see your progress **(L)**. When you're finished, check the drawknife on a piece of wood **(M)**.


G


H


I


J


K


L


M

Hook Knife

A carver's hook knife can be kept sharp easily with a small, smooth second-cut file and slipstones. If the tool is very dull, file the bevel at about 25 degrees **(A)** to restore the edge, and use a tapered round slipstone **(B)** or a small dowel wrapped in 180- or 220-grit sandpaper, followed by a hard Arkansas slipstone **(C)**. After working the bevel, stone the back with a hard Arkansas slipstone to smooth and deburr the edge **(D)**.

Router Plane

Router planes **(A)** are quite simple. The blades must be square, however, and parallel with the sole of the tool. Carefully grind the bevel **(B)**, and correct any out-of-squareness on a bench grinder or belt sander. Check your progress as you go **(C)**. True up the bevel with a diamond file **(D)** or a coarse stone, then hone the back flat and stone the bevel **(E)** through 8000 grit until the edge is sharp **(F)**.


A


B


C


D


E


F


A


B


C


D


E


F


G


H

Small Scorp

A small carving scorp **(A)** is sharpened very much like an inshave. Begin by working the inside curve. Use a marker to check your progress **(B)**, and round slipstones, if necessary, to smooth the surface. You can also use 180- and 220-grit abrasive paper wrapped around a dowel. For a very nice finish, a fast (red) or medium (green) cutting diamond paste on a dowel **(C)** works very well.

➤ See *"Inshaves"* on p. 78.

You can prepare the outside with a 1-in. belt sander using 100- or 150-grit belts or 220-grit abrasive paper mounted on a flat wooden board. If you don't have a belt sander or Tormek, use waterstones, oilstones, or slipstones to finish the outside. But if the scorp is in good enough condition, you can move directly to finish honing by using diamond paste **(D)** and a small stick.

An alternative is a leather strop on a Tormek sharpener, which produces a nice finish when used with honing compound **(E)**. Holding the scorp firmly against the strop, rotate it gently to hone the full curve **(F)**. This will produce a finished edge **(G)** that is ready to use **(H)**.

Travisher

A chairmaker's travisher **(A)** also has a curved blade. Start by working the inside of the blade with 180-grit abrasive paper on a large dowel or piece of PVC pipe **(B)**. Follow this up with coarse **(C)** and fine **(D)** slipstones, taking care to keep the surface flat. Do not curve or back-bevel the edge. Use a marker to make it easier to see what you are doing, and lay the stones flat on the bevel to get good registration.

Proceed to the outside curve by clamping the blade firmly in a vise and using slipstones **(E, F)**. Some travisher blades have a hollow on the back face of the blade, which makes honing go quickly. In any case, keep the stone flat on the blade. Deburr the inside edge, and you're ready **(G, H)** to use the tool.


A


B


C


D


E


F


G


H


A


B


C


D

Inshave

New inshaves usually need a lot of work before they can be used because the factory edge is so rough. Begin by cleaning up the inside of the curve to make sure it is as flat and smooth as you can get it. Clamp the inshave in a vise **(A)**. A 2-in. drum sander works well for the heavy work **(B)**. Start with 50-grit abrasive if the edge is very rough, and finish with 80 or 100 grit. You are looking for a smooth, flat curve **(C)**. Next, grind the outside bevel. An easy way to do this is with a 1-in. belt sander. Work above the platen, so that the belt will flex with the curve of the shave **(D)**. A 100-grit belt used with a light touch will provide an edge smooth enough to finish off

easily with waterstones or oilstones **(E)**. If you don't have access to a belt sander, you can do all this work using 180- or 220-grit abrasive paper mounted with spray adhesive on a thin board or entirely using a 180-grit oilstone.

Next, go back to the inside edge. Use a black felt-tip marker along the edge **(F)** so your progress will be easier to gauge. Wrapping 180-grit sandpaper around a dowel or a piece of 2-in. PVC pipe **(G)** makes a nice tool for the intermediate honing. Move along the edge of the shave as you stroke the abrasive forward. Follow up with 220-grit sandpaper or fine-gouge slipstone **(H)** checking the edge frequently **(I)** until you are satisfied with the result **(J)**.


A


B


C


D


E


F


G

Scissors

Scissors **(A)** can be kept sharp with a belt sander, files, or diamond files. They are easier to sharpen if you can disassemble them first **(B)**. Position the scissors in a vise and, maintaining the existing bevel, use several strokes of a fine file, such as an 8-in. mill file **(C)**. Check the bevel to make sure that you've cleaned it right up to the edge.

Following up with a fine diamond file **(D)** will give you a great edge.

A belt sander with a 150-grit or 180-grit belt will do a nice job as well. Set the table to the bevel angle of the scissors **(E)**. Lay the scissors on the table, and take very light strokes across the surface of the belt until the bevel is clean **(F)**. It's a good idea to follow up with a good fine diamond file or a piece of 220-grit abrasive paper on a wooden stick. Whatever method you use, deburr the back when you are done using a fine whetstone **(G)**.

Planes

Chip Breakers

- Preparing the Back of the new Blade (p. 91)
- Preparing Chip Breakers (p. 92)

Straight Blades

- Grinding a Primary Bevel with a FastTrak Jig (p. 93)
- Honing the Bevel with FastTrak (p. 94)
- Honing without a Jig (p. 95)
- Honing Japanese Plane Blades (p. 96)
- Cross-Grain Nickers and Slitters (p. 97)

Curved and Angled

- Scrub Plane Blade (p. 98)
- Cambering a Smoothing Plane Blade (p. 99)
- Honing a Skew Blade with the Veritas Jig (p. 100)
- Beading Cutter for Wood Molding Plane (p. 101)
- Molding Cutter (p. 102)

Using a handplane with a sharp blade is a satisfying experience, not a chore. The blade cuts wood easily and quickly, making a distinct slicing sound and leaving behind a surface that's smooth to the touch. Few things are as aggravating as working with a plane that tears wood fibers and leaves behind a rough, mottled surface. Although a variety of problems can make a handplane difficult to use, honing the blade razor sharp is always a first step toward getting good results. Plane blades, especially straight blades, are not difficult to sharpen, and the process need not take much time. The key is to hone the blade frequently once it is sharp to keep it in top shape.

Often when people talk about plane performance, they focus on how thin a shaving a plane will make. Japanese craftsmen compete against each other with exquisitely sharp planes, producing perfectly uniform, gossamer-thin shavings. This may be interesting, and, in fact, a thin shaving is a good sign the blade really is sharp. But the real point of planing is to make a smooth surface, not produce thin shavings. When we sharpen planes, we should concentrate on what kind of surface the blade leaves. That's what really counts.

A sharp handplane slices wood effortlessly, leaving behind a glassy surface that needs little if any sanding.

Despite a variety of sizes and styles, planes with straight blades are all treated the same when it comes to sharpening.

Molding and beading cutters for metal- and wood-bodied planes require some patience and ingenuity to sharpen.

Convex blades, like those used in scrub planes, must be sharp, but the exact radius is unimportant.

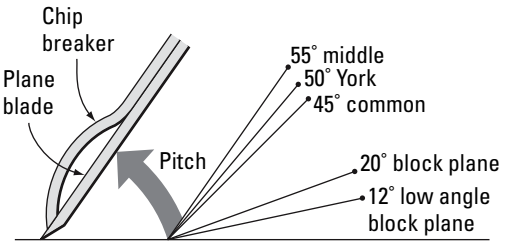
Planes for Many Uses

There are many types of planes and a variety of plane blades (also called irons). Straight-edge plane blades make up the largest group: bench planes, block planes, rabbet planes, shoulder planes, and skew planes, among others (see the top photo at left). No matter what the tools are designed to do, straight blades are all sharpened in essentially the same way. Another group are shaped plane irons, such as molding cutters with complex profiles, or beading cutters (see the center photo at left). Not as commonly used in this age of the router, these blades require a bit more ingenuity and some special tools to sharpen. Finally, there are the curved blades: hollowing planes with convex cutters and radius planes with concave irons (see the bottom photo at left). These also require slightly different sharpening techniques. In all cases, the object is the same: to marry a smooth, polished back with a finely honed bevel. That's what makes a keen working edge.

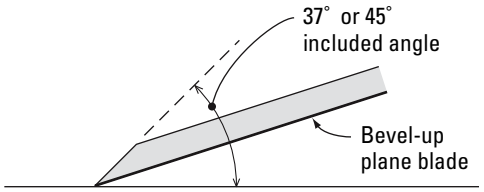
Pitch Angles Vary

Pitch is the angle at which the blade is bedded in a plane, and it varies widely depending on the type of plane and even when and where it was made. Planes with the blade mounted bevel down belong to a group known as bench planes. In modern bench planes, blades are typically pitched at 45 degrees. Manufacturers settled on this angle as they began to mass-produce planes, and in fact it is now called "common pitch." Many hand-built smoothing planes, however, have blades pitched higher than that. Because many of these tools were made in England in the days before mass production, they are

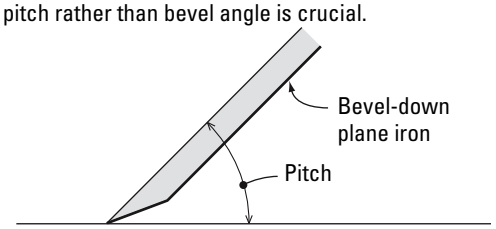
PITCH ANGLES



INCLUDED ANGLE



In block planes (top), the included angle is the bevel angle plus the bedding angle. In bench planes (below), pitch rather than bevel angle is crucial.



known by English names: 50 degrees is York pitch and 55 degrees is called middle pitch. These or similar angles were frequently used because they work better for smoothing difficult, wild-grained wood prone to tearout.

In the block-plane family, blades are mounted with the bevel facing up, either at 12 degrees in a low-angle plane or at 20 degrees in a standard tool. They are commonly sharpened with the same bevel as a bench plane. The blade meets the wood at the bedding angle plus the angle of the bevel on the blade. This is called the included angle. So a low-angle block plane with a 25-degree bevel on the blade meets the wood at 37 degrees. The same iron in a standard, or 20-degree, block plane would give you 45 degrees, the same as a bench plane. On a bevel-up block plane, you can vary the pitch angle by changing the bevel angle.

With a bench plane, where the blade is mounted bevel down, the angle at which blade meets wood is determined by the plane's pitch, not the bevel angle of the blade. It is the back of the blade that becomes the leading edge as the blade cuts wood. As a result, bevel angle on a bench plane blade is less important than it is on a block plane blade.

Differences in pitch, or whether the bevel is mounted up or down, do not affect the way these straight-edged blades are sharpened. But they do help explain why some planes work better on end grain or hardwoods with curly figure. Understanding them can be helpful in choosing the right bevel angle for grinding and honing.

Choosing a Bevel Angle

Manufacturers typically bevel plane blades at 25 degrees, a good compromise suitable for most work. But hardwoods and softwoods plane differently, just as end-grain and flat grain behave differently. The best bevel angle depends on what kind of wood and what kind of grain you're working. A higher angle, 30 degrees or so, usually works better for hardwoods. The edge is stronger and lasts longer than a blade with a standard 25-degree bevel. A higher bevel angle also improves edge life for planes with a York pitch. The tradeoff is that steeper bevel angles increase

resistance, making it a little harder to push the plane. Bevels as low as 20 degrees work well on softwoods, but they are not as durable in hardwoods. If you think your blade dulls too quickly, try a higher bevel the next time you sharpen it.

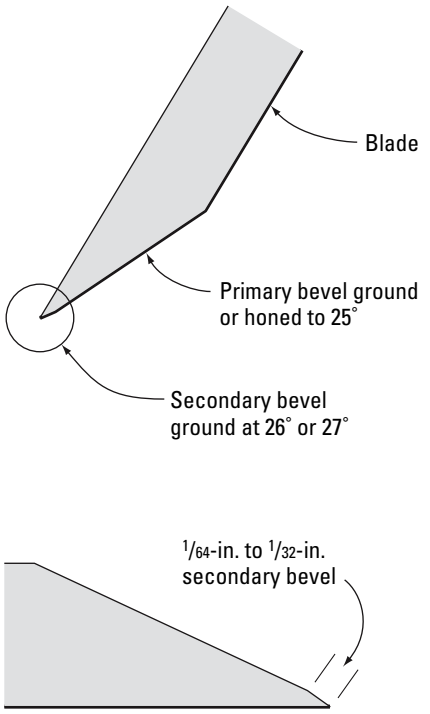
Primary and Secondary Bevels

The angle of the bevel to the blade is called the primary bevel. It is often shaped on a grinding wheel before it is honed. If so, the bevel will be slightly concave. A 6-in.-dia. wheel makes a more pronounced hollow than an 8-in.-dia. wheel. Flatter bevels, however, are best because there is more metal to support the cutting edge. So if you have a choice of grinders, pick one with a larger wheel.

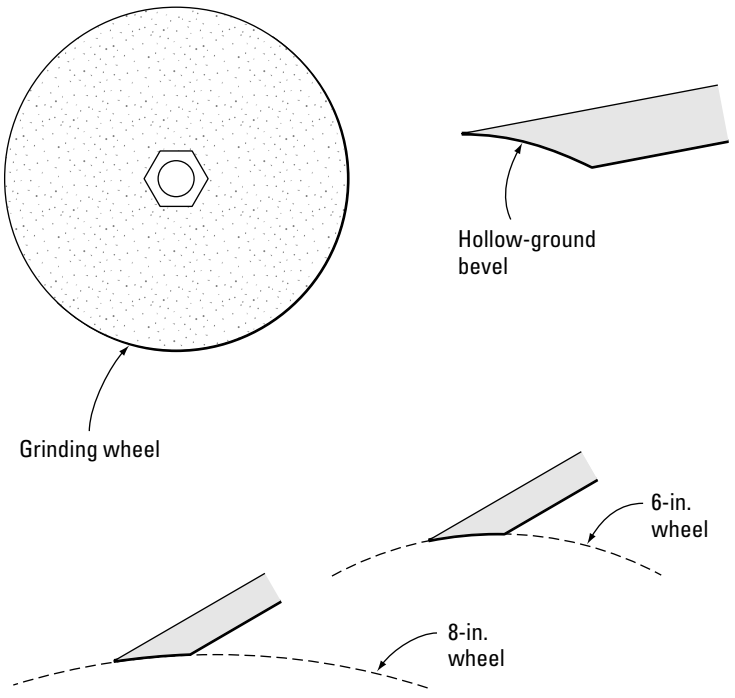
Using a grinder is an excellent way to establish (or reestablish) a primary bevel on a plane iron, but there are a couple of caveats. One is to avoid overheating the blade. Burn marks blue to black in color on the edge of the bevel mean the blade has lost its hardness in that area. Grinding is easier with a jig that safely holds the blade at a constant angle.

Whether the primary bevel has been ground on a wheel or flattened by hand on a stone, the final edge should be honed at an angle a degree or two higher than the primary bevel. This is called a secondary bevel.

SECONDARY BEVEL



GRINDING A BEVEL



Larger-diameter stones produce flatter bevels.

A secondary bevel allows you to concentrate your honing efforts on only the outer edge of the blade, so it takes less time to get a very sharp edge. In addition, the edge will last longer because it is at a slightly steeper angle. Once you've established a secondary bevel, don't hone the entire bevel each time the blade needs sharpening. Hone only the secondary bevel. In time, honing will widen the flat of the secondary bevel until the primary bevel no longer exists. It is then time to regrind the blade to reestablish the primary bevel.

Honing a Back Bevel

Hardwoods and those with figured or difficult grain, may respond better to a blade with a higher angle. This can mean using either a bench plane with common or higher pitch or a block plane sharpened with a higher secondary bevel. By honing a higher secondary bevel (as much as 40 degrees), you can successfully use even a low-angle plane on these problem woods.

To get a higher effective pitch on bench-plane blades, another approach is to hone a back bevel, a very small bevel on the back of the blade. Back bevels increase the angle at which the face of the blade meets the wood. Difficult woods often respond very well to a 5-degree back bevel, which would be the same as using a plane with a 50-degree, or York, pitch. One drawback is that a back bevel can only be removed by regrinding the blade, which can be a tedious process. Another problem is that blades with back bevels dull more quickly. So it makes sense to prepare an extra blade with a back bevel for those situations where you really need it. Stick with a standard bevel the rest of the time.

The distinction between low-angle planes and bench planes is much less important than the angle at which the blade meets the wood. By manipulating the secondary bevel or using back bevels, you can get the most out of your plane for the particular type of wood you're using. The results may surprise you.

BEVEL ANGLES

Most manufacturers grind plane blades to 25°, but steeper angles are more durable.

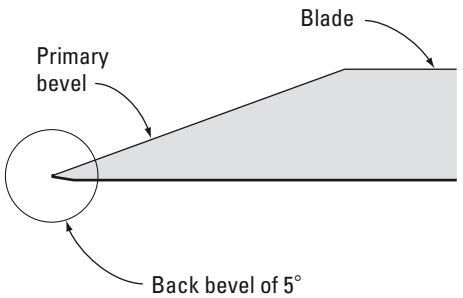
22°
Good for soft woods;
not durable.

25°
Most hardwoods and softwoods;
more durable.

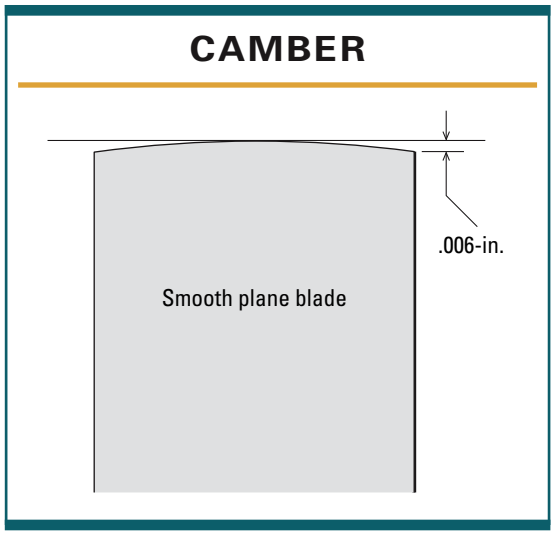
30°
Hardwoods;
durable, but increased resistance.

35°
Longer edge life in hardwood;
most durable, but most resistance.

BACK BEVEL



Scoring a line across the back of a plane blade can help you keep the blade square as it is ground.



Honing in Camber

For block planes, rabbet planes, and most bench planes, blades should be sharpened straight and square. Check with a square while honing. It also helps to scribe a square line across the back side of the blade (see the photo above). This reference line is a big help when you are grinding the blade because a true reference mark is always visible.

This straight-and-square approach, however, is a rule that should sometimes be broken. A square blade on a smoothing plane can leave tracks on the wood. Unless the blade is perfectly parallel with the sole of the plane body and set to take an extremely fine shaving, the corners of the blade will leave marks on the wood. To counter this inherent problem, a smoothing plane blade should have a very slight curve, or camber, honed in. It doesn't take much of a radius: a few thousandths of an inch of camber is all you need. A fine shaving taken with such a blade will taper to nothing at its edges, resulting in a smooth surface. Cambering a blade is easy to do by hand.

What Tools to Use

There are many different kinds of stones and sharpening jigs that can be used to sharpen plane blades. Here, I am using waterstones made by Norton, the FastTrak jig, and the Veritas honing guide (see Resources, p. 210). The FastTrak fixture system is unique because

it is used for both grinding and honing, which saves a lot of set-up time. But other abrasives and jigs will work just as well. You should use what you have or can afford.

I like to use a cool-cutting, open-grit stone mounted in a slow-speed grinder (it turns at 1,850 rpm rather than the standard 3,450 rpm). This combination is ideal, but you can use a high-speed grinder and conventional wheels. Just be careful to use a light touch so you don't burn the blade.

You do not have to grind the bevel every time you sharpen a blade. That just wastes metal. If you hone your blades frequently, you will only need to regrind when a blade chips or when you need to reestablish the primary bevel. A new blade will need grinding only if the edge is very dull or out of square. All of the work that the electric bench grinder does can be done on the 220-grit stone by hand. It just takes longer.

Hone frequently. Honing keeps the edge in top shape, and it saves time in the long run because even frequent honing takes much less time than grinding and honing a completely fresh bevel. Frequent honing also allows you to use just your fine stones. Try touching up the blade with just the two finest grits of your honing system—your 4000- and 8000-grit stones, for example—rather than beginning with a very coarse stone and working all the way up.

Set aside some time to do all of your blades at once. The job will go faster. Sharpen a spare blade for the tools you use most, and swap when the first blade shows signs of dulling or when you want the best possible finish on your final passes.

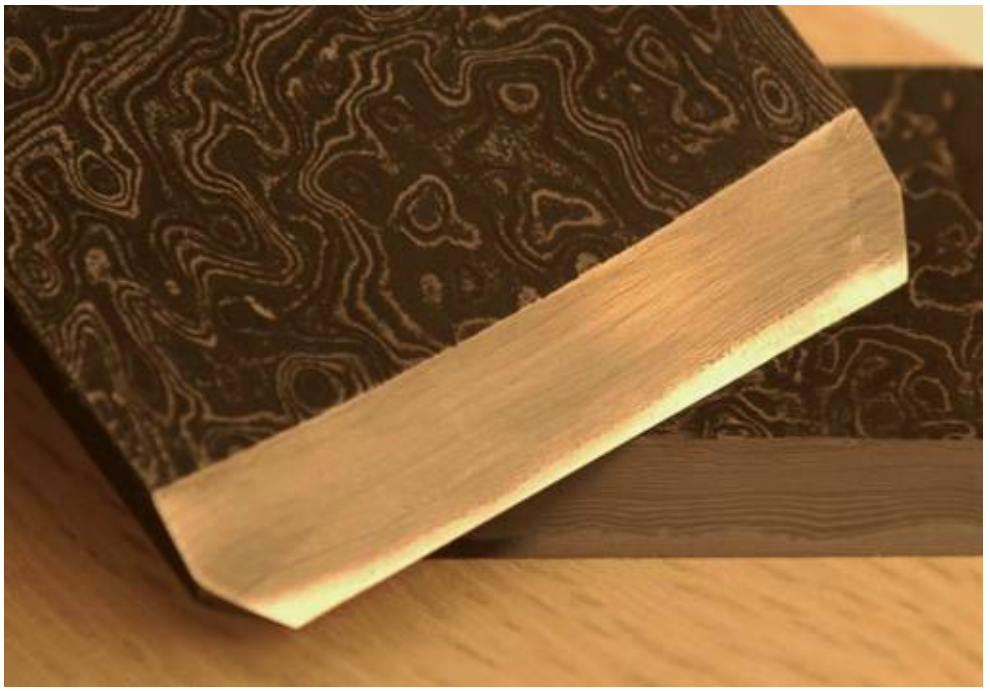
THE THICK AND THE THIN OF IT

Years ago, thin plane blades were touted as an innovation because they took less time to sharpen than thick blades. Undoubtedly, this is true, especially with the slower-cutting oilstones in use at the time. In addition, tool steel was once much more expensive than it is now, and thin blades require less metal to make. That's a savings for manufacturers.

A thin blade, however, is prone to vibration even with a stiff chip breaker or back iron. Thicker blades work much better because they don't vibrate as much. Wooden planes typically have very thick irons, usually with a thick back iron as well.

Thicker plane blades, like the one on the left, are less prone to chatter, and wide bevels make it easier to hone without a jig.

Unlike Western plane blades, a Japanese blade is a marriage of a very hard cutting edge and a softer metal that absorbs shock.



A Japanese plane blade is hollowed on the back and must be flattened only with care.

Japanese Plane Blades

Japanese plane blades are very different from their Western counterparts. They are very thick and made by forge-welding a thin layer of very hard tool steel for the cutting edge to a back of soft iron for strength and durability (see the photo above). This is an advantage in sharpening because you only have to work a small area of hard steel. The soft iron cuts quickly.

Japanese plane blades are made with a pronounced hollow in the back (see the photo at left). This makes sharpening easier because there is a relatively small surface area of steel to work. Once the bevel has been ground back to meet the hollow, the flat back needs to be reestablished. In order to maintain the thickness of the blade, which is crucial to the fit of the blade in the wood body, the back can't simply be flattened on a stone as a Western blade would be. Instead, the soft iron of the bevel is

DAVID'S RULER TRICK

A blade with a pitted or rough back can never truly be sharp no matter how much you labor over the bevel. But as essential as it is to flatten and hone the back, it can seem like an endless process. If you are in a hurry, you can try a simple trick I learned from David Charlesworth, an English furniture maker, teacher, and writer.

After initial honing on a coarse stone, move directly to a 8000-grit stone. A thin steel ruler placed along one edge of the stone angles the blade very slightly and creates a small back bevel (less than 1 degree) as the back is honed. This hones the only part of the back that really matters—the part that forms the cutting edge. It is also easy to repeat accurately.

A thin steel ruler slightly elevates one end of the blade, making it easier to flatten the back and produce a sharp edge.

The result is a very slight back bevel of less than 1 degree, not enough to affect the blade for general use.

The back of a Japanese plane iron must periodically be reformed by hammering the iron on an anvil.

Japanese planes (far right) are typically drawn toward the body, not pushed.

A very thick blade helps stabilize the tool, eliminating blade chatter and allowing it to produce exquisitely thin shavings.

hammered to push out a thin, hard layer of steel that can be honed to create a new flat at the edge of the blade (see the top photo). Hammering out the blade on an anvil takes practice, and to Western woodworkers it probably seems unnecessarily fussy. This bit of maintenance is likely one of the reasons why Japanese planes have not become as widely used here as either Japanese chisels or saws. Yet the planes can be a joy to use. They are typically pulled instead of pushed (see the photo above) and they can indeed, as Japanese craftsmen claim, produce amazingly thin shavings (see the photo at left).

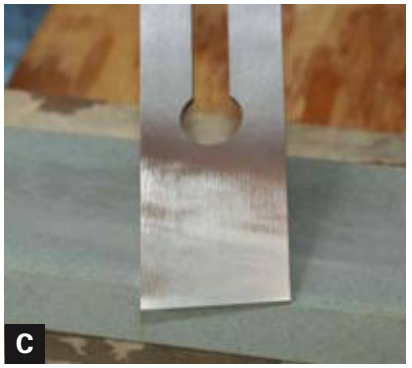
Japanese blades are thick and consequently have wide bevels. That makes it easy to register the bevel on a stone and hone by hand. And because the blades are short, it is much easier to hold them steady. Unlike Western blades, Japanese irons typically do not get a secondary bevel, nor are they hollow ground because the thin layer of hard steel needs to be well supported.

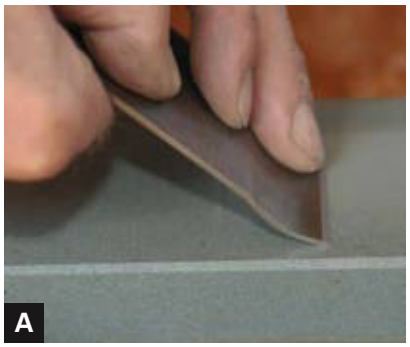
Preparing the Back of a New Blade

Before using a new blade, check the back. It may need to be honed to remove mill marks left from the factory and to ensure that it is completely flat **(A)**. If the surface is not flat and polished, it will be impossible to get a truly sharp edge on the blade. Honing the back is a quick job as long as you spend enough time with the coarse-grit stones. You should only have to do this to a blade once.

Lay the back of the blade on a 220-grit stone, and with firm pressure, run it back and forth over the surface **(B)**. It's not necessary to dress the entire back, just the area at the end of the blade near the bevel. Once the scratch pattern from the 220-grit stone is uniform **(C)**, move to the 1000-grit stone, then to the 4000-grit stone and finally to the 8000-grit stone. Make sure that you have removed all the scratches from one grit before moving to the next one. The blade will look progressively more polished with each stone **(D, E)**. Take special care on the finest grit **(F)**. It cuts more slowly, so don't hurry. When you are finished, the back of the blade, especially the area near the end of the blade, should be smooth and flat **(G)**.

Additional polishing—with diamond paste, for example—may be a good idea when you intend to use the plane to produce a finished surface on wood. But in most cases, the surface left by an 8000-grit stone will be fine.




A


B


C


D


E


F

Preparing Chip Breakers

A new chip breaker, or back iron as it's also called, needs attention before a plane will work at its best. This is another one of those preliminary jobs that will not need repeating. Even a used tool will benefit from honing and setting up the chip breaker correctly.

The curved top of the chip breaker, from the front edge to a point about ¼ in. or so back, should be honed smooth. Start with the 220-grit stone **(A)** to remove any deep scratches or to reshape the front of the breaker into a smooth curve. Hold the chip breaker on the stone, and draw it toward you while rotating it up toward the vertical. Keep an eye on the tip. Repeat on the 1000-, 4000-, and 8000-grit stones.

After honing, buff the edge smooth with an abrasive hand block **(B)**, a fine diamond hone, or a cloth buffing wheel if you have one. The face should be smooth **(C)**.

The surface that contacts the blade also must be smooth and flat. It should meet the blade across the entire edge without gaps so wood chips will not become wedged between it and the blade. Before you start, blacken the flat on the edge of the breaker with a felt marker so you can check your progress as you go. You will be able to see exactly what part of the breaker is in contact with the stone and whether you are inadvertently tipping the blade as you work. Hold the flat edge of the chip breaker firmly on the stone, and hone it by stroking sideways down the length of the stone **(D)**. Use 220-, 1000-, and 4000-grit stones. It's not necessary to go all the way up to an 8000-grit stone.

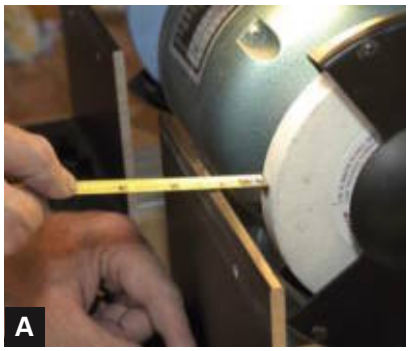
When fitted to the blade, the chip breaker should be in firm contact along the entire front edge **(E)**. Hold it up to the light to check for gaps **(F)**. A honed chip breaker that fits well will noticeably improve the performance of a plane.

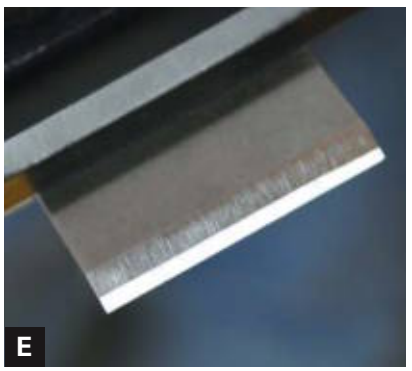
Grinding a Primary Bevel with a FastTrak Jig

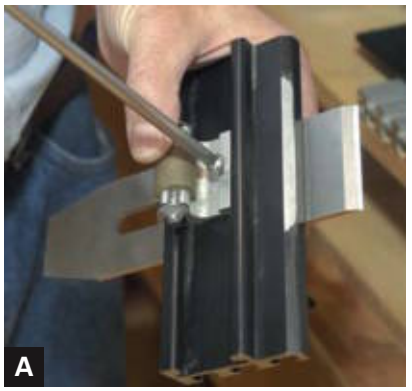
Jigs that hold the plane blade firmly make it easier to get a consistent bevel when grinding and also help to keep the edge of the blade square. There are many on the market. This FastTrak tool rest has one particular advantage: The blade can go directly from the grinder to a sharpening stone without being repositioned.

Set the FastTrak tool rest 1 in. from the face of the stone **(A)**. Set the blade in the jig with one edge against the block to keep it square. Extend the blade 1 in. from the front face of the jig **(B)**, which will produce a bevel angle of 25 degrees. An adjustable block is provided with the system to set this distance quickly and accurately, or you can nail a strip of wood to your bench 1 in. from the edge. Here, I have set the aluminum track supporting the tool rest 1 in. from the edge of the sharpening bench for use as a quick reference.

With the blade in place, grind carefully, moving the blade from side to side across the face of the stone **(C)**. Be careful not to apply too much pressure or hold the blade in the same place for too long—the result is the telltale blue-black of a burned edge, which means the hardness has been removed in that area **(D)**. If the jig does not glide smoothly, lubricate the contact between the jig and the tool rest with wax. When you're finished grinding, the edge of the blade should be straight and sharp **(E)**.

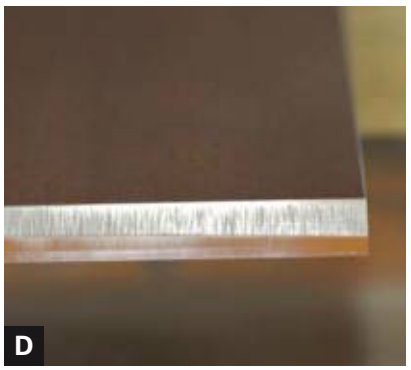





A


B


C


D


E

Honing the Bevel with FastTrak

By attaching a roller to the bottom of the FastTrak jig **(A)**, you can go directly to honing the bevel without readjusting the angle of the blade. Start with the 220-grit stone, then work through the 1000-grit and 4000-grit stones, taking enough time on the coarser grits before finishing on the 8000-grit stone **(B)**. A burr, or wire edge, will appear on the back of the blade. Remove this by backing off, or lightly honing the back of the blade once more, on the 8000-grit stone. Make sure the blade is perfectly flat on the stone when you do. If the burr is very small, run the edge of the blade through end-grain wood to remove it **(C)**, then inspect the edge. The outer edge of the bevel should have a finely polished surface **(D)**. Use a magnifying glass and good light if you have trouble making a close inspection. There should be no nicks in the edge.

Honing a bevel this way doesn't take long, and the result is a razor-sharp edge ready to cut wood **(E)**. Getting a uniformly thin shaving off a plane, or planing figured wood without producing any tearout may be the best test of all, but a smooth surface is really what you want.

Honing without a Jig

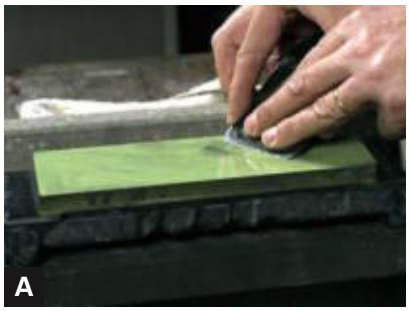
Although honing jigs are very useful, it's also possible to produce an excellent edge without one **(A)**. Both grinding and honing can be done freehand. It just takes some practice.

To hone the blade, stand comfortably before your sharpening bench, one foot in front of the other. Grip the blade firmly with both hands **(B)**. Locate the bevel so it's flat on the surface of the stone. You can find this point by raising and lowering the blade slightly until you feel the entire bevel come into contact with the stone (you can raise the blade slightly if you want to hone only a secondary bevel). Next, lock your arms and move the blade across the stone by rocking your entire body forward **(C)** and then back. Take care not to change the angle of the blade on the stone as you work—that's the really hard part of working without a jig. It will take some practice to avoid putting a rounded bevel on the blade. Begin on the 220-grit stone and work your way up through the grits—1000, 4000, and finally the 8000. Then back the blade off as you normally would to remove the wire edge.


A


B


C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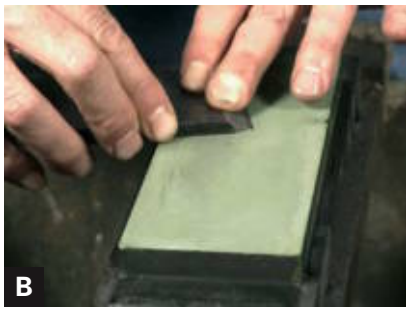
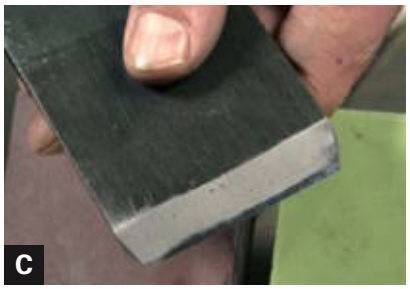

B


C


D


E

Honing Japanese Plane Blades

Place the bevel of the blade flat on the 1000-grit stone at an angle to the direction of motion **(A)**. Blades are typically very thick, so you can easily feel when the bevel is flat on the stone. Grip the blade firmly with both hands, and make short strokes back and forth across the stone. As you hone, work around the stone to minimize wear in one place. Work up through 2000- and 5000-grit stones, and finish on the 8000-grit stone. Back off the wire edge between grits by honing the back carefully **(B)**. The final edge is a bright line of polished steel backed by the soft iron **(C)**. Set the blade in the plane body, or dai **(D)**, adjust the blade depth, and you are ready to plane **(E)**.

Cross-Grain Nickers and Slitters

Many rabbet and combination planes have small cutters installed in front of the blade to slice wood fibers cleanly when the tool is being used cross-grain, as it would be in forming a tenon. These cutters are typically one of two types: a three-lobed cloverleaf nicker or a knifelike slitter.

Cloverleaf nickers are quite small and hard to handle. I made a simple tool holder by drilling and tapping a hole in the end of a metal rod so the nicker can be mounted securely. Once it's screwed in place, I grind a bevel on one lobe **(A)**. Grind the lobe so that it will project about 1/64 in. below the bottom of the plane sole when installed. Then hone the nicker **(B)**, running up through the grits (220, 1000, 4000 and finally 8000). Register the flat you have just ground on the stone, and move the nicker back and forth, maintaining the same angle. When you're done, the cutting edge should be razor sharp **(C)**. If you don't want to bother making a tool holder, try gripping the nicker with a pair of pliers.

Slitter-style cutters are like small knives, with either a double bevel, a single bevel, or a radiused point. Stone the flat of the leading edge, following the machined bevel **(D)**, then hone until sharp **(E)**. Once properly sharpened, the nicker will make a clean cut in wood, allowing the plane to work cross-grain without tearout or splintering the edge **(F)**.


A


B


C


D


E


F


A

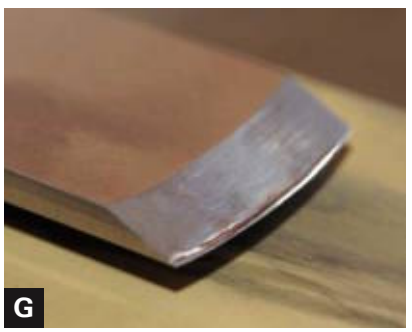

B


C


D


E


F


G

Scrub Plane Blade

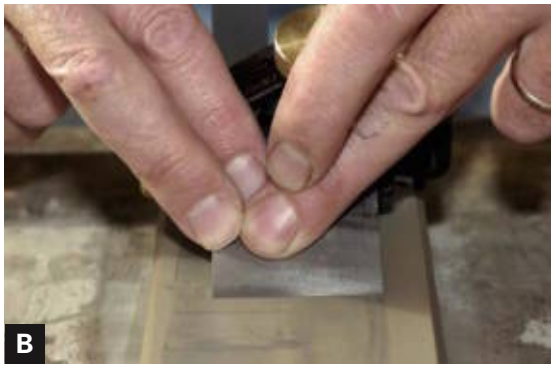
With its large-radius blade and open mouth, a scrub plane is used to remove a lot of wood in a hurry. Scrub plane blades are easy to sharpen. The exact radius is not important, and the curve of the blade does not have to be perfectly symmetrical to do a good job. It just has to be sharp.

After preparing the back of a new blade like any other plane blade **(A)**, you are ready to tackle the bevel. One easy way is to hold the blade vertically in a vise and start with the coarsest stone necessary **(B)**. Hold the stone flat against the bevel, and stroke the stone upward as you move it across the bevel. To hone with finer grits, I find it easier to work at the bench. Register the bevel firmly on the stone, and roll the blade from one side to the other as you move down the length of the stone **(C, D, E)**. Go all the way up through the grits as you would on any plane blade: 220, 1000, 4000, and finally 8000. When the edge is sharp, stone the back of the blade to remove the wire edge **(F)**. The finished edge should be consistently sharp from one side of the blade to the other **(G)**.

Cambering a Smoothing Plane Blade

Using a honing guide and your finest stone, take a half-dozen strokes while applying extra pressure on one side of the blade **(A)**. Repeat, applying pressure to the opposite side **(B)**. Check the edge with a straightedge or square **(C)**. Repeat this pattern of alternating pressure until the edges of the blade are lower than the center by the thickness of the shaving you want to take **(D)**. For smoothing plane blades, 0.006 in. is enough.

This technique is easiest using a honing guide with a narrow roller because it's harder to rock the blade from side to side with a wide roller. A more severe camber than shown would be much easier using the side-clamping jig, which has a very narrow roller.

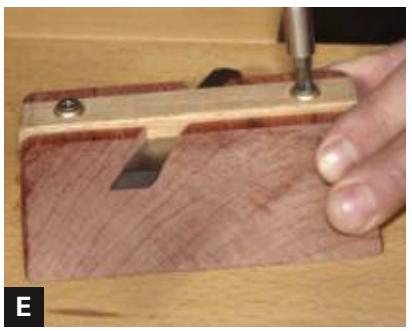



A


B


C


D


E


F


G

Honing a Skew Blade with the Veritas Jig

Skew blades cut very well, and it's worth taking care to sharpen them properly. Be sure to maintain the original angle of the blade. If in doubt, use a protractor to inscribe a line on the back of the blade for reference.

The Veritas honing guide is one of the few that will accommodate a skewed blade **(A)**. Set the blade in the jig, and register the bevel flat on the stone, being sure to make full contact all along the edge **(B)**. Adjust the cam on the Veritas jig to make a 1-degree or 2-degree secondary bevel, then hone using 220- through 8000-grit stones **(C)** to get a very sharp secondary bevel that extends evenly across the width of the blade **(D)**.

Some skew blades, such as those for side rabbet planes, are too narrow to fit in the Veritas jig. You can hone these freehand, but for accurate results, try making a simple shopmade jig **(E)**. This jig can be held in a vise, with the stones registered on the large, flat part of the jig **(F)**. Hold the stone and hone, using grits 220 through 8000. Remove the wire edge from the back of the blade **(G)**, and you're ready to go.

Beading Cutter for Wood Molding Plane

Beading cutters have one or more semicircular beveled edges flanked by flat bevels. Stone the flat bevels as you would any other blade **(A)**. For the semicircular bevels, prepare a dowel or other rod of an appropriate diameter with several grits of silicon-carbide sandpaper (I use three grits: 400, 600, and 1000). Use these to work around the inside of the cutter **(B)**, backing off the blade **(C)** to finish with a brightly polished cutting surface **(D)**. Test a freshly honed blade on a scrap of wood to make sure that it will cut the entire profile cleanly **(E)**.


A


B


C


D


E

Molding Cutter

Complex profile cutters can be handled by sharpening each part of the blade separately. First, flatten the back of the blade **(A)**, then stone the flat bevels either freehand **(B)** or by clamping the blade upright in a vise and holding the stone in your hand **(C)**. It is fairly easy to maintain the correct bevel angle this way. The curved sections of the blade can be honed with an abrasive-wrapped dowel **(D)**. Back off the blade as usual **(E)**, and you're ready to make some molding!

Chisels

Paring and Mortise

➤ Paring and Mortise Chisels (p. 105)

Japanese Chisels

➤ Japanese Chisels (p. 106)

Corner Chisels

➤ Sharpening Corner Chisels (p. 107)

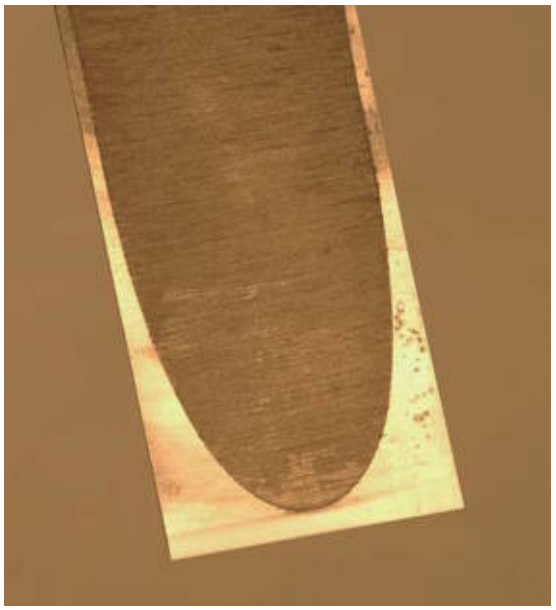
Chisels are about as basic as a tool can get, not much more than a length of steel and a wood or plastic handle. Available in many patterns and lengths, chisels also are very versatile. They can remove quantities of wood in a hurry or pare shavings as thin as paper tissue. Even a slick, the largest member of the chisel family, is capable of the most delicate and precise work (see the photo at right). They work best, however, with a very sharp edge.

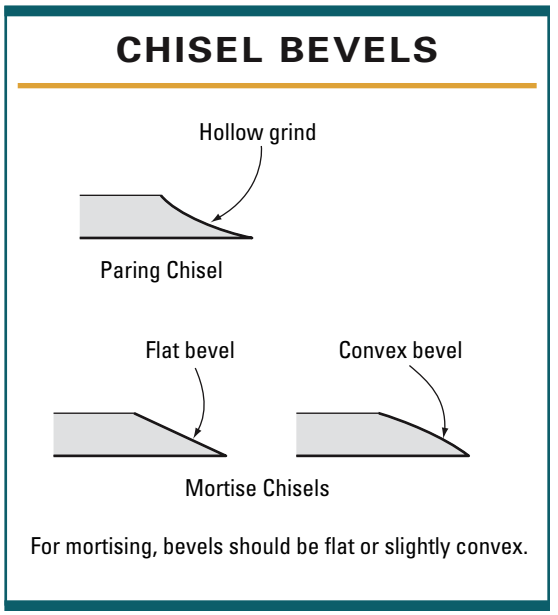
Chisels are made from steels similar to those used in plane blades and tempered to similar hardness. Most chisels made in the United States or Europe test from 58 to 60 on the Rockwell C scale. They can be sharpened easily with the same abrasives as plane blades: oilstones, waterstones or silicon-carbide paper. Japanese chisels, just like plane blades, are a lamination of a thin layer of hard tool steel backed by a thick layer of soft steel. The steel is typically harder than that in Western chisels, as much as Rockwell 64 to 65. This makes sharpening them a little slower. To make the process easier, the backs of Japanese chisels are hollowed (see the photo on p. 104).

Chisels work fine when the edge is not perfectly square to the sides (skew chisels, in fact, can be handy for reaching into tight spots). But using a honing jig makes it easy to get a square edge. Chisels for heavy work, on the other hand, are sometimes sharpened with a radius on the end for fast stock removal.

Even a giant slick, the largest of the chisel family, is capable of very fine work when carefully sharpened.

A hollow on the back of a Japanese chisel makes it easy to flatten the back.





Choosing a Bevel Angle

Manufacturers usually give chisels that are used for paring—such as bench and butt chisels—a 25-degree bevel. As is the case with plane blades, this makes a good general-purpose edge, but a bevel of 30 degrees will last longer in hardwoods. Mortise chisels are used to chop directly into solid wood, which is very tough on a thin cutting edge. Low-angle bevels are more likely to fold over when the chisel is struck with a mallet or hammer, so mortise chisels should get a bevel of 30 degrees to 35 degrees for added strength. While paring chisels may be hollow-ground on an electric grinder, mortise chisels will stay sharper longer if they have a flat, or even a convex, bevel.

For either paring or mortise chisels, secondary bevels work well to speed the sharpening process, just as for plane and spokeshave blades. Secondary bevels also help strengthen the cutting edge.

Corner chisels, which have the bevels on the inside of two perpendicular faces, require care to keep the edges straight and the bevels flat. The corner at the intersection of the bevels needs to be crisp and clean.

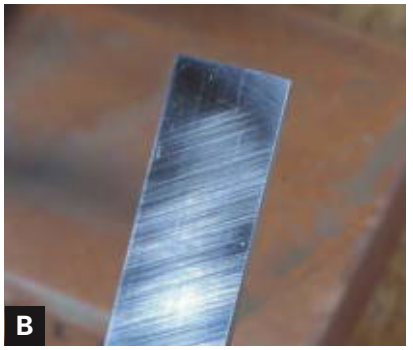
Start with a Flat Back

The first step in sharpening any kind of chisel is to prepare the back. On a new tool, remove all grinding marks left from the manufacturing process, especially near the cutting edge. A chisel for rough work does not need to have a mirror finish, but any chisel used for very fine work should. Be careful to keep the back flat while honing. Ordinarily, the back of a chisel must be flattened and honed only once. But after this initial preparation, it still doesn't hurt to touch up the back occasionally on a very fine stone—an 8000-grit stone for fine paring chisels and a 4000-grit stone for chisels used for rougher, heavier work.

Paring and Mortise Chisels

The first step in sharpening any chisel is to prepare the back, just as you would a plane iron **(A)**. Make sure to keep the chisel flat as you work it over the stone. If the back is very rough, start with a 220-grit stone, and work up through 1000, 4000, and 8000 grits until all scratches are removed and the back near the cutting edge is shiny **(B)**. Next, grind the bevel. If you're unsure what the bevel angle is, check it with a gauge before grinding **(C)**. It is easiest to keep a chisel square by using a jig that clamps the edges of the chisel. This honing guide has been modified by adding two pins **(D)** so it can be used more conveniently with the tool rest of a grinder. Set the chisel to the correct angle and grind **(E)**. If you're using a high-speed grinder, don't grind to the very edge of the bevel. Instead, leave a small flat. It will help you avoid burning the edge, but it's not necessary when using a slow-speed grinder like this Tormek. After grinding, set the chisel in the jig for a 1-degree or 2-degree secondary bevel and hone **(F)**, then back off the blade on the 8000-grit stone. If you record the distance the chisel must project from the honing guide to obtain a specific angle with a line on a piece of wood, you will be able to quickly set the next chisel to the same distance. Test for sharpness on end grain.


A

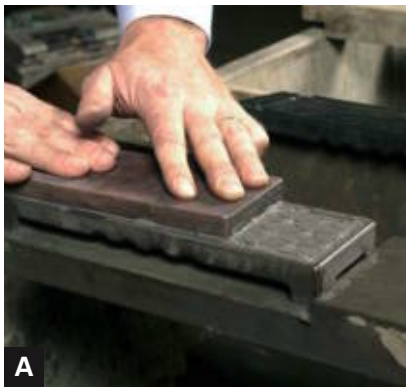

B


C

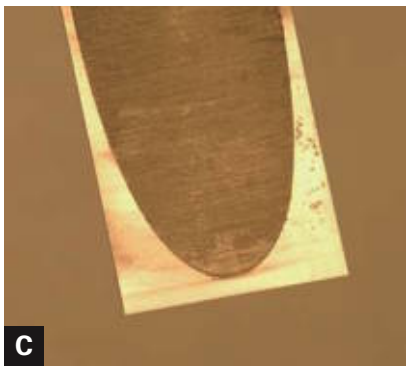

D


E


F


A

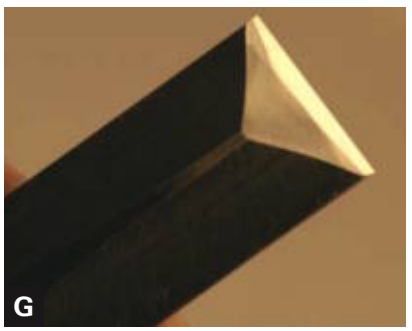

B


C


D


E


F

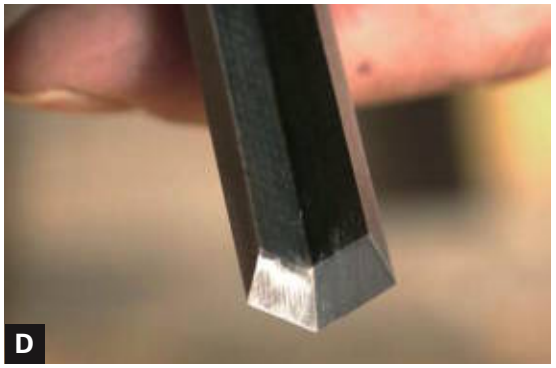

G

Japanese Chisels

Japanese chisels are honed as you would Western chisels, but they are not dressed on an electric grinder. Here, I'm using Shapton waterstones, which are specifically designed for Japanese steel. The stones have been flattened on a steel plate **(A)** with an abrasive compound to remove wear from previous use **(B)**. Hone the back of the chisel using successive grits (the Shapton stones come in 1000, 2000, 5000, and 8000 grit) until you get a mirror finish. Because the back of the chisel is hollow, this goes quickly **(C)**. Honing the bevel reduces the amount of material between the hollow and the edge, so the back of the chisel should be flattened periodically to restore it. Japanese chisels are not hammered out as are Japanese plane blades. The blade of this tool is short and the bevel is quite wide, so it is easy to hone freehand **(D, E, F)** to achieve a razor-sharp edge **(G)**.

Sharpening Corner Chisels

The first step in sharpening a corner chisel is to prepare the backs as you would a plane blade. The bevels are another matter. It is very difficult to grind the inside bevels of a corner chisel with home-shop equipment. The bevels of a new chisel should be straight and even. If they aren't, send it back. If you have to regrind a chipped or badly worn corner chisel, consider taking it to a machine shop. A certain amount can be done successfully by hand with a very coarse stone. But for touching up a dull corner chisel or preparing a new one, hold the tool in a vise and use a coarse slipstone **(A)**, then follow up with a fine stone, such as a hard Arkansas **(B)**. Back off on a fine stone **(C)** to remove the wire edge, and inspect the bevel **(D)**.



Spokeshaves and Beading Tools

Spokeshaves

- Flat Spokeshave Blade (p. 111)
- Concave Spokeshave Blade (p. 112)
- Razor Spokeshave Blade (p. 113)
- Cigar Shave Blade (p. 114)

Beading Tools

- Beading Tool Blade (p. 115)
- Making a Beading Tool Blade (p. 116)

Spokeshaves come in a variety of shapes and sizes. These tools are designed to work on curved or irregular surfaces where a flat-soled plane would be awkward or inefficient. Most spokeshaves are versatile tools, although some of them—such as the Preston Improved Circular Lamb-tongue Router—were made for very specific jobs and are very unusual.

Most spokeshaves available today are one of two basic designs. The most common type consists of a flat blade set in a metal body at 45 degrees to the sole, bevel down, and is essentially a kind of plane. Flat blades are sharpened just as plane blades, although their small size makes them a little harder to hold as they are sharpened. Manufacturers generally grind a 25-degree bevel on spokeshave blades, which is fine much of the time. But for hardwoods, an angle of 30 degrees to 35 degrees will give better edge life.

Blades are sharpened like plane irons, and the first step in readying a new blade is preparing the back. It should be flattened, with any manufacturing marks or defects removed, and then brought to a very fine polish with your finest stone. Like plane blades, spokeshave blades can be sharpened with a secondary bevel. This makes it easier to get a sharp edge quickly because less material must be removed from the bevel.

This specialized spokeshave is equipped with two blades and a mirror-image sole so it can be used in either direction.

Secondary bevels also can be used to increase the bevel angle and make the tool behave better in figured woods.

In addition to square blades, spokeshaves also are available with either convex or concave blades for shaping outside or inside curves. Convex blades can be sharpened on a stone or in a vise just as a scrub plane blade (see p. 98). Concave blades, on the other hand, can't be sharpened on a stone because of their shape. Instead, use slipstones or wrap a dowel whose diameter roughly matches the radius of the blade with silicon-carbide sandpaper. It's good to keep several grits of sandpaper on hand. I typically use 220-, 600-, 1000-, and 2000-grit paper. Where you start depends on how worn the edge has become and whether you must remove any nicks.

The other most common style is the razor shave. It consists of a short, wide blade set flush with the bottom of a wood or metal body. Because the bevel faces up, it represents the total included angle of cut and makes the razor shave a very low-angle tool indeed. The easiest way to sharpen these blades is to register the bevel firmly on the stone and sharpen them by hand.

Flat spokeshaves are sharpened on stones as any straight-blade tool would be.

Concave shaves are sharpened with abrasives wrapped around dowels.

Blades for razor-style spokeshaves are honed by hand on a stone.

Cigar shaves are an older design, made by Millers Falls and others until the early part of the 20th century. Although cigar shaves aren't quite as common these days, you can still find them. Cigar shaves have a semicircular cutter wrapped around a round body. The bevel is on the outside of the blade and also acts as the sole of the shave. Since the blade is quite thick, it is fairly easy to register the wide bevel on a stone without rocking it. Slipstones or similar tools are used to clean up the inside of the curved blade.

Beading Tools Are a Type of Scraper

Beading tools are really a kind of scraper used to form profiles. The edge of the blade is prepared without a burr at 90 degrees to the blade. Because the blade is set in the tool at 85 degrees, only the leading edge of the blade actually cuts the wood. This means that the blade can be turned around in the tool for a fresh edge when the first side becomes dull.

A cigar spokeshave has a semicircular blade whose bevel is honed on a stone. The inside of the curve is touched up with slipstones.

Beading tool blades are sharpened by honing the flat on the blade only. Once in a while, the shape itself may have to be honed with slipstones to restore the edge or remove a nick. This requires both good light and patience.

Make Your Own Cutters

One advantage of a beading tool over a tool like a router or shaper, at least for small runs of material, is that custom-shaped cutters are easy to make. This is a big advantage when you're trying to reproduce a piece of molding or a particular edge profile for which no standard cutters are available. A profile is scribed on a blank of unhardened steel roughly 1/16 in. thick, then shaped with files. An unhardened blade is easy to shape, and the edge will work for quite a while. This is a good way to make shorter lengths of special molding quickly. If you expect to use the tool a lot, however, the blade should be hardened. If you start with hardened steel, it will have to be shaped with a grinder because a file isn't hard enough to cut it.

Beading tools can be pushed or pulled, with or against the grain. Avoid too much downward pressure, and let the tool do the work. If you get chatter, lighten up on the pressure, reverse the tool in the cut, and work in the opposite direction.

A scratch stock is essentially the same thing as a beading tool, except that it doesn't have a factory-made handle that holds the blade. Blades are made the same way. Furniture makers often mount a hand-shaped blade in a block of wood to make it easier to use. They can be made from small pieces of thin steel—old hacksaw or bandsaw blades, for example—that otherwise would be thrown away.

Flat Spokeshave Blade

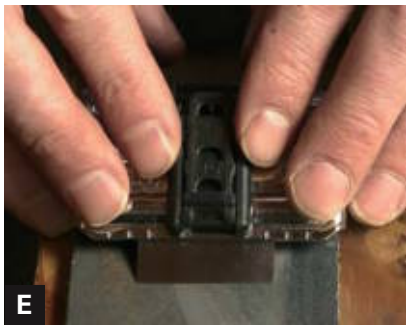
Flat blades can be sharpened on waterstones or oilstones or on different grits of sandpaper as they are here. Start by gluing pieces of silicon-carbide paper to a piece of plate glass with spray adhesive. I'm using four grits: 220, 600, 1000, and 2000. Hone the back of the blade first **(A)** until the surface is smooth and polished **(B)**. Smaller spokeshave blades are short and don't fit in most jigs, but the Stanley jig will work for some of them **(C)**. Bevel angle is determined by the amount of blade that extends beyond the edge of the jig **(D)**. Another option is to bolt the blade to a small block of wood, then clamp the assembly in the honing guide or hone the bevel freehand. After preparing the back, hone the bevel on progressively finer grits of paper **(E)** until you are satisfied with the edge **(F)**. Then back off the blade on your finest grit to remove the wire edge **(G)**, and try the spokeshave on a scrap of wood **(H)**.


A

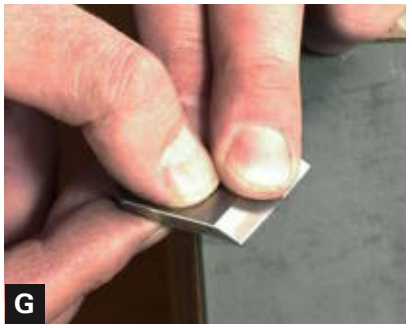

B


C


D


E


F


G


H

Concave Spokeshave Blade

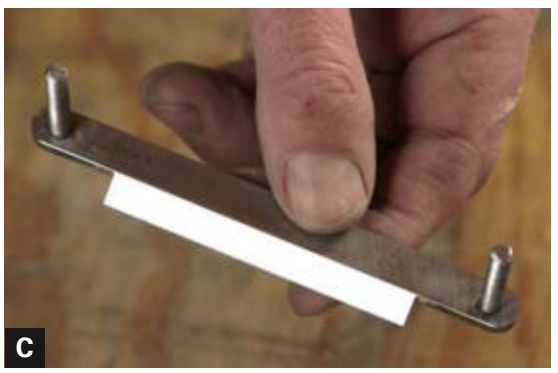
Use slipstones or a large-diameter dowel wrapped with abrasive paper **(A)**. Cut pieces of paper large enough to wrap around the dowel, spray the back of the paper with adhesive **(B)** and roll the paper tightly to the dowel **(C)**. Roll a different grit paper on each end of the dowel (you'll need two dowels and four grits of paper). After preparing the back of the blade **(D)**, clamp the blade upright in a vise **(E)** and hone the bevel **(F)**. It helps to roll the dowel across the edge with each forward stroke. The finished blade should have a smooth radius **(G)** and cut cleanly **(H)**.

Razor Spokeshave Blade

There are various types of razor shave blade designs. Most, but not all, have threaded posts or forged tangs used to hold the blade in the body of the shave. Hone the back first **(A)**, just as you would a plane blade. If you're using sandpaper, switch to waterstones to sharpen the bevel so the posts on the blade don't get in the way **(B)**. Move up through the grits, beginning with a 1000-grit stone and ending with an 8000-grit stone **(C)**. Because the bevel is wide, it's easy to keep it flat on the stone. You won't need a jig. When you're finished, test the shave on a piece of wood **(D)**.


A


B


C


D


A


B


C


D


E


F


G

Cigar Shave Blade

Cigar shave blades are somewhat difficult to hold. Register the bevel flat on a stone **(A)** or abrasive paper and hone **(B)**. Keep the bevel angle constant as you move the blade over the stone. If you blacken the bevel with a marker first **(C)**, it will be easy to monitor your progress by watching where the stone has removed the dye **(D)**. It may be easier to do the final honing with the blade held in a vise **(E)**. The inside of the tightly radiused blade also needs attention. Use an abrasive-covered dowel **(F)** or a slipstone **(G)** to work this carefully without rounding it over.

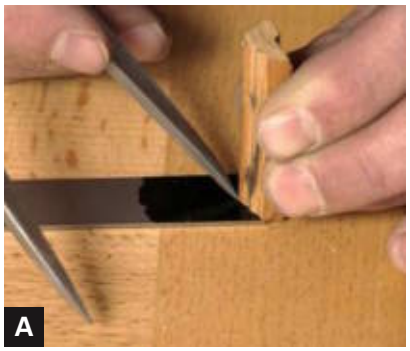
Beading Tool Blade

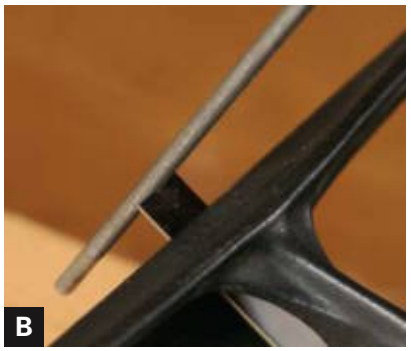
Beading tool blades are usually sharpened only by stoning the flat face **(A)**. It isn't necessary to give the blade a mirror surface. I usually start with a 1000-grit stone, then move to a 4000-grit stone and that's enough. You can skip the 1000-grit stone if the blade is not overly dull and just use the 4000-grit stone for light touchups. The back of the blade should be smooth and shiny when you're finished **(B)**. The beading tool blade is held in the tool with a slight forward angle, so if you stone both sides of the blade, you will have two cutting edges and can turn the blade around in the tool when the first edge gets dull. After a lot of use, the profile of the blade may need touching up. This can be done with slipstones **(C)**. Be careful to keep the stones at 90 degrees to the blade. If you do need to touch up the edge, do that first and then hone the sides of the blade flat.


A


B


C





Making a Beading Tool Blade

Beading tool blades are very easy to make using a small tool steel blank. Start by blackening one side of the blank with a marker and tracing the profile with a sharp scribe **(A)**. Put the blank in a vise and start filing **(B)** with the largest file that will fit within the scribe marks. You may need several files, both flat and round, to get the profile right. Finish the profile carefully, and make sure to keep files square to the blade **(C)**. When you are satisfied, hone the blade on a 1000- and 4000-grit stone **(D)** until the flat sides are polished smooth **(E)**. The blade is now capable of making a faithful reproduction of the original molding **(F)**.

Scrapers

Card Scrapers

➤ Card Scraper (p. 122)

Curved Scrapers

➤ Curved Scraper (p. 123)

Scraping Planes

➤ Scraping Plane Blade (p. 124)

Scrapers are a group of finishing tools that are used with the blade almost vertical to the surface of the wood. Because the blade angle is so high, scrapers won't lift wood fibers, so they won't tear even difficult and wild-grained woods. Scrapers are useful when even a very sharp handplane is unable to produce a clean surface and when working around an area where the grain changes. Scrapers can be used to work the entire surface or just a particularly stubborn spot.

Scrapers come in several styles, but the most common is probably the hand scraper, also called a card scraper. It's a rectangle of thin, flexible steel made in a variety of thicknesses and in both straight and curved patterns (see the photo at right). Hand scrapers are held with both hands and

Card scrapers are simple, effective tools available with curved as well as straight edges.

Cabinet scrapers make extended work periods easier, and fingers stay cooler.

A scraping plane has a much larger sole than a cabinet scraper, and some come with thick blades that do not need a burr.

slightly flexed, then either pushed or pulled across the surface of the wood to produce a shaving. A cabinet scraper consists of a cast-iron body in which a scraping blade is clamped (see the photo above). A thumbscrew flexes the blade, so the tool is more comfortable to use, and a broad sole makes the scraper useful for smoothing large, flat surfaces. A scraping plane is an even heavier tool with a longer sole and sometimes a thicker blade (see the photo at left). Hand scrapers and cabinet scraper blades are sharpened the same way. Scraping planes can be a little different.

A Burnishing Tool Creates the Cutting Edge

A square edge on a scraper blade will produce shaving. In fact, pieces of glass have been used as effective, if dangerous, scrapers. But a better, longer-lasting edge is made by rolling a very small hook or burr of metal along an edge that has been filed and honed

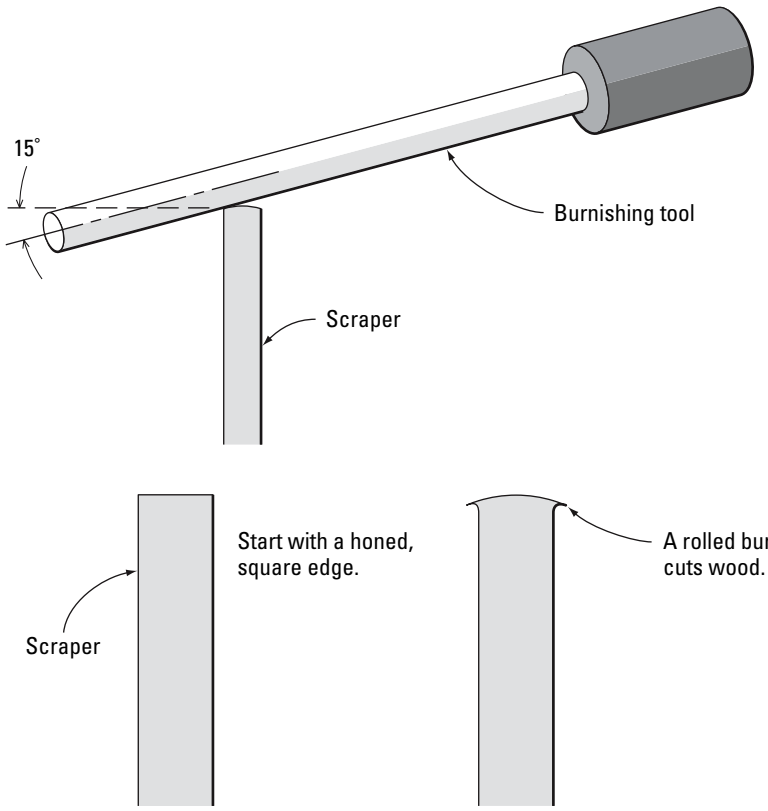
square. The burr is created with a burnisher, a triangular, round, or oval piece of steel made harder than the scraper so it can shape the edge without being damaged (see the photo below). Another type of burnisher is a block of wood with a steel rod or wheel mounted inside. These allow you to exert more pressure on the blade safely and form a burr at a preset angle. In a pinch, you can use just about any smooth steel rod to form a burr. The shaft of a screwdriver, for instance, will work, although it is not as hard as a tool made expressly for burnishing.

Producing a fine burr on a precisely squared edge is the key to sharpening a scraper. It's a two-step process. After the scraper has been filed and honed, it is mounted in a vise. The burnisher is held in both hands and drawn along the cutting edge at a slight angle with firm, downward pressure. Six to 12 strokes on each edge should be enough to roll a burr. Burnishing a scraper can be dangerous because it takes some force to roll the metal over. If you slip, you may cut yourself on the exposed edge. Some burnishers have a guard on the handle to minimize the risk (see the top photo on p. 120).

Begin by holding the burnisher at 90 degrees to the scraper, and with successive strokes drop the outer end of the burnisher about 15 degrees to roll the burr off the

Burnishing tools, whether triangular, round, or oval in cross section, are made of polished, hardened steel.

BURNISHING A SCRAPER



A guard on the handle of this burnisher helps prevent an injury in case of a slip.

A sharp scraper produces thin shavings, much as a plane does.

When a scraper makes sawdust instead of clean shavings, it is dull.

edge. Each edge gets a burr, so when you're done you will have four cutting edges. You can even sharpen the short ends of the scraper. It is not difficult to roll a burr, but it does take some practice and experimentation to learn what kind of edge works best. It's easy to turn the burr too far. A very pronounced burr dulls quickly, but a burr that has not been rolled enough won't cut wood effectively. A good edge is a compromise between the two, and that takes practice.

It's easy to tell when a scraper has a good edge. You can feel the tool cutting, and it should produce a shaving (see the top photo at left). A dull scraper makes sawdust (see the bottom photo at left). Like plane irons, scrapers can be touched up when the edge dulls slightly without completely rebuilding the edge. As the burr wears, use a burnishing tool to roll over a bit more metal from the edge. In time, this will no longer be effective and you will have to start at the beginning with a file and stones, then a burnisher.

USING A LOW-ANGLE PLANE AS A SCRAPER

Brian Boggs, a chairmaker in Berea, Kentucky, sometimes uses a low-angle plane as a scraper. He simply grinds back the end of the blade so there's a flat about 1/16 in. wide at the very end (see the top photo at right). The flat and back of the blade are then honed. Set up this way, the plane becomes a scraper plane capable of smoothing curly maple and other woods that don't respond well to a regular plane (see the bottom photo at right). The obvious disadvantage is that it would take a lot of work to restore the blade for use as a plane, so this technique is good in a real pinch or if you have an extra blade you're willing to devote only to scraping.

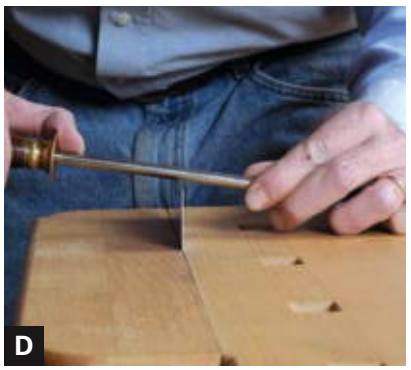
When you are resharpening, the edges must be brought back to 90 degrees. That means honing off any re-maining burr on a stone before reburnishing.

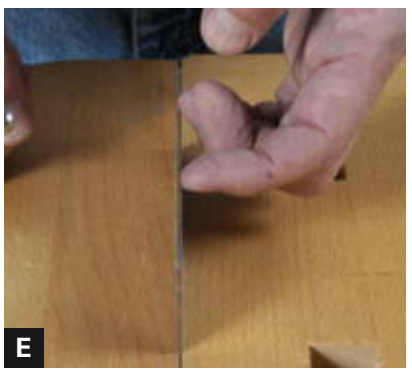
Scraping Planes

A card scraper is quick to prepare and very effective, but using one for any length of time can be hard on the hands. Friction heats the blade, enough so that some woodworkers are forced to wrap their fingertips in tape. Scraping planes give you something more comfortable to hold, and their flat soles help keep the wood surface flat and true.

Many scraping planes have thin blades, just like hand scrapers, and they are prepared with a burr in exactly the same way. On some, the blade is at a fixed angle in the tool; on others, the angle is adjustable. Depending on the burr, the angle of the blade can be adjusted to get the best cut, just as you would with a hand scraper. In fact, an easy way to set the best angle in your scraping plane is to try the blade by hand to see what angle works best, then set the angle to match.

Other scraping planes have thick blades with a beveled edge. These can be prepared with a burr as well. But if sharpened and honed like a plane blade, with no burr at all, the thick blades work very well. This eliminates forming a burr entirely, which can be an advantage.





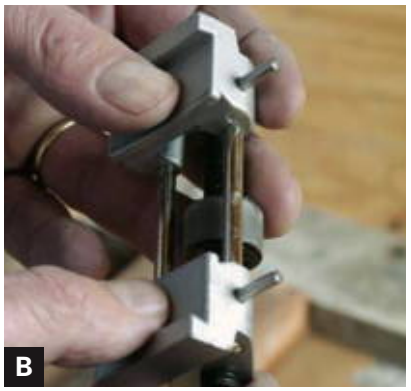
Card Scraper

The first step in sharpening a card scraper is to file the edge square. Hold the scraper in a vise, and use a fine file, such as a mill bastard **(A)**. Take light strokes. Hone the filed edge first with a 1000-grit stone and then with a 4000-grit stone, either by keeping the hand scraper in the vise and holding the stone **(B)** or by taking the scraper to a bench-mounted stone. Be careful to keep the scraper square to the stone. Then hone the flat sides of the scraper on a 1000-grit stone to remove any burr caused by filing **(C)**. Now you are ready to roll a burr with a your burnisher. To create a burr, hold the scraper upright in the vise. Begin by holding the burnisher at 90 degrees to the blade, then increase the angle with successive passes **(D)**. Use firm pressure. Work the edge until you can feel a distinct hook all the way across the edge **(E)**. Be careful not to cut yourself on the upright scraper! A properly sharpened scraper will produce shavings, not dust **(F)**.

Curved Scraper

A curved scraper is sharpened exactly the same way as a straight one. Start by honing the sides flat **(A)**. Holding the scraper in a vise, file **(B)** and stone **(C)** as much of the curved edge as you plan to use. Be careful to keep the file and stone square to the scraper. Then burnish **(D)**. The scraper is ready to use **(E)**.


A


B


C


D


E

Scraping Plane Blade

Many scraping planes have thin blades and are sharpened with a burr just as card scrapers. Others have thick blades that do not flex in use. These are prepared as you would a plane blade. Some blades are 2⅞ in. to 3 in. wide and will fit in very few sharpening jigs. The side-clamping type is one that will take such a wide blade **(A)**. This jig can be modified by drilling and installing two small pins **(B)** that slide along the top of the grinder's tool rest **(C)**. Grind a bevel of 45 degrees (it doesn't have to be exact) then hone both the back and the bevel and establish a secondary bevel, just as you would with any plane blade **(D)**. To set the blade, lay the tool on a flat surface, and drop the blade with some pressure on the top. A shim of paper under the front of the tool **(E)** may be necessary to elevate the sole slightly. Don't try to set the blade too deep or you will get chatter, not clean shavings.

Drills

Twist Drills

- Twist Drill with a Jig (p. 129)
- Sharpening a Twist Drill by Hand (p. 130)
- Split-Point Drill (p. 132)
- Brad-Point Drill (p. 132)

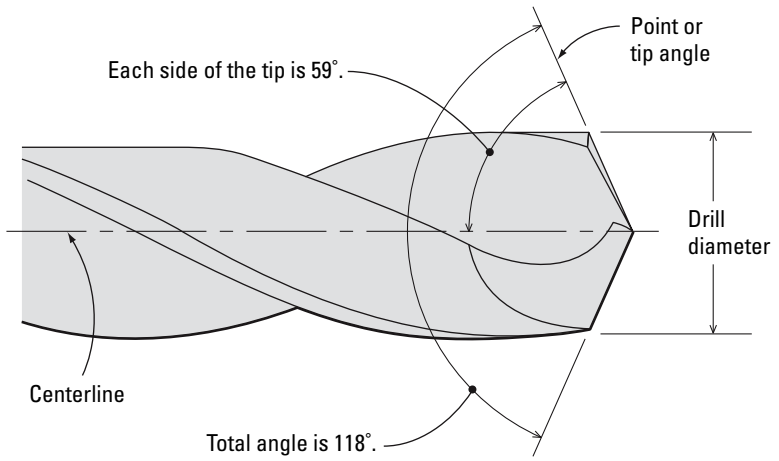
Augers

- Auger Bit (p. 133)
- Adjustable Auger Bit (p. 133)

Specialty Drills

- Spade Bit (p. 134)
- Forstner Bit (p. 135)
- Hollow Chisel Mortiser (p. 136)
- Plug Cutter (p. 138)
- Awl (p. 139)
- Spoon Drill and Taper Reamer (p. 139)
- F-Hole Cutter (p. 140)

DRILL-POINT ANGLE



There are a number of specialized drills available to woodworkers. Most of them, such as auger bits and hollow-chisel mortise bits, are easy to keep sharp using files and slipstones. The easiest way to sharpen a common twist drill is to use a drill-grinding jig and a bench grinder. Twist drills, especially small ones, are inexpensive. Learning to sharpen them is not going to save much money, but it will give you the ability to modify them for special tasks and to keep them in top shape. You should not have to use a dull drill because you don't have a new one at hand.

The drill-point angle on a twist drill is typically 59 degrees when it comes from the factory, which is good for most purposes. A sharper point is better for woodwork. You can alter the point angle depending on the material you are cutting (see the chart below). The cutting edge, or lip, of the drill

Point Angles

This is a general guide to useful point or tip angles for different materials, measured from the centerline of the drill (the angle of the tip itself is double).

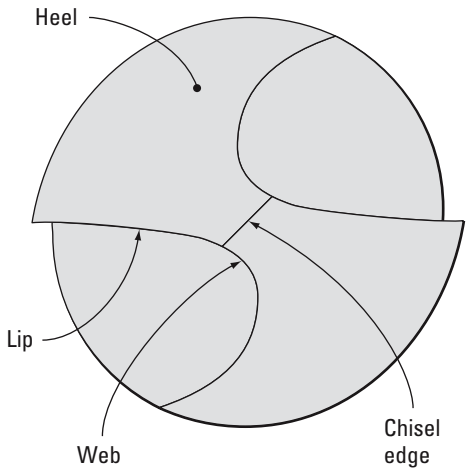
88° - Very hard or thin materials

68° - High-production metal cutting

59° - General purpose

49° - Soft materials, such as copper, wood, and plastic

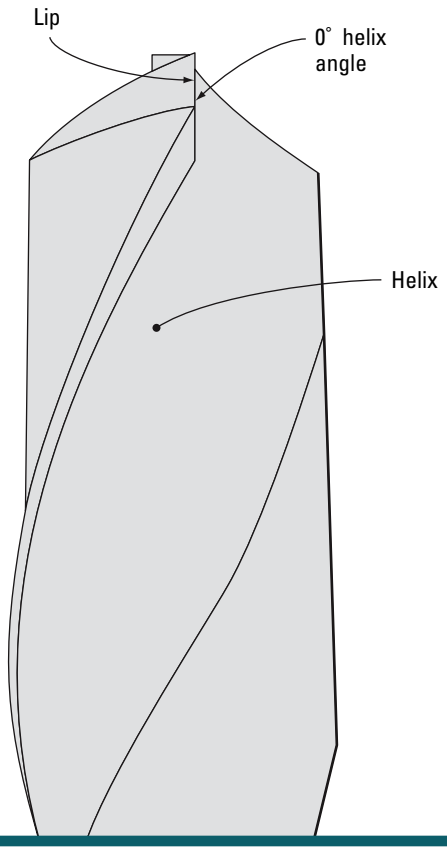
STANDARD TWIST DRILL



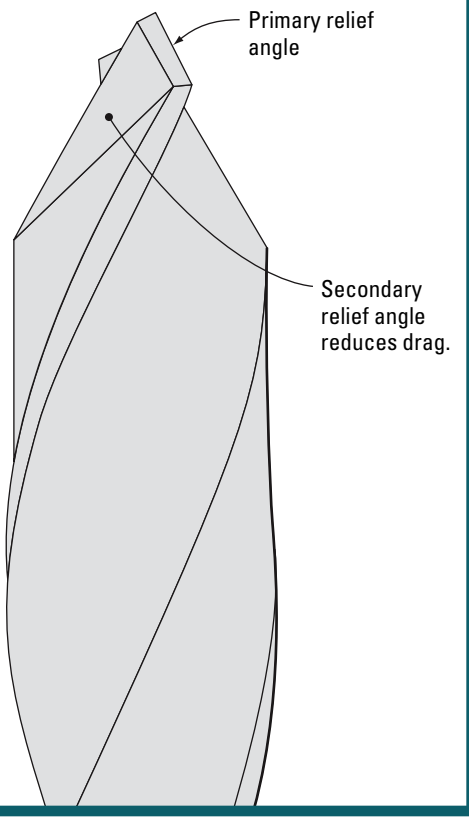
is formed by the point angle and the helix that forms the shank (see the top drawing at left). The underside of the cutting edge is called the helix angle or rake angle. As the drill turns, the helix tends to pull the drill into the work. This is fine except when you are drilling thin materials, such as sheet metal, or drilling through soft metals like brass. As the drill breaks through, it tends to grab the work. This tendency can be eliminated by grinding the helix angle to 0 degrees (see the bottom drawing at left).

The heel of the drill, behind the cutting edge, may cause drag, especially on larger drills. If so, grind a relief on the heel (see the

MODIFIED HELIX ANGLE



SECONDARY RELIEF ANGLE



drawing bottom right on the facing page). The angle of this relief is not important.

The chisel edge of a twist drill can skate across the surface of the workpiece before it grabs, a frustration that also mars the work. One solution is to grind a split-point pattern on the tip. On this grind, the relief angle is extended as the back relief until it meets in the middle, creating a point that is easier to keep centered (see the top photo at right).

Brad-point drills have a long center point and two long cutting spurs, which make them very good for cutting clean holes in wood. There are several types of brad-point drills (see the center photo at right). The flutes of these bits can be touched up with slipstones.

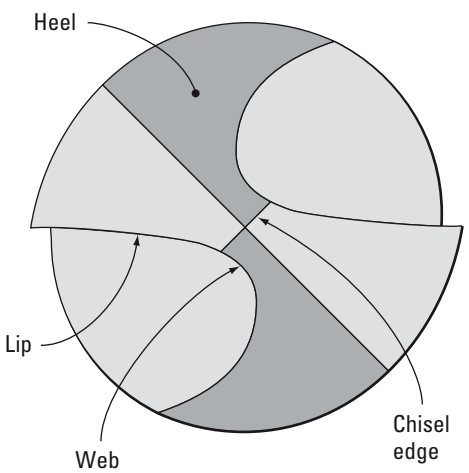
Auger bits and adjustable auger bits are sharpened on the cutting edges and on the inside of the lips (see the bottom photo at right). Use an auger-bit file, which has safe (or untoothed) edges, to avoid damaging parts of the bit that you don't want to file. Finish up with a fine India slipstone.

A split-point grind is easier to keep centered when starting a hole than is a standard grind.

Two types of brad-point drill, one with cutting spurs and one without.

A lead screw at the end of an auger bit draws the tool into the work while sharp spurs and cutting edges create the hole.

SPLIT-POINT DRILL



Occasionally, damaged lead screws will need filing with a triangular file.

Spade drills (see the photo below) tend to get abused. A few minutes with an 8-in. smooth file or auger-bit file will restore the edges. Follow the existing geometry, and file all the cutting edges. The spade drill is the only drill on which you can safely work the outside diameter to create a custom-sized drill.

Spoon bits can be kept sharp easily with slipstones. Honing compound or diamond paste is useful for finishing the inside edge; the curved outside should be honed or stropped, at least near the cutting edge.

Forstner bits (see the photo below) are easy to sharpen with slipstones as long as you are careful to follow the existing geometry of the bit. Make sure to keep the rim slightly higher than the cutting edges to guide the bit in the wood. Don't force a Forstner bit into the wood, and keep the bit clean. It is much easier to sharpen if you don't let it get too dull in the first place. Toothed Forstner bits can be touched up with a file.

With a few simple tools—8-in. smooth and auger-bit files, coarse and fine triangular slipstones, and diamond files—you can sharpen most woodworking bits. Twist drills can be kept sharp easily with a bench grinder and simple grinding jig. Keep your drills sharp to get the most out of them.

Spade drills are available with and without spurs on the outside edges.

WARNING **To avoid eye injuries, make sure your bench grinder is equipped with safety shields, and always wear eye protection.**

Forstner bits, both traditional and toothed models, cut flat-bottomed holes. The sharp rim of the tool should be higher than the cutting edges.

Twist Drill with a Jig

Sharpening a twist drill is straightforward, but it takes practice. Getting started with a jig mounted next to your bench grinder, such as this one made by General, can help you learn the basics and, eventually, allow you to sharpen bits free-hand. The General jig is adjustable for point angle, and it rotates to bring the bit against the side of the grinding wheel. Adjust the jig for the tip angle you want **(A)**, and install the bit. Adjust the drill-length stop on the jig so the point of the bit just clears the angled stop **(B)**. Rest the inside of the bit against the angle stop, and tighten the clamp. Move the jig forward until the tip of the drill bit contacts the grinding wheel.

It is easy to burn the drill by forcing it against the grinder, so go slowly, and back off often until you are able to rotate the drill freely against the wheel **(C)**.

When the first side of the drill has been sharpened, loosen the clamp, rotate the drill 180 degrees, set the front against the angled stop, and do the second side. If you are changing the tip angle significantly or trying to salvage a badly damaged bit, it is a good idea to go through this procedure at least twice. Remove the bulk of the material on the first pass, and create a finished edge on the second.

[VARIATION] Things can happen fast on a bench grinder with a hard stone. A more forgiving tool is a 1-in. belt sander. It will do as good a job, and it won't burn the drill as easily.


VARIATION

Sharpening a Twist Drill by Hand

Jigs help you get repeatable, accurate results, but they do limit your flexibility. With a little practice on some dull drills, you can learn how to sharpen very nicely by hand. This allows you to make alterations to tip and rake angles easily, which will improve the bit's performance in certain applications. With a light touch, you also can control the surface finish on the drill, which contributes to good edge life and clean cutting.

The first step is to dress the grinding wheel **(A)** to make sure it is flat and smooth. Lightly dress the side of the wheel as well as the face to create a sharp corner.

The head of a new drill has a curved surface, which prevents the trailing edge of the tip from rubbing against the wood and interfering with the cut. The General drill jig will reproduce that geometry, but the surface behind the cutting edge really doesn't have to be curved. A flat relief angle works just as well, and it's much easier to produce when you're sharpening by hand.

Stand comfortably in front of the grinding wheel. Hold the drill bit perpendicular to the grinding wheel. Move the back of the drill to your left, and align the left-hand side of the drill tip parallel with the face of the grinding stone. Support your hands on the tool rest, then drop the back of the drill between 10 degrees and 15 degrees to create the tip angle. Press the bit against the wheel lightly **(B)** and check your progress as you go.

When you're satisfied with the angle, lightly touch the bit on the wheel until you see sparks coming over the top of the cutting edge, which means you've ground enough **(C)**. When you have finished with one edge, rotate the drill 180 degrees and repeat the process. When you're finished, you should have a fresh tip angle on each side of the bit **(D)**.

If you want to change the drill-tip angle, measure the existing angle **(E)**, and move the back end of the drill to the right or left to create the new angle you want. Grind with a light touch, and check the angle of the finished edge. Both ground faces should be the same angle.

To grind the rake or helix angle, hold the drill with one cutting edge parallel to the side of the grinding wheel. Drop the end of the drill so you can see what you are doing, and lightly touch the edge to the wheel to create a very small flat **(F)**. Repeat on the other side.


C


D


E


F

Split-Point Drill

When a steep secondary relief angle, roughly 60 degrees, is ground on each flute from the edge to the center of the tip, you create a split-point bit. The advantage of this geometry is that the bit won't wander or skate on the surface when you start the hole **(A)**. Start by roughing away the bulk of the material **(B)**. Align the corner of the wheel with the center of the drill, then sneak up on the tip carefully **(C)**. If you place a straightedge on the tip of the drill, it will touch only one point.

Brad-Point Drill

It is not practical to regrind a brad-point drill in the home shop. A little work with a triangular slipstone on the tips and flutes, however, will prolong the bit's life and improve performance. Before you start, blacken the end of the bit with a felt-tip marker so it will be obvious where the file or hone is removing material **(A)**. Then use the slipstone to sharpen the tip **(B)**, but use gentle pressure and try not to remove much metal. You can also hone the underside of the cutting edge **(C)**, once again not removing a great deal of material and making sure that the two cutting edges of the bit are symmetrical when you're finished.

Auger Bit

An auger bit is not difficult to sharpen, assuming it was made properly in the first place, but you will need an auger bit file, which has smooth edges (what's called a "safe edge"). Start with the spurs **(A)**. Keep the file flat against the inside surface of the spur at a consistent angle. File both spurs on the inside only, removing the same amount from each. Then file the cutting lip maintaining a consistent angle. If necessary, lightly file the bottom edge of the cutting lip as well **(B)**. The lead screw on an auger can be touched up with a triangular file or a feather file **(C)**, but this is not a normal part of the sharpening process. It is only necessary if the lead screw has become damaged.


A


B


C

Adjustable Auger Bit

The adjustable auger bit is sharpened very much like a standard auger. Start by removing the adjustable cutter from the shank of the tool **(A)**. File the bevel of the cutting lip first **(B)**, then file the spur and the cutting lip **(C)** of the removable blade. You can also use slipstones **(D)** to work the curved underside of the cutting lip.

A new adjustable auger bit may also need a bit of work to remove manufacturing burrs and to smooth up the little dovetail groove that the adjustable blade rides in **(E, F)**. When all the parts have been sharpened and deburred, the auger can be reassembled, in much better condition than when you started **(G)**.


A


B

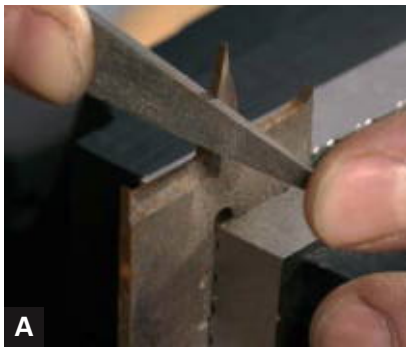

C


D


E


F


G


A


B


C


E


D

Spade Bit

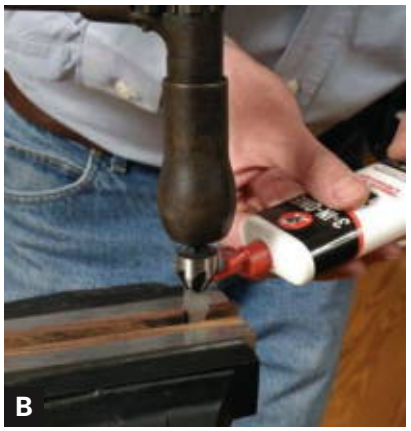
It may seem unnecessary to sharpen a spade bit because they are so inexpensive and so often used for rough work. But a few minutes spent with an auger-bit file, especially on a used bit, will make it cut much more cleanly and easily. Clamp the drill firmly in a vise **(A)**, and file the center point first, taking a few strokes on either side. File the flat cutting surface **(B)** and the scoring points **(C)**. Finally, touch up the small groove in the center of the point **(D)**. You don't have to remove a lot of metal, just enough so that the cutting edges have been dressed. Check with a square when you are done **(E)** to make sure the cutting surfaces are even.

Forstner Bit

Forstner bits must be kept sharp to work properly. They are prone to overheating, and any buildup of wood resin on the outside diameter must be removed before sharpening. Use mineral spirits and a piece of Scotch-Brite or very fine sandpaper to scrub the surface clean.

There are two cutting edges to address. First is the inside bevel of the bit. A medium India round slipstone can be used, or you can wrap some 180-grit sandpaper around a small-diameter dowel **(A)**. Draw the abrasive across the bevel while moving around the edge **(B)**. Hone until the bevel is flat and comes to a sharp edge. The top and bottom of the cutting edges should be worked with an auger-bit file or slipstone **(C, D)**. Touch up the centering point if necessary, and you're done **(E)**. Keep the cutting edges the same height. Because the rim guides the bit, cutting edges should be about 0.005 in. lower than the height of the rim.


A


B


C


D


E


F

Hollow-Chisel Mortiser

These cutters consist of two parts: a hollow chisel with very sharp edges that shears the sides of the mortise and an augerlike drill bit that turns inside to bore the center of the mortise and remove the waste. Both parts should be kept sharp. For the chisel, you should use a reamer, a special tool that is something like a countersink **(A)**. The pilot of this reamer is specific to the size of the chisel being sharpened, and you have to make sure that your sharpener is made for the brand of chisel you are sharpening. It is only necessary to use this reamer if the tool you are sharpening is very dull. If not, you can go right to slipstones.

To use the sharpener, mount it in a bit brace, lubricate with a little oil, and rotate the reamer slowly until you have cleaned up all the way to the points on the chisel **(B)**. For the next step, use medium India slipstones **(C)**, and work all the way around the inside. Finish the chisel by stoning all four outside faces lightly to remove burrs

from sharpening and to clean up and smooth any rough edges **(D)**. Use the same number of strokes per side. A few strokes on a 4000-grit stone should be enough to bring the surfaces to a good polish **(E)**. This is especially important with a new chisel because it is likely to have mill marks on it that increase friction and make it harder to withdraw the chisel from the work **(F)**.

The drill that fits inside the chisel is very much like an auger bit. Start by filing **(G)** and stoning **(H)** the inside of the lip. The single cutting edge needs to be filed on the top and bottom **(I, J)**. Sharpen the edges of the auger by rolling the bit over a stone **(K)** or by working it with a fine India stone **(L)**. When you are done, deburr the outside edge on a fine stone **(M, N)**.


G


H


I


J


K


L


M


N


A


B


C


D

Plug Cutter

Plug cutters definitely benefit from an occasional touch-up. On the four-flute type, use a file, a diamond file, or a stone to dress the end of each flute lightly **(A)**. Then stone the inside edge **(B)** on the side of a fine (4000- to 8000-grit) water-stone. Take the same number of strokes on each edge to keep the plug cutter's flutes equal in length and thickness.

The barrel-type plug cutter has one cutting edge that can be sharpened with a file **(L)** or a stone. The beveled end of the tool can be stoned or lightly dressed, if necessary, on a fine deburring wheel **(D)** or on a fine belt sander. Apply gentle pressure, and rotate the tool against the abrasive, being very careful not to grind the filed cutting edge as you rotate the cutter.

Awl

Sometimes called a birdcage awl, this square-shanked tool **(A)** is great for drilling through thin material or for starting holes for screws. It can easily be kept sharp by using a file **(B)**. Lightly file each side of the square, tapering down to a sharp point.


A


B

Spoon Drill and Taper Reamer

The spoon drill is a wonderful cutting tool favored by chairmakers, and it's easy to sharpen **(A)**. You can work inside the cutting edge with a small, round slipstone. Hold the slipstone at about a 25-degree angle, and work all the way around the radius on the inside. Follow up with fine slipstones or diamond paste on a dowel **(B)**. Carefully maintain the angle of the inside curve while doing this. The curved outside also needs to be addressed if it is not smooth. This can be done with various hand stones, but a soft deburring wheel or a power hone setup like a Tormek **(C)** works very well and produces a mirror image **(D)**.

The chair-maker's reamer is a very simple tool that just requires occasional stoning on the inside of the cutting edge **(E, F)**.


A


B

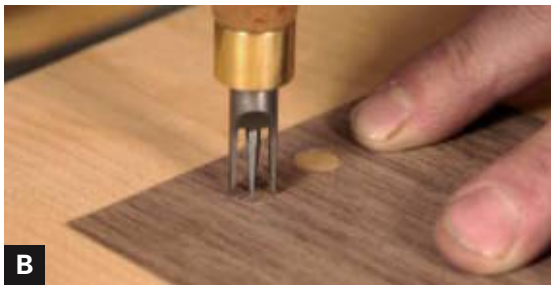

C


D


E


F


A


B


C


D


E

F-Hole Cutter

This unique instrument maker's tool **(A)**, used for cutting F holes in violins and other instruments, also cuts veneer very cleanly **(B)**. Sharpening is simply a matter of attending to the inside surface of the cutting edge. Use a marker **(C)** to help guide your work, and use an auger-bit file **(D)** or a fine slipstone to get the edges flat. When you are finished, lightly deburr the outside edge with a fine stone **(E)**.

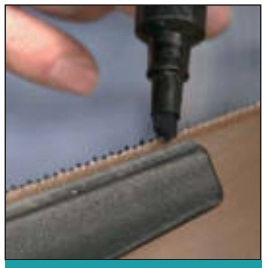
Handsaws

Jointing and Setting

- Jointing and Setting the Teeth (p. 150)
- Checking and Adjusting the Set (p. 151)

Ripsaws

- Sharpening a Ripsaw (p. 152)
- Sharpening a Japanese Ripsaw (p. 153)



Crosscut Saws

- Sharpening a Crosscut Saw (p. 154)

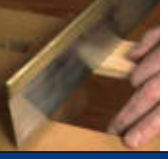
Veneer Saws

- Sharpening a Veneer Saw (p. 155)

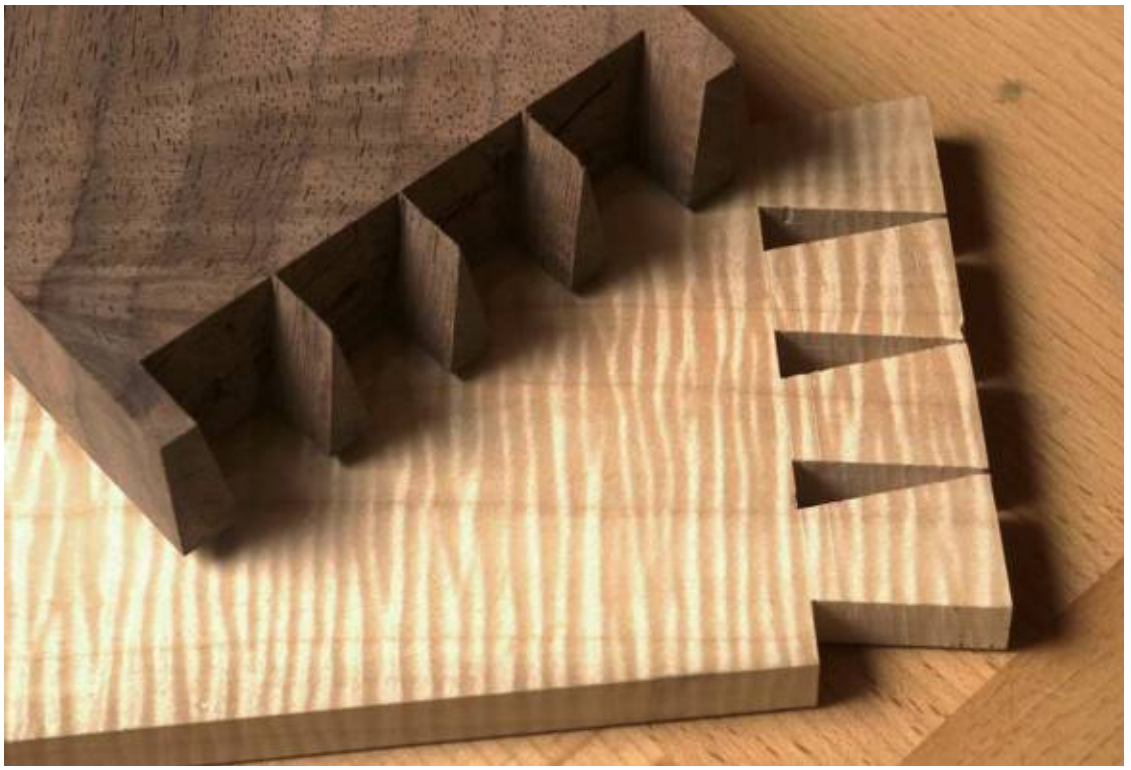
Why learn to sharpen a saw when you can send it out to a shop? It's a fair question. The obvious answer is that a dull saw is next to useless, while a sharp tool is a precise instrument capable of very fine work (see the photo on p. 142). Ironically, many sharpening services don't do a very good job, so learning the process helps ensure that your saws will be truly sharp and properly tuned.

An equally compelling reason is that once you learn to sharpen a saw you will be able to modify the teeth for optimal performance, no matter what kind of wood you're cutting. The tooth geometry provided by the saw's maker is necessarily a compromise. No single tooth configuration is ideal for all cutting conditions. Saws behave differently depending on whether the wood is hard or soft, green or dry. You may want fine or aggressive cutting. Once you learn the process, you can tune a saw for a specific task, making the job easier and more enjoyable. Or you can alter the tooth pattern of a saw completely. Most dovetail saws are sold with crosscut teeth, for example, even though dovetails are cut with the grain and should therefore have a rip pattern. Once you understand the sharpening process, you can change the tooth pattern from crosscut to rip relatively quickly.

You can also experiment with graduated teeth; that is, forming smaller teeth at the toe for starting the cut and larger teeth on the rest of the blade for more aggressive cutting. Saws can even be customized with a combination of rip and crosscut teeth in the same way that two-man crosscut saws often have raker or rip-filed teeth alternating with crosscut teeth. The rakers clean the kerf and make for fast cutting. Disston™ made panel



Sharp handsaws with the right amount of set will cut to a line with extreme accuracy, making hand-cut joinery like these dovetails possible.



saws with combination teeth and advertised them as quick-cutting saws for framing. That may be something you'll want to try.

Mass-produced saws that supposedly never need to be sharpened are made with impulse-hardened teeth. They are very hard and long wearing, but they also are too hard to be filed. Eventually they will dull, and then you are out of luck. In addition, you can't modify these superhard teeth, so you are stuck with the geometry and amount of set the manufacturer provides. In all, these saws are fine for rough work. But for joinery, a traditional saw that can be tuned perfectly will give the best results. There are many saws in use today that are 50 to 100 years old. They have been sharpened so many times that the blades are noticeably thinner, but they still give good service.

Although many people hesitate to try sharpening a saw, it is not difficult, certainly not beyond the skills of a competent woodworker. You have to understand a few basic things about tooth geometry and have some simple tools. Work in good light, and practice filing consistently formed, sharp teeth. Get an inexpensive saw to practice on.

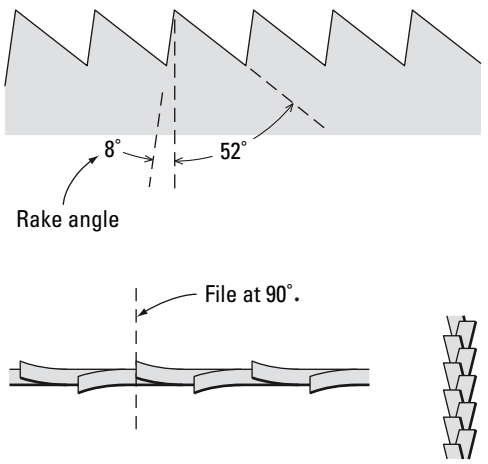
Saws Are Either Crosscut or Rip

Good sawblades are made from tempered spring steel with a Rockwell C hardness of 54 to 55. It's hard enough to hold an edge, but you can still cut it easily with a file. This steel is fashioned into a variety of saws. Backsaws have blade stiffeners of steel or brass to keep the sawblade rigid. Panel saws, typically made from slightly thicker steel, are

general shop workhorses and are sharpened to cut either with or across the grain. A bowsaw has a blade mounted in a wood frame that is tensioned with wire or string. It does the same thing as a panel saw, but it also can be fitted with a narrow blade for sawing curves. Despite all this diversity, from a sharpening point of view there are only two kinds of saws: rip and crosscut.

Ripsaws are sharpened by filing the teeth straight across the saw (see the drawing at right). The square teeth act like a series of small plane blades. Ripsaws are generally used to saw with the grain, such as when ripping a board down to size or when cutting dovetails. The amount that the face of a sawtooth leans back from vertical is called

RIP-TOOTH CONFIGURATION

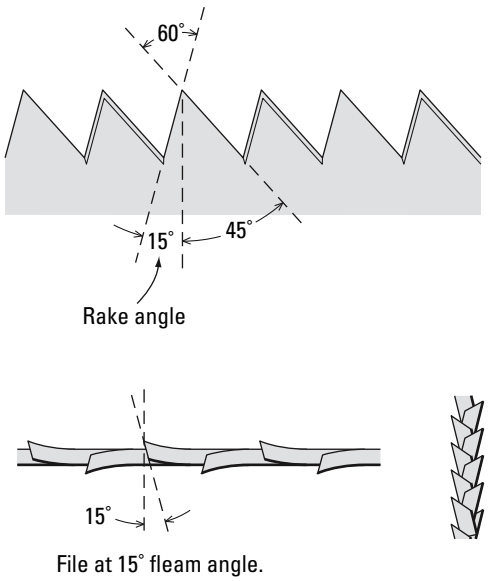


JAPANESE CROSSCUT SAWS

The fine teeth on a Japanese crosscut saw are notoriously difficult to sharpen. The tooth geometry is very complex, much different than it is on Western saws, and you'll need very thin feather files for the job. As much as I advocate learning how to sharpen your own Western-style saws, I think woodworkers who don't sharpen their own Japanese crosscut saws probably have the right idea. Harrelson Stanley, a graduate of the North Bennet Street School in Boston who also studied woodworking in Japan for many years, is just such a person. As accomplished as he is, Harrelson sends his saws back to Japan for sharpening. He gets a superb job for not too much money. For less expensive saws, the simplest option is to replace the blade when it gets dull. Extra blades are readily available.

Teeth on a Japanese crosscut saw are more complex in shape than those on a Western-style saw.

CROSSCUT-TOOTH CONFIGURATION



File at 15° fleam angle.

the rake angle. On a ripsaw, the rake angle is typically from 0 degrees to 8 degrees. During sharpening, the file is canted slightly to produce this angle.

The rake angle on crosscut sawteeth is typically from 12 degrees to 15 degrees. Crosscut teeth also are filed at an angle across the blade, normally from 15 degrees to 20 degrees (see the drawing above). This is called the fleam angle. An angled tooth makes the saw work better than a ripsaw across the grain—when cutting a board to length or when cutting tenon shoulders or miters—because the sharp corners of the teeth sever the wood fibers cleanly, like small knives.

That's the traditional view, but some craftsmen advocate a fine rip-style tooth with very little set for crosscut joinery—and they get great results. Once you learn the

A small block of wood on the end of the file helps maintain the rake angle. A second block guides the file at the right fleam angle.

basics of filing, this also is something you can try for yourself.

Jigs Can Help You Learn

It is important to maintain consistent angles while working down the length of the saw. A couple of simple jigs can help while you learn. For the rake angle, drill a hole in a small block of wood, and stick the block on the end of the file away from the handle. Rotate the file so it's correctly oriented in the gullet between teeth, and rotate the block so one face is horizontal. When you file, keep an eye on the end of the block (see the photo on the previous page); it will make it much easier to keep the file correctly oriented on the teeth. This is especially useful when you combine it with another simple jig designed to maintain the correct fleam angle. Cut a wood block about 1 in. by 3 in., and saw a kerf about halfway through the block at the correct angle (see the top photo at right). Place the saw kerf over the sawblade, and use the long edge as a guide for the file. You can slide the block up the saw as you work.

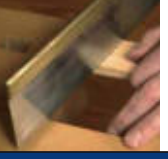
Another simple way to maintain the fleam angle is to lay a protractor on the bench directly in front of a saw vise and keep an eye on it as you file (see the bottom photo at right). Alternately, you can draw a pencil line directly on the bench or on a piece of scrap wood.

Saw Geometry

As you are learning to file saws, it's a good idea to stick with the existing tooth shape, at least in the beginning. For one thing, you can use the existing teeth as a guide for get-

Mark a block of wood at the fleam angle, and saw about halfway through. The guide rides along the teeth as you work your way down the blade.

A protractor arranged in front of the vise is a simple guide for maintaining a consistent fleam angle as you file a crosscut saw.

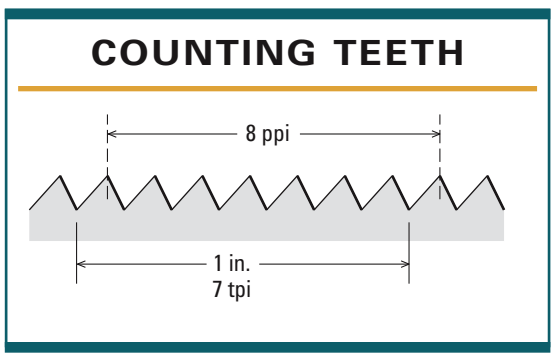


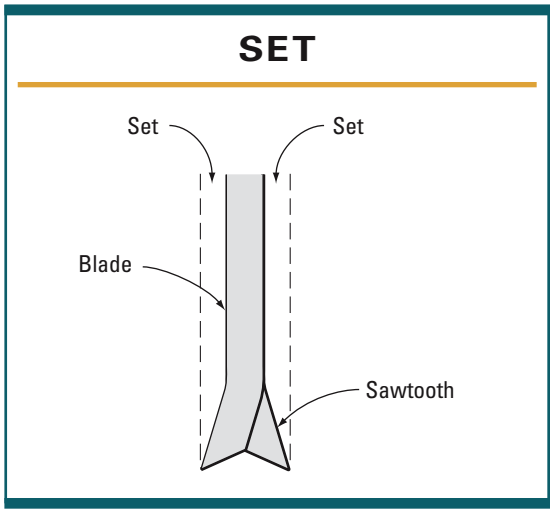
ting the correct file angle. As you gain experience, you can modify both the rake and fleam angles to suit different kinds of work. Steeper rake angles make more aggressive cutting but will be harder to start in the cut. Higher fleam angles are more aggressive and work well in softer woods. On crosscut saws, you also can experiment by dropping the handle of the file from 20 degrees to 30 degrees from horizontal to deepen the gullet. That helps clear sawdust from the cut quickly (this, by the way, is not something that can be done when you send your saw out for machine filing).

Points

The number of teeth, or points, a saw has is one of the most important factors that influence how a saw performs. The number is described as teeth per inch (tpi) or points per inch (ppi). They are not exactly the same thing. In 1 in., there will be one less tooth than there are points (see the drawing below).

A saw with fewer teeth cuts faster because it takes a bigger chip and the sawdust can be removed from the cut quickly. A rip panel saw has very coarse teeth, typically 4 to 7 teeth per inch. Dovetail and tenon saws have from 8 to 20 teeth per inch; crosscut panel saws normally have 5 to 12 tpi. A fine-tooth blade works better in thin stock





because more of the teeth will engage the wood at any given time. Saws with fewer teeth are more effective for thick stock. Yet woodworkers often choose finer-tooth saws when a coarser tooth pattern will do just as good a job and do it faster. This is especially true of dovetail saws, which do not necessarily have to have very fine teeth. It is a mistake to assume that a fine-tooth saw will be more accurate or that a saw with many teeth will necessarily cut a thinner kerf.

Set Determines Width of Kerf

Alternating sawteeth are typically bent slightly to each side—one to the right, the next to the left, and so forth. This is called set (see the drawing above). Set provides clearance for the sawblade so it won't bind in the cut. But too much set makes it difficult to saw a straight line because the sawblade can wobble in the kerf. Set is usually a function of the number of teeth. That is, fine teeth get less set than larger teeth. But set also can be adjusted for a specific task. Ripping or crosscutting green wood, for instance, requires a good deal of set because

the saw is more likely to bind. Cutting dovetails in dry stock requires almost no set.

In the past, the best panel saws were ground with a taper from the teeth to the back of the blade to minimize the need for set. Disston made several taper-ground panel saws for finish work in hardwoods with no set at all.

You do not need to set a saw every time you file it. But you do reduce the set at every filing, so when the saw begins to bind in the cut, it is time to set the saw again. This will probably be necessary every third or fourth time you sharpen.

Tools for Sharpening

The tools needed for sharpening saws are fairly simple and relatively inexpensive, but they also tend to be specialized. Because sawteeth are often small and a little hard to see, good light is essential for proper filing. Natural light is best. Magnifying lenses are helpful as well.

Files

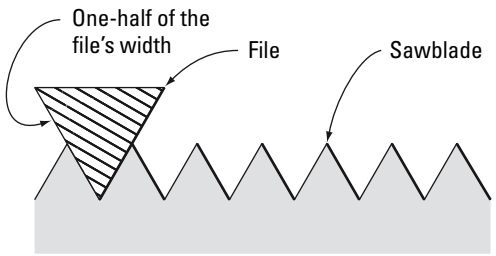
Triangular taper files have three corners and three cutting edges that correspond with the shape of the teeth (see the chart below) Ideally, about half of the cutting surface of the file will be in contact with a tooth—half of the file will be in the gullet and the other half unused. When you rotate the file to get a fresh edge, it will be uniformly sharp. If you use a smaller file, only some of the new surface will be fresh and the rest dull (see the drawing above). This practice extends file life as well as gives consistent results. But if you are not concerned about file life, using a smaller file is fine. Whatever size you use, choose a quality file. Price is one way to determine quality; don't look for the cheapest file in the store. Small files, in particular, should have sharp corners. In addition to triangular files, you also will need a smooth mill file either 8 in. or 10 in. long for jointing the teeth.

For safety, always use a handle on the file tang. A dowel on the other end of the file is useful as a second handle to help you guide the file as you work. You can use some chalk to keep the file teeth from loading.

File-Size Recommendations

PPI	FILE SIZE
4–5½	7-in. regular taper
6–7	7-in. slim taper
8	6-in. slim taper
9–10	6-in. extra-slim taper
11	6-in. double extra-slim taper
12–14	5-in. double extra-slim taper
15–20	4-in. double extra-slim taper

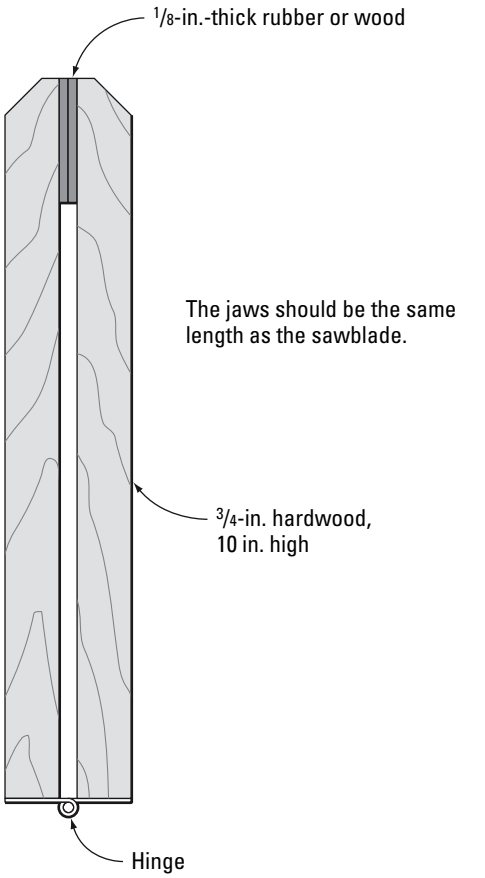
SIZING A FILE



Vises

A saw vise has long, narrow jaws that hold the sawblade securely and allow you to get close to the blade with a file. You can make one from wood (see the drawing on p. 148)

SAW VISE



that can be clamped in your bench vise, or you can buy one. Manufactured metal saw vises are typically too short to hold the entire blade, especially a panel-saw blade, so you must file one section at a time and move the saw to file the next. For long saws, a shopmade wooden vise that clamps the entire blade is very handy. Whatever vise you use, make sure the vise jaws contact the blade evenly to minimize vibration. Facing the jaws with leather or rubber helps.

See *"Making a Saw Vise"* on p. 56.

A simple jointing guide is nothing more than a block of wood about 10 in. long with a groove for a smooth mill file.

Saw Jointer

A jointer is a device that holds a flat file at 90 degrees to the sawblade. It is used to file the tops of the teeth to an even height. Various metal ones have been manufactured over the years, but you can make an effective one from a short length of wood slotted to hold the file (see the photo above). You only need to use a jointer on the saw when the teeth have become uneven due to repeated or inexpert filing.

Saw Sets

A saw set is a tool that uses a plunger to bend the tooth against a beveled anvil (see the top left photo on the facing page). They are adjustable; a dial marked with numbers corresponds to the number of teeth on the saw (see the bottom left photo on the facing page). A mechanical saw set is designed to set large teeth more than small ones. To reduce the amount of set, adjust the dial on the set for more tpi than would otherwise be indicated. Conversely, if you want more set, just choose a lower number on the adjust-

Saw sets are adjustable devices that bend teeth away from the sawblade.

Numbers on the set's adjustment knob correspond to the number of teeth per inch on the saw.

ment wheel than you normally would. The numbers are a rough guide, but they may not produce the exact set you want. With experience, you'll learn which setting produces the best result, so make a note of the setting you prefer for future reference. Most saw-set plungers are too wide for saws with more than 12 points per inch. If you find that's the case, disassemble the saw set, remove the plunger, and grind its sides narrower. Saw sets with handles at a right angle to the plunger are more comfortable to use for an extended period (see the top right photo).

How much set do you need? If a saw binds in the cut, it doesn't have enough set. Saws used in greenwood or softwood need

Pistol-gripped saw sets are the most comfortable style to use for extended periods of time.

the most set; dry hardwood the least. Coarse-tooth ripsaws need plenty of set, and in general large saws for large work need more set. Fine-tooth crosscut and ripsaws for accurate joinery need little set, if any.

When to Sharpen

If your saw seems to cut slowly, gives a poor finish, or binds in the cut, take a good look at the teeth. If the tips are rounded or show wear, it is time to sharpen. Carefully feel the teeth of a sharp saw with your thumb. In time, it will be easy to recognize when a saw needs sharpening. A good saw, properly cared for, will last a long time before it must be resharpened.

Having a properly sharpened saw allows you to focus on one of the most important sawing variables that is often overlooked: your sawing technique. Take long, even strokes. Relax; a sharp saw does not need to be forced. Let the saw do the work. Use a little wax for lubrication, especially in resinous woods. Keep the saw clean. Enjoy your work. You will find you will use handsaws much more often.

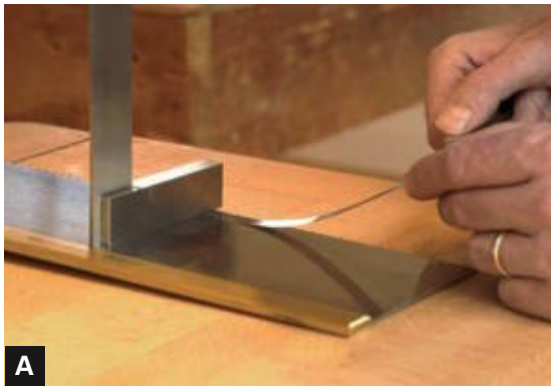
Jointing and Setting the Teeth

Over time, sawteeth may become uneven in height **(A)** and will need jointing to make them even again. Do this by using a smooth mill file held in a block of wood **(B)**. The block should keep the file at 90 degrees to the sawblade. Working the length of the sawblade evenly, file until the tops of the teeth are even. The flat spots on top of the teeth are likely to vary from tooth to tooth because they were not even to start with. Don't worry about that; teeth will be brought to a uniform shape as you file. Periodically, you also must reset the teeth. To do so, set every other tooth, then turn the saw around in the vise and set the remaining teeth **(C, D)**. Be careful to use the same hand pressure each time to keep the set as even as possible. Set the dial on the saw set to correspond to the number of teeth on the saw, then test it on the teeth nearest the handle first since they are used less. Use gentle pressure with the set.

Checking and Adjusting the Set

After filing, check the amount of set on both sides. An easy way to do this is with a square and a feeler gauge **(A)**. Rest the handle of the square on the teeth, then check the distance between the sawblade and the handle. Use a feeler gauge equal to the amount of set you are looking for. The set on this dovetail saw is 0.002 in., and the set should be even on both sides of the blade. If you find you've given the saw too much set, you can adjust it by clamping the teeth lightly in a small, smooth-jawed vise **(B)**. This is useful to know if you make a mistake, but it's not a normal part of setting a saw. Clamp one area of the blade, and apply gentle pressure. Loosen the vise and clamp the next section, taking care to use the same amount of pressure each time.

When you're finished, make a test cut with the saw. If the cut does not follow a straight pencil line, the set is uneven. The set is too heavy on the side of the saw that the kerf bends toward. You can correct too much set, or an uneven set, by lightly honing the heavy side with a fine sharpening stone, such as a fine India slipstone. Take only a few strokes, and hone from the back of the saw to the tip. Test again.


A

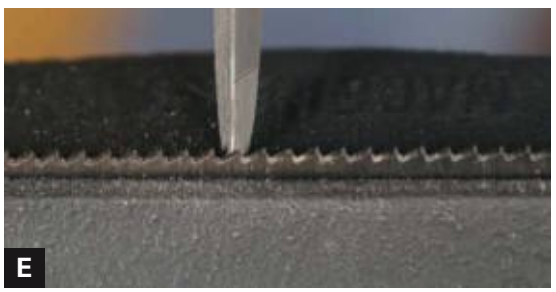

B


A


B


C


D


E

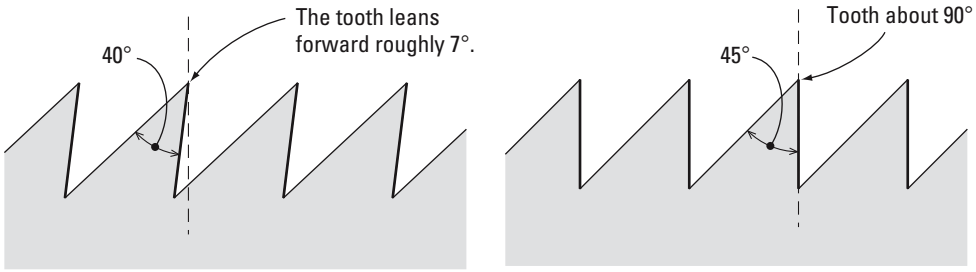
Sharpening a Ripsaw

After setting, blacken the tops of the teeth with a marker to make it easier to see what you are doing as you file **(A)**. Because the teeth are filed at 90 degrees to the sawblade, a ripsaw is the easiest kind of saw to sharpen. Start by putting the saw in a vise **(B)** so the teeth are as close as possible to the jaws. This will help to prevent the blade from vibrating and the file from chattering. You'll get better results if you make sure the saw is horizontal. Start filing the teeth closest to the handle, and work toward the front of the saw (this is a good habit because the back teeth usually get less use, so get your rhythm going here where it doesn't matter as much). On a ripsaw, the front of the sawtooth may be at 90 degrees or lean back slightly. This is called the rake angle. On this saw, it is 8 degrees. Cant the file at that angle, keeping an eye on the top of the file to maintain a consistent angle. You will be filing the front of one tooth and the back of the adjacent one at the same time.

Take the same number of strokes on each tooth. Keep the file horizontal **(C)**, at right angles to the blade **(D)** and at the proper rake angle. File only enough to remove the black mark on each tooth **(E)**. You can file all the teeth on a ripsaw from the same side, but since the file cuts the tooth leaning away from you with less chatter, it's a good practice to file every other tooth, then turn the saw around in the vise and repeat the filing process. Once again for the sake of consistency, start at the handle end and work toward the tip of the saw.

Sharpening a Japanese Ripsaw

The larger rip-style teeth on Japanese blades are much easier to sharpen than the teeth on cross-cut saws, not only because there's more room to maneuver the file but also because the shape of the teeth is not as complex. Sharpening a Japanese saw isn't much different than filing a Western-style ripsaw, although rake angles are different for cutting hardwood and softwood **(A)**. Set the saw in a vise just as you would a Western-style saw. Some woodworkers prefer a shopmade vise of wood **(B)**, but a standard metal vise is fine. File every other tooth **(C)**, then flip the saw around in the vise and file the other side. File straight across the blade with a rake angle of roughly 7 degrees for softwood (making the tooth lean forward instead of back) and about 90 degrees for cutting hardwood **(D)**.



A SOFTWOOD HARDWOOD

B

C

D


A


B


C


D

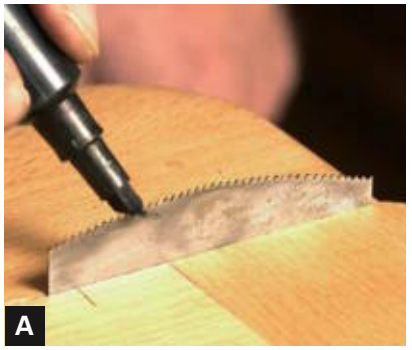
Sharpening a Crosscut Saw

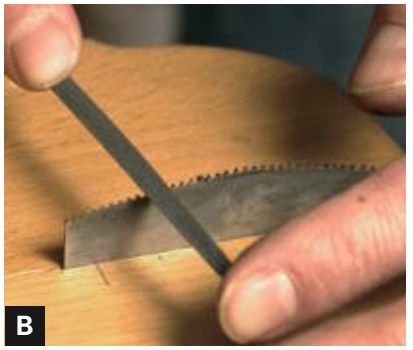
Placing the crosscut saw in a vise, joint and set it as necessary. Blacken the teeth with a marker **(A)**, and reset the saw low in the vise, making sure it is horizontal. Beginning at the rear of the saw, file every other tooth with the same number of strokes and the same amount of pressure. The only difficulty in filing a crosscut saw is in maintaining the proper angles between the file and the teeth as you move down the length of the blade. In this case, the rake angle, the amount the tooth leans back, is 15 degrees. On a crosscut saw, the face of each tooth is angled off perpendicular, so the handle of the file is angled back toward the handle of the saw. Here, the angle also is 15 degrees **(B)**. This is the fleam angle. Stand comfortably and, keeping an eye on the top of the file, be careful to hold the file at a consistent angle in the stroke as you move down the saw.

It is helpful to use a guide of some sort to help maintain the right angle. A protractor, or a line, on the bench behind the saw, is one way **(C)**. File every other tooth (just the ones bent away from you), then flip the saw around and repeat from the other side. Test the saw on a scrap of wood **(D)**. If it does not follow a straight pencil line, the set is uneven. If the set is too heavy or uneven, correct it as you would on a ripsaw and test again.

Sharpening a Veneer Saw

Veneer saws work more like a knife with teeth than a saw. Veneer saws have no set and are filed as a rip, with the file held 90 degrees to the blade horizontally and vertically. Remove the blade from the saw, put it in a vise, and joint if necessary. Then use a black marker on the tops of the teeth to help you see how much material you remove with the file **(A)**. Veneer-saw teeth are equilateral triangles. Keep the top of the file perpendicular to the arc so the blade maintains the correct shape. File every tooth straight across **(B)**, taking care to keep the arc of the blade even. After filing the teeth, lay the saw-blade flat and file the beveled side of the blade to a sharp edge **(C)**. Remove the burr from the back side of the blade on a fine stone **(D)**; a 4000-grit waterstone is fine enough. It's a good idea to stone the bevel as well **(E)** with the same stone. Once you reattach the blade to the saw, you are ready to use it **(F)**. Don't expect to cut the veneer in one pass—several are better. The saw should give a clean cut. If it doesn't, refile and hone the bevel.





Axes and Adzes

Axes

➤ Ax (p. 158)

Curved Adze

➤ Curved Adze (p. 159)

Lipped Adze

➤ Lipped Adze (p. 160)

Axes are ancient woodworking tools that may seem out of place in today's woodshop. But a sharp ax is handy to have around, and not just for chopping firewood or splitting kindling for a woodstove. Used with care, an ax is a precise tool. Over the centuries, various specialized ax forms have evolved for specific tasks. In Norway, for example, axes are still used by some artisans as the primary hand tool for building traditional small crafts.

An adze is basically an ax mounted at right angles to the handle. Many have flat blades, but the turned-up edges of the lipped adze are specific for cutting across the grain. The curved adze, or sculptor's adze, is a variation that is typically small in size and used for hollowing.

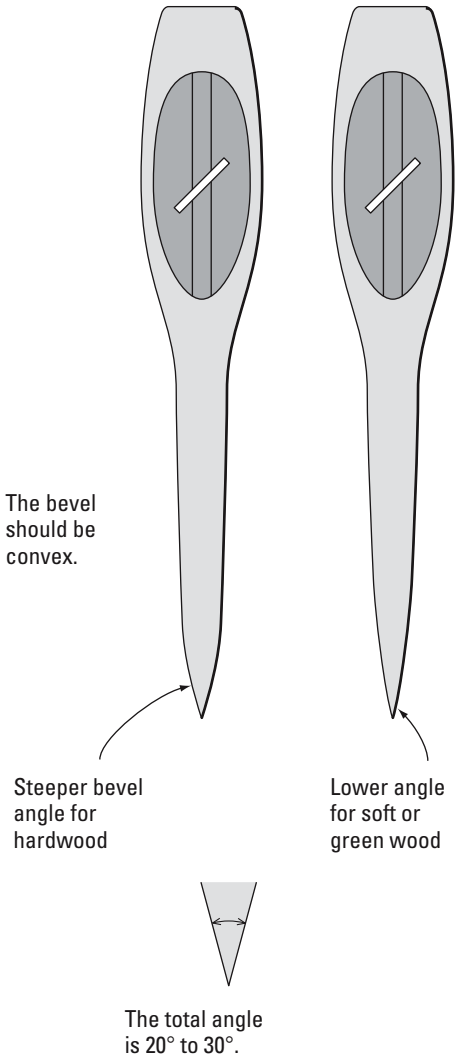
The bevel of an ax or adze should be honed razor sharp. The total bevel angle should be from 20 degrees to 30 degrees (that is, from 10 degrees to 15 degrees per side), on the lower end of the range for green wood and softwood and higher for hard or dry wood. The bevel should be slightly convex, more so for hardwoods than for soft, and should not be hollow ground. A hollow grind will be weak and likely to chip. Adzes work best with a flat bevel.

You can do a lot of shaping on the bevel of an ax with a file. If you prefer to use a bench grinder, be especially careful not to overheat the tool and to shape the bevel in a slightly convex shape. A safer, and slower, alternative is to use a narrow belt sander,

A shipwright's lipped adze is designed to cut cleanly across the grain.

An ax with a curved edge (left) is better to use for green hardwood, whereas a straighter edge (right) works better in dry wood.

AX BEVEL ANGLES



which can leave a surprisingly good finish that makes honing easier.

Single-bevel axes, such as broadaxes and some hatchets, are trimming tools and can be sharpened with a flat bevel of about 20 degrees to 25 degrees. The same is true of adzes, although a very small back-bevel will give you more control. The back of a broadax should be flat.


A


B


C


D


E

Ax

The first step in sharpening an ax is to remove any dings or nicks in the edge, and the best tool with which to do this is a bastard file **(A)**. If you have access to an old sandstone grinding wheel, you can sharpen the ax entirely on that **(B)**. Work one bevel, then turn the ax over and work the other bevel. After filing or grinding, finish with a hand-held stone.

You can also grind an ax on a bench grinder fitted with conventional wheels, but a tool that is safer both for the ax and for the operator is a 1-in. belt sander **(C)**. Frequent passes on each side with the ax at the correct angle to the platen will produce a serviceable edge very quickly. You are much less likely to burn the ax or ruin the temper of the blade with a belt sander than you are with a bench grinder.

You can follow up with a 280-grit hand-held stone, smoothing the edge as much as you desire, but a fine Scotch-Brite deburring wheel mounted on a bench grinder does a great job very quickly **(D)**.

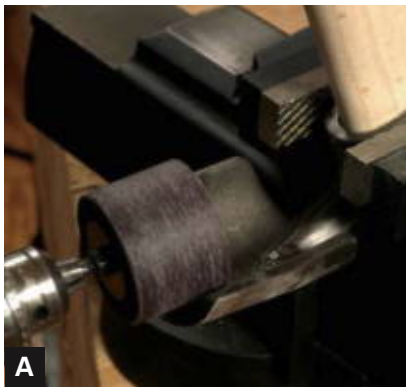
A single-bevel ax is, of course, only sharpened on one side. The back is ground flat and honed smooth close to the cutting edge **(E)**.

Curved Adze

The curved adze, or carver's adze, has a bevel on the inside of its curve. This bevel can be ground with a 2-in. drum sander mounted in an electric drill **(A)** using a 50-grit and then 80-grit sleeve. Keep the bevel flat. When the edge has been smoothed with the drum sander, use abrasive paper wrapped around a dowel or a piece of PVC pipe **(B)** up to 180 or 220 grit to finish the edge. Coloring the bevel with a felt-tip marker will help you gauge your progress.

The outside of the curved blade can easily be smoothed with a 1-in. belt sander **(C)** using light strokes. Rotate the tool against the belt above the platen where it is flexible enough to conform nicely to its rounded shape. If you don't have access to a belt sander, you can dress the back of the blade with a file **(D)**.

Further smoothing of the back of the edge can be done with 180- and 220-grit abrasive paper mounted on a board with spray adhesive **(E)**. It's easier to fair the curve this way than with hand stones, but you can use a hand stone, such as a 180/280-grit Carborundum™ **(F)**. When you are done with the outside, deburr the inside bevel and check the edge **(G)**.


A


B


C


D


E


F


G


A


B


C


D


E

Lipped Adze

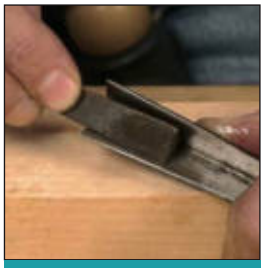
Lipped adzes are not very common and are available these days only on the used tool market. But if you happen to obtain an old one, it is worth learning how to sharpen this tool for occasional use. If it has been reasonably well taken care of, the outside flat surface won't need much work. Clean with fine sandpaper and slipstones **(A)**, being careful not to roll the edge over. Then get to work on the bevel.

You can ground the bevel using a 2-in. drum sander in an electric drill **(B)**, but keep the power tool away from the turned-up edges. You can do further work with 180- and 220-grit abrasive paper wrapped around a dowel or a piece of PVC pipe **(C)**, followed by slipstones **(D)**, or you can work entirely with slipstones until the tool is razor sharp. Work with the stones right up into the corner of the lip. It is not necessary to remove small nicks on the edge **(E)**. As you resharpen, in time the small nicks will eventually disappear.

Carving Tools

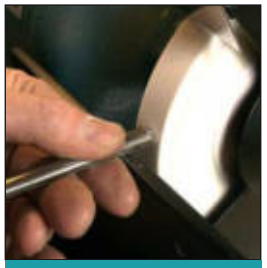
Chisels

➤ Chisels and Skew Chisels (p. 168)



V-Tools

➤ V-Tool (p. 170)



Gouges

➤ Grinding a Gouge Bevel (p. 173)
➤ Honing a Gouge Bevel (p. 174)

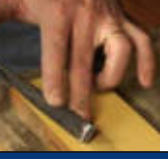
Oar Jig

➤ Using the Oar Jig (p. 177)

Carving is a woodworking specialty of its own. Full-time carvers typically have a wide selection of tools with particular shapes designed for very specific tasks. There are tools made especially for chip carving and a large assortment of other implements that can be used to create everything from acanthus leaves and linen-fold panels to a claw-and-ball foot. Even those woodworkers whose interests don't encompass elaborate carving will find that having a few of these tools on hand (and keeping them sharp) will expand their woodworking options.

Many woodworkers may find the sheer variety of carving tools confusing, but from a sharpening point of view, there are just three basic types of carving tools: chisels, gouges, and parting tools, or V-tools.

Carving tools are available in a bewildering variety of shapes and sizes, but they really are variations on three basic types.



Carving tools are either parting tools (also called V-tools), gouges, or chisels, so there are only three sharpening techniques to learn in order to keep any carving tool sharp.

Unlike a bench chisel used in general woodworking, both sides of a carving chisel are beveled.

A carving chisel has a straight, flat blade and may have a skewed end or may widen toward the cutting edge in a fishtail-like pattern. Unlike bench chisels, carving chisels are beveled on both sides of the blade (see the photo above). Gouges have curved blades with profiles ranging from very shallow, almost like a chisel, to a deep sweep. They may be bent, fishtail, or spoon shape. But they are all sharpened with the bevel on the outside and sometimes with a small bevel on the inside.

The curve of a carving gouge is beveled on the outside of the tool.

The two beveled edges of a V-tool should be even in length and thickness and sharpened uniformly.

Parting tools are beveled on the outside (see the photo above). Each side of the V is sharpened like a chisel, but the apex where the two sides meet needs special treatment. On a well-made V-tool that has been properly maintained, the thickness of the two adjoining blades is the same. Uneven thickness will make the tool difficult to sharpen properly.

Blade Geometry

Carving tools should be sharpened with as low a bevel angle as possible for whatever type of wood that's being worked. That's generally from 20 degrees to 25 degrees,

although you can use a lower bevel angle in softwoods than in hardwoods. If the tool seems to dull quickly, or if the edge chips, increase the bevel angle slightly to make a more durable edge. Carvers may talk about the length of the bevel instead of a specific angle; a lower angle makes a longer bevel than a higher-angle bevel. With practice, you will get to know how a specific angle corresponds to the length of the bevel on a particular tool, but in the beginning, it is a good idea to measure the bevel with a protractor when you're sharpening the edge.

Experts differ on whether carving tools should get a secondary bevel, which is a very narrow secondary edge honed at a slightly steeper angle than the main bevel. A secondary bevel certainly makes sharpening faster because relatively little material must be removed to create a fresh edge. But it is tricky to hone a secondary bevel freehand, so it's safer to stone the entire bevel at one angle.

Gouges frequently are sharpened with a small inside or back bevel (up to 5 degrees). This is a way to strengthen the edge if the outside bevel is a bit too low without having to regrind the whole bevel. Gouges are often used to make a scooping cut in wood, and an inner bevel also makes the tool easier to control.

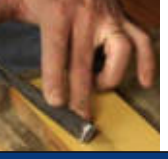
Gouges can be sharpened with a forward or backward sweep but are usually sharpened square.

The part of a bevel that meets the shank of a carving tool is called the heel. It should be gently rounded and polished so it burnishes the cut.

Gouges and V-tools should be sharpened with a straight edge, square to the centerline of the tool unless a specific carving task would be easier with a different profile.

The part of the bevel that meets the shank of a carving tool is called the heel (see the photo above). After sharpening the bevels, this sharp corner should be softened and polished. That way it will tend to burnish the cut, not mar it. Softening this area also makes the tool easier to manipulate.

The part of a V-tool where the two bevels meet is called the keel. This area also needs to be softened a bit so it's not a hard 90-degrees corner. A good guide is to round the keel so it matches the small radius on the inside on the tool. On a small V-tool,



this will be almost a sharp corner; on a larger tool, the radius is more significant. If you do not round the keel area to match, the tool will be dull at this point.

What Tools Work Best

Many carving tools may be sharpened with the same tools used for plane blades and chisels: a bench grinder, waterstones or oilstones, or sandpaper bonded to a sheet of glass or other flat surface. Rounded abrasive surfaces—both shopmade and commercially available—also are useful. A professional carver may have a collection of specialized slipstones and strops to make sharpening easier, and some even use specialized stropping machines. But a simple approach with the equipment that most woodworkers already have will do the job nicely.

Slipstones are used for working the inside of gouges and V-tools. You can also shape a slipstone on coarse (60-grit) sandpaper until it fits a particular tool exactly, or use sandpaper to make slipstones from worn or broken waterstones. Abrasive papers wrapped on a dowel are an effective, simple, and inexpensive option for the same job.

Diamond files cut quickly and are useful for reshaping bevels and smoothing rough surfaces such as the inside faces of V-tools. Many carvers also like to use leather strops charged with honing compound to finish an

Commercial slipstones, diamond files, and shopmade slips all can be useful for sharpening and honing the curved edges of carving gouges.

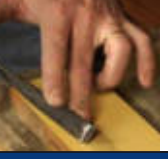
Triangular India slipstones, fine India and Arkansas slipstones, and India gouge slipstones are good for both gouges and parting tools.

Diamond files are useful for shaping and cleanup. They cut quickly.

edge. Leather gives a bit under pressure, so you have to be careful not to round over the cutting edge when stropping. You can also use a softwood block for stropping. A small scrap of softwood can easily be shaped to fit inside and outside profiles of a gouge perfectly, and when used with honing compound it will sharpen the tool beautifully. Once made, these pieces of wood, sometimes called slips, can be labeled and tucked away for the next time the tool needs a fresh edge.

Some carvers sharpen with only a bench grinder and felt buffing wheels charged with honing compound. This produces a serviceable edge, but the technique has some drawbacks. You have to be careful not to round the cutting edge on the buffing wheel, and deep scratches from the grinding wheel are hard to remove on the buff alone. It's also easy to overheat the tool on a felt buff. A better way, especially on gouges and V-tools,

A leather strop with honing compound puts on a final edge. Simple wooden slips can be made to fit specific carving tools and be saved for future use.



The long belt of this 1-in. belt sander won't overheat and burn the edge of a carving tool as readily as a bench grinder will.

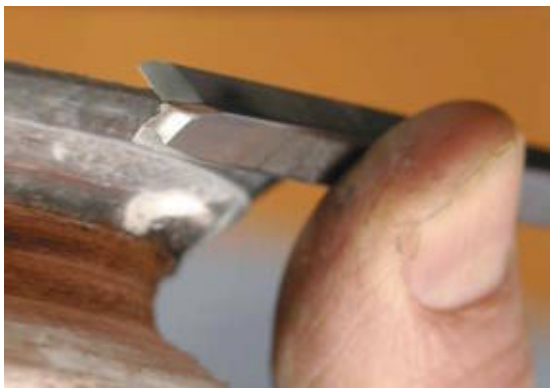
is to use waterstones or oilstones after doing preliminary work on a grinder. You have a lot more control when honing by hand, and creating a finished edge doesn't take long with waterstones because they cut so quickly. A 1-in. belt sander is a great alternative to a bench grinder, especially for gouges. The long belt does not overheat the steel as easily, and there is a bit of flex in the belt that works well in grinding curved shapes. A 60- or 80-grit belt will work fine.

Some new carving tools come well prepared, but others do not. Used tools often need quite a bit of work to restore the proper blade geometry. But honing the inside of a gouge or V-tool is much like flattening and polishing the back of a new chisel or plane iron: You won't have to do any more than deburr the surface when sharpening in the future.

Although expensive, a Tormek grinder handles carving tools well. The slow-turning, water-cooled wheel won't burn the tool, and the flat, leather strop wheel and optional shaped leather strops are good for producing a final edge. Although Tormek advises that you can go directly from the grinding wheel to the strop, you will get better results if you also hone on waterstones before stropping.

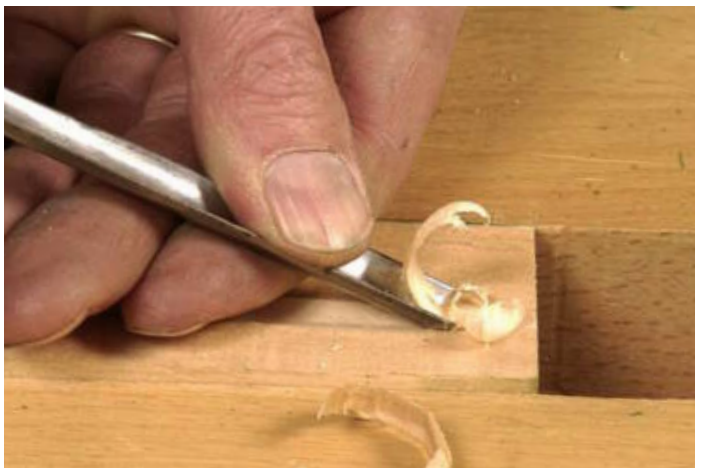
Jigs and Guides Are Limited

There are alot of jigs and honing guides on the market for plane blades and chisels. That's not the case for carving tools. Carving tools, however, are typically small and not as top-heavy as something like a large plane blade, so honing by hand works well. Shaping the edge with a single flat bevel, and no secondary bevel, also makes it easier to do an accurate job.



Coated with abrasive paste, the carving tool strop on a Tormek machine quickly polishes the inside faces of a V-tool.

The unusually shaped Oar Sharpener jig can be used to guide V-tools and gouges. Its rounded bottom keeps a consistent honing angle on curved gouges.



Test-cut for sharpness on a piece of softwood. When the tool severs wood fibers cleanly rather than tearing or crushing them, you know the blade is sharp.

The rules are the same as they would be for honing a chisel or plane iron by hand: Register the bevel flat on the stone, maintain your body position so the blade doesn't rock on the stone, and check your progress frequently. Blackening the edge with a marker also can be a big help by showing clearly where material is being removed.

There is at least one jig designed for carving tools, the Oar Sharpener™ (see the photo above). Named for its inventor, not because it looks like an oarlock, it holds large gouges, V-tools, and chisels firmly. It can, however, be awkward with small tools.

Hone Carving Tools Frequently

When you think you have honed enough, test the tool on a piece of softwood. A sharp tool will cut cleanly and leave a polished surface. If it doesn't, you haven't honed the edge enough. It is a good idea to restrop frequently and rehone as necessary to keep carving tools razor sharp. If you do that, the results will be better, and regrinding the bevel will only be necessary if you want to change the angle of the bevel or if you somehow chip the edge. When the tool becomes harder to push or doesn't cut the wood cleanly, restrop.

Frequent sharpening is an important part of woodcarving. Learn to sharpen your carving tools yourself. As marine carver Jay Hanna said, sending your tools out to be sharpened is like having someone tie your shoelaces for you.


A


VARIATION


B


C

Chisels and Skew Chisels

If the edges of your carving chisels are in relatively good condition, all you may need to sharpen them is a set of oilstones or waterstones and a leather strop. But if an edge is nicked or ragged or if you want to change the bevel angles, start by grinding the bevels evenly on the side of a bench-grinding wheel **(A)**. Don't use the face of the stone because it will produce a hollow grind. Instead, hold the tool against the side of the wheel to produce a flat grind. If the end of the chisel is uneven, grind it square first.

[VARIATION] You can use a 1-in. belt sander to grind the bevels. Be careful not to overheat the edge, and check your progress frequently to keep the two bevels at the same angle.

Once the bevels are established, hone them on waterstones or oilstones. If you are going straight to the stones without using a bench grinder, square the end by drawing it across the face of the stone, then hone the bevels flat on the stone **(B)**. Take care not to rock the tool as you hone, which would round over the bevel **(C)**. Try to use the full surface of the stone to minimize wear, especially when sharpening narrow chisels.

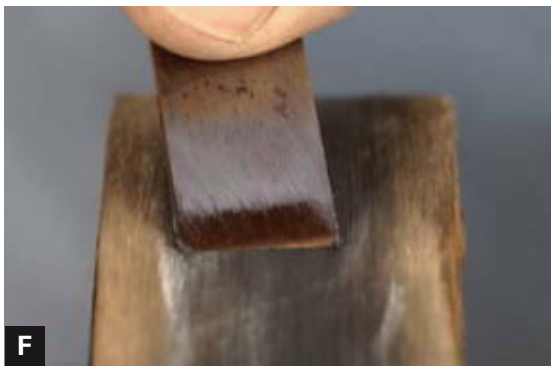
Repeat on the other bevel, and switch to progressively finer stones until you have polished the edge with a 4000- or 8000-grit stone **(D)** and all the marks from previous stones have been erased. The last step is to round over the sharp heel of the bevel. Work the area until the sharp transition is softened, but in the process be careful not to round the edge you have just sharpened.

You'll get the best edge by finishing up with a leather strop charged with honing compound **(E)**. Pull the tool down the strop using moderate pressure, and test your edge on a scrap of wood.

An alternative is to use the Tormek Sharpening System, which includes both a leather strop and a grinding wheel **(F, G)**. A major advantage of the Tormek is that it will not overheat the steel. Use the side of the slow-speed grindstone to shape the bevel. Take the time to get as smooth a finish as possible on the grinding wheel or it will be difficult to get a nonrippled surface from the stropping wheel. Hone on waterstones if necessary. Charge the leather strop with honing compound and a few drops of oil, and work both bevels of the chisel from heel to edge until it's razor sharp.


D


E


F

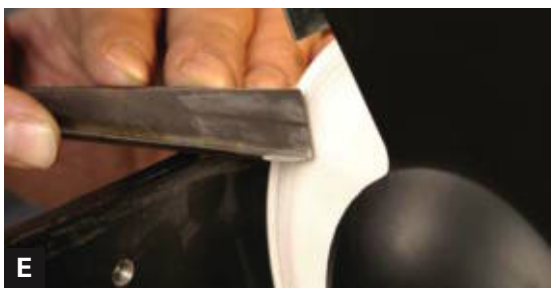

G


A


B


C


D


E

V-Tool

V-tools are the most difficult of all carving tools to sharpen. There are two cutting edges, not just one, and they must be kept straight, square, and uniformly thick as they are honed. In addition, the corner where the two cutting edges meet can be tricky to sharpen without wearing away too much metal and collapsing the edge.

Mistakes happen quickly on a power grinder, so it's a good idea to switch to oilstones or water-stones after doing just the rough shaping with a bench grinder or belt sander. Edges should not be hollow-ground. So if you use a bench grinder, do the work on the side of the wheel instead of the face. A 1-in. belt sander with a 100- or 150-grit belt is more forgiving than a bench grinder, and it will produce a flat bevel.

First, square the end by pushing the tool straight into the sanding belt or abrasive wheel **(A)** with gentle pressure. Looking at the squared end will tell you how much, and where, metal should be removed to produce uniform bevels. If the blunted end of the tool is not the same thickness from edge to edge—that is, if the flat tapers in width—grind away material from the thick area by holding the flat against the platen on the belt sander or against the side of the stone if you're using a bench grinder. What you are trying to produce is a flat on the end of the tool that is the same width **(B)**. Once this has been established, you can grind both bevels, using either a bench grinder **(C)** or a belt sander **(D)**. Stop grinding before the flat disappears.

Next, grind the basic angle of the keel, the area where the sides, or wings, of the tool meet in the middle **(E)**. Make sure you can see what you

are doing. Using the side of the bench grinder gives you a good view from the back of the tool. Be careful not to grind too much material away. Grind the same angle on the keel as you did on the bevels.

Work the inside of the V-tool, making sure the inside surfaces are flat and smooth. If the surface is pitted or uneven, a coarse India triangular slipstone or a diamond file will remove material quickly. Then hone the surfaces smooth with a fine India slip **(F)**. Be careful to hone each side evenly. Keep an eye on your progress by checking the flat on the end often. The line should be straight and the flat part uniformly thick.

Polishing the inside faces of the tool with finer abrasives will produce an even better edge. Arkansas slipstones can be useful, but they may need to be shaped to fit the inside profile of the V precisely. Another way is to plane a strip of wood to fit the inside profile exactly **(G, H)** and charge it with honing compound **(I)**. Prop the tool on your bench or a block of wood, and work the wood slip over the inside surfaces. This approach will give you excellent results.

After finishing the inside, go back to the bevels. Hone the bevel starting with 220 grit or your coarsest waterstone **(J)**. Keep working on the coarsest grit until the flat line of light on the end of the tool almost disappears. Be careful not to round the bevels while honing. The hardest part is to get the bevel even all the way across. It's easy to hone more aggressively near the middle of the V, which will cause the edge to break

(Text continues on p. 172.)

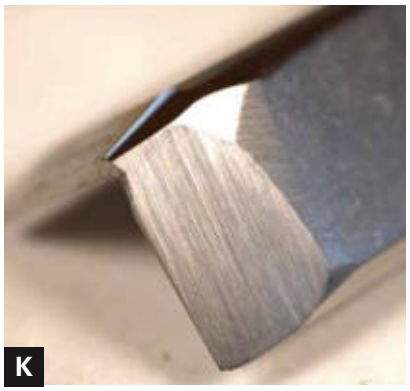

F


G


H


I


J


K


L


M


N


O


P

through **(K)**. If that happens, square up the end again **(L)** on a stone and go back to work.

When you have the edges even and the flat reduced to a hairline, step up to the next grit and hone to remove the flat completely. Finish honing on your finest stones.

The sharp heel between the bevel and the tool created during sharpening can mar the work-piece. Slightly round the heel on a stone, then make sure to polish this area as well. The final step is to hone the keel by rolling the tool as you travel the length of the stone **(M, N, O)**. Uneven spots can be honed with a back-and-forth motion. When you're finished, the outside of the V should match the small radius on the inside. Strop the bevels and the keel with honing compound on a leather or wood strop for a mirror polish **(P)**.

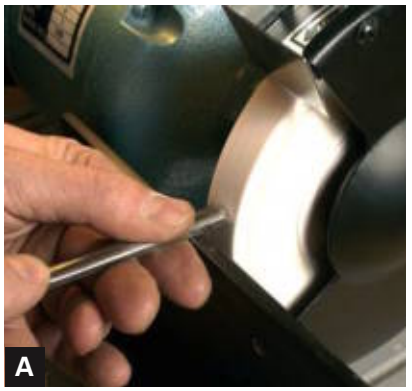
Once the tool has been prepared properly, you shouldn't have to do much to the inside surfaces when resharpening other than to remove the wire edge created during honing.

Grinding a Gouge Bevel

The first step in sharpening a carving gouge is to square the end of the tool. That will help you produce an edge that's even in thickness as well as sharp. If the tool has been well cared for, it won't be necessary to take off much material, and you may be able to use an oilstone or waterstone. But if the end of the tool is ragged or badly skewed, it's easier to use a bench grinder **(A)**.

The flat you create on the end of the gouge will show as a line of light when the tool is viewed from the end **(B)**. It is this line that you will use to gauge your progress as you grind and then hone the bevel: When the line disappears, it's time to stop. If the line is very wide, a lot of material will have to come off, and that's easier to do with a bench grinder than it is with oilstones or waterstones. Hold the tool horizontally with the handle pulled toward you so the bevel fully contacts the stone **(C)**. Start on one side and roll the gouge, keeping light contact on the wheel. Check the line of light frequently, and try to keep it an even width as you work the sweep of the bevel. Stop grinding just before the line disappears.

An alternative to using a grinding wheel is to use a 1-in. belt sander. Because there is a little give to the platen behind the abrasive belt, sharpening is easier to control on a belt sander. And the long belt reduces the risk of overheating the gouge. Proceed as you would on the wheel by squaring the tool first **(D)** and then grinding the bevel with a light, steady contact as you rotate the gouge **(E, F)**.


A


B


C


D


E


F

Honing a Gouge Bevel

A hard felt wheel mounted on a bench grinder can be used to finish the bevel after grinding, and you may even start with a felt wheel if the tool only needs touching up rather than reshaping. Apply polishing compound **(A)**, then work the bevel by rotating it against the wheel, being careful not to round over the edges or the corners. Hold the gouge at a slight angle to the wheel, buffing toward the cutting edge to avoid digging the tool into the rotating felt **(B)**. Be careful—even a felt wheel can overheat the thin edge of a carving tool very quickly.

Felt buffing wheels are fast and leave a shiny surface that looks sharp and may in fact be sharp. But you have to be very careful not to round over the cutting edge. This work can be done more precisely, and quite quickly, on waterstones or oilstones. Stones also give a better edge that will last longer.

Lightly square the end if you haven't already done so **(C)**. Begin with a 220- or 1000-grit stone, depending on how much material you have to remove and how thick the line of light is, and work the tool by rolling it on the bevel as you push it across the stone **(D)**. Keep the bevel flat on the stone, and do not round the cutting edge over. Check the bevel often as you hone to make sure you are working the entire surface and that it stays flat. Work the bevel up through 4000- and 8000-grit stones, or on your finest oilstones, until the line of light has disappeared. A set of magnifiers or a small magnifying glass can be a big help **(E)**.

There's one more thing: The sharp heel created during sharpening can mar the workpiece. Slightly round the heel on a stone, then make sure to polish this area as well.

After grinding and honing the bevel, it's time to work on the inside of the tool. If this surface is not already smooth, you will need to use gouge slipstones **(F)** or 220- or 320-grit silicon-carbide paper wrapped on a dowel **(G)** to polish it. Even a fine India slipstone is too coarse for a finish surface, so follow with fine oil slipstones or finer grits of abrasive paper to get as smooth a finish as you can on the inside. This is also the time to apply a very small back bevel to the gouge **(H)**. It will make carving a little easier.

The inside surface of a deep gouge may be too tight for standard slipstones. Although slipstones can be shaped to fit a particular tool, there's a simpler way. Take a small piece of softwood, and plane it to fit the inside of the gouge **(I)**. Use the gouge upside down to check the fit. Apply honing compound **(J)** to this wooden slip, and use it to strop the inside of the gouge **(K)** including the back bevel.

(Text continues on p. 176.)


F


G


H

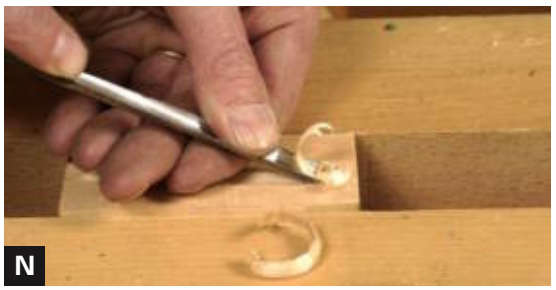

I


J


K


L


M


N


O


P

The next step is to polish the bevel. You can use a leather strop after working the bevel with waterstones. Charge the strop with honing compound **(L)**, and pull the gouge down the strop so that you won't cut the leather, rotating it while you do **(M)**. Another way is to cut a groove in your little wooden slip **(N)**. Charge the groove with honing compound, and use that custom-made tool to polish the bevel by pulling the tool toward you **(O, P)**. When you're finished, note on the piece of wood which gouge was used to sharpen it. Next time, you'll already have your slip made.

Using the Oar Jig

The Oar Sharpener should ride on a surface approximately the same level as the surface of your stones. A piece of wood of the correct thickness works fine **(A)** to shim up the jig. If you use more than one stone, which of course you should, the stones need to be at exactly the same height **(B)** or the bevel angle will be different as you move from one stone to the next. Cardboard shims can raise the stones to the same height. Of course, if you use sandpaper on glass as a honing system, this will not be a problem.

For gouges, extend the gouge so that the bevel lies flat on the stone **(C)**. Use the center screw to hold the gouge in place **(D)**. Hold the gouge perpendicular to the centerline of the stone, and rock the gouge as you move down the stone **(E)**. Color the bevel with a felt marker so you can check your progress as you go **(F)**.

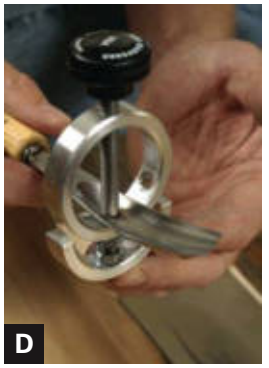
For V-tools, there are two additional screws that lock the tool in place. Unfortunately, they will only fit a very large V-tool. If the jig doesn't seem to hold the tool firmly, grind a taper on the end of the center screw so that it fits the inside of the V-tool better **(G)**. That should lock the tool in place.

Extend the V-tool through the jig so the bevel lies flat on the stone **(H)**, lock it in place with the center screw, and hone one bevel **(I)**, then the other. To create a small radius on the keel, roll the tool over your finest-grit stone while it is still in the jig. Finally, polish the heel freehand to finish the job.


A


B


C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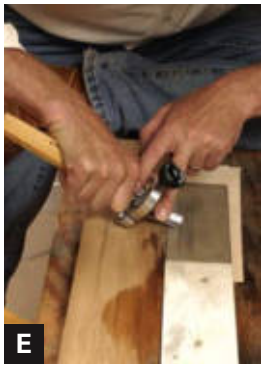

E


F


G


H


I

Turning Tools

Dressing the Wheel

➤ Dressing the Wheel (p. 185)

Skew Chisels

➤ Skew Chisel (p. 186)

Gouges

➤ Roughing and Bowl Gouges (p. 188)
➤ Deep-Flute Bowl Gouge with a Side Grind (p. 189)

Parting Tools

➤ Diamond Parting Tool (p. 191)

Scrapers

➤ Scraper (p. 192)

Hook Tools

➤ Hook Tool (p. 193)

Turners have developed a variety of turning tools for specialized tasks, particularly for turning hollow forms. But for the average woodworker who only wants to make furniture parts on a lathe, a basic kit of turning tools can be very simple, consisting of a few scrapers, skews, gouges, and parting tools. If you can sharpen these four tools properly, you will be able to sharpen most other tools you need for more specialized work.

Bevel angles are steeper on turning tools than they are for plane blades and chisels. That's so they hold up under power—a turning tool cuts a lot more wood than a handplane in the same amount of time. Bevel angles also should be varied to suit the task at hand: steeper for hardwoods and for better edge life, and shallower for softer woods and a better finish.

Basic Turning Tools

Scrapers are relatively thick, flat tools, ground with a blunt bevel of 70 degrees to 80 degrees so the cutting edge has a good deal of support. Scrapers come in a variety of sizes and may be ground straight across, with a curved end, or with special shapes for specific jobs. For the best finish and edge life, hone off the burr left by the grinder, and roll a hook on the edge using a burnisher. A properly sharpened scraper will produce shavings, not sawdust.

Professional turners often own a variety of tools, including (from left) a sizing tool with a Bedan scraper, skew chisel, skewed scraper, spindle gouge, parting tool, deep-flute bowl gouge with side grind, hook tool, roughing gouge, radiused scraper, parting tool, and an Ellsworth scraper for hollowing.

Skew chisels are often used to make planing cuts with the bevel bearing on the wood or to cut beads and curves. The bevel on each side is quite shallow, from 10 degrees to 12 degrees for a total angle of 20 degrees to 25 degrees. The skew angle is typically about 30 degrees. Some turners prefer to sharpen a skew with a slight radius to the cutting edge.

Gouges are a large family of tools. A roughing gouge is a heavy tool with a shallow flute, typically sharpened with a square end and blunt bevel of about 45 degrees. Bowl gouges are heavy sectioned with a deep flute. Spindle gouges are lighter and have shallower flutes. Both bowl and spindle gouges can be sharpened with a square end or with a radius on the end, which is formed by grinding the sides of the flute back at an angle of 10 degrees to 20 degrees.

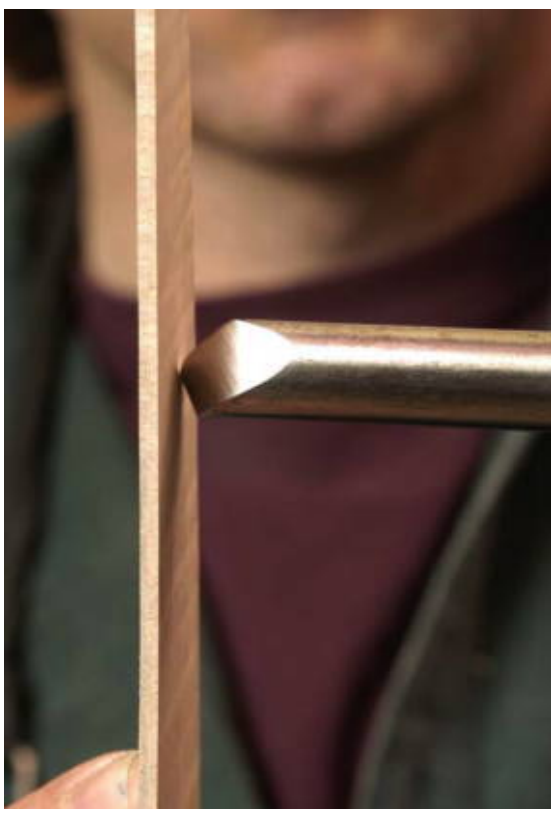
The sides of a deep-flute bowl gouge are often ground much farther back, with a

Scrapers are ground with a steep bevel for support. The end of the tool may be straight or rounded.

Skew chisels have a bevel on each side of the blade, typically at an angle of 10 degrees to 12 degrees.

They're all gouges: This family of tools has many members, from heavy roughing gouges to more maneuverable spindle gouges.

A deep-flute bowl gouge with a side grind is a more versatile tool than one with a square profile.

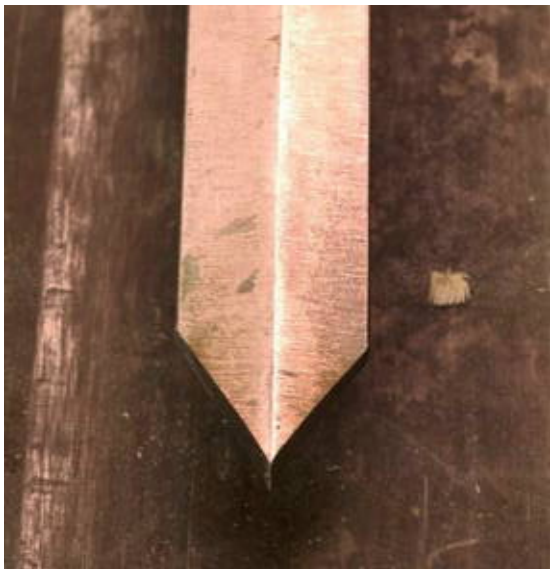


slight radius to the edge. This style of grind, called a side grind, is versatile because different parts of the bevel can be used for different cuts. You can use the long edge like a skew for finish cuts or like a roughing gouge for heavy cuts, and the front of the tool for shaping work, roughing with heavy pressure, and finishing with lighter pressure.

The inside, or flute, of any gouge should be checked and honed smooth if necessary the first time you sharpen the tool. You can do this using slipstones, abrasive paper wrapped around a dowel, or a slipstone that has been shaped by grinding a radius on an old waterstone.

Parting tools, used for marking out diameters or for forming beads like a skew, are available in a variety of tip shapes, typically with two bevels on the narrow edges coming to a point of from 40 degrees to 50 degrees (the higher angles for harder woods). The diamond style is thicker in the middle to give clearance, and the point of the tip must be centered on the widest part of the tool.

The inside surface of a gouge should be honed and polished when the tool is new.



A diamond parting tool has two bevels that meet at a point and form an angle of 40 degrees to 50 degrees.

Turning Tools Need Frequent Sharpening

Turning generates a lot of heat, which can dull a tool quickly. Inexpensive turning tools are often made from ordinary tool steel; better ones from high-speed steel. High-speed steels have alloy elements, primarily tungsten and molybdenum, that prevent high heat from drawing the temper from the tool. Turning tools are made from a variety of high-speed steels (see the sidebar at right).

Turning tools manufactured from any alloy steel will need frequent sharpening, but some will need more frequent sharpening than others. Price is a reasonably good guide to wear resistance because the more sophisticated and longer-wearing alloys are more expensive. Fortunately, the tools needed to do a great sharpening job are pretty basic. A slow-speed grinder (one that turns at 1,725 rpm) is a good choice. It provides more control than a standard-speed grinder, and it will heat the tool more slowly. If you choose an 8-in. grinder, a slow-speed model will be less intimidating and less dangerous than one spinning a grinding wheel at twice the speed.

An 8-in.-dia. wheel is the best choice for grinding turning tools because it produces a less pronounced hollow grind than a 6-in. wheel. The hard gray wheels often sold with grinders are not the best choice for grinding

An 8-in. grinding wheel is a better choice for turning tools than a 6-in. wheel because the hollow grind it creates is less pronounced and, as a result, stronger.

PARTICLE METALLURGY FOR LONG-WEARING STEEL

Some high-speed steels used in turning tools are made in a process called particle metallurgy technology. They are typically known as PM steels or CPM (Crucible particle metallurgy) after a company called Crucible Steel that developed the process. CPM steel is made from extremely fine particles of steel and alloy elements, the result being a very even distribution of carbides and alloy elements and very fine grain size. CPM techniques also allow a higher content of alloy than can be made any other way. CPM steel is expensive, but it wears very well.

Friable aluminum-oxide grinding wheels wear a little more quickly than standard wheels but dissipate heat more efficiently.

tool steel because they generate too much heat. Wheels with an open-grain structure and a fairly soft bond are better for cutting tool steel. Several makers offer them. They are often described as "friable" and are typically white in color. The surface of the wheel wears faster than a common grinding wheel, which means some of the heat developed during grinding is dispersed with the chips of steel and wheel particles. Freshly exposed abrasive particles cut quickly. Even with a softer bond, these wheels still last a very long time.

A more expensive option for grinding high-speed steels is the blue SG (seeded gel) grinding wheel from Norton. This ceramic aluminum-oxide wheel breaks down quickly,

DRESS THE WHEEL FIRST

Before grinding, make sure the face of the wheel is flat and true with a smooth surface. The smoother the surface of the wheel, the better edge you will get. Dressing the wheel also exposes fresh, sharp abrasive particles. Whenever you mount a new wheel on your grinder, dress it before using it to sharpen tools. There are many different dressers on the market. The one that I like best is a diamond tool with a fine adjustment for depth of cut that slides smoothly across the face of the wheel on the tool rest or on the fixed base of a jig system.

Before putting tool to stone, make sure the face of the grinding wheel is flat and square to the sides. A diamond dresser makes the process fast.

This seeded gel ceramic aluminum-oxide wheel from Norton is a good choice for grinding high-speed steel.

the small seeds of compounded abrasive fracturing as they wear to continuously expose fresh cutting surfaces.

Another tool choice altogether is a 1-in. belt sander, which can be very useful for grinding turning tools. It won't readily overheat the steel.

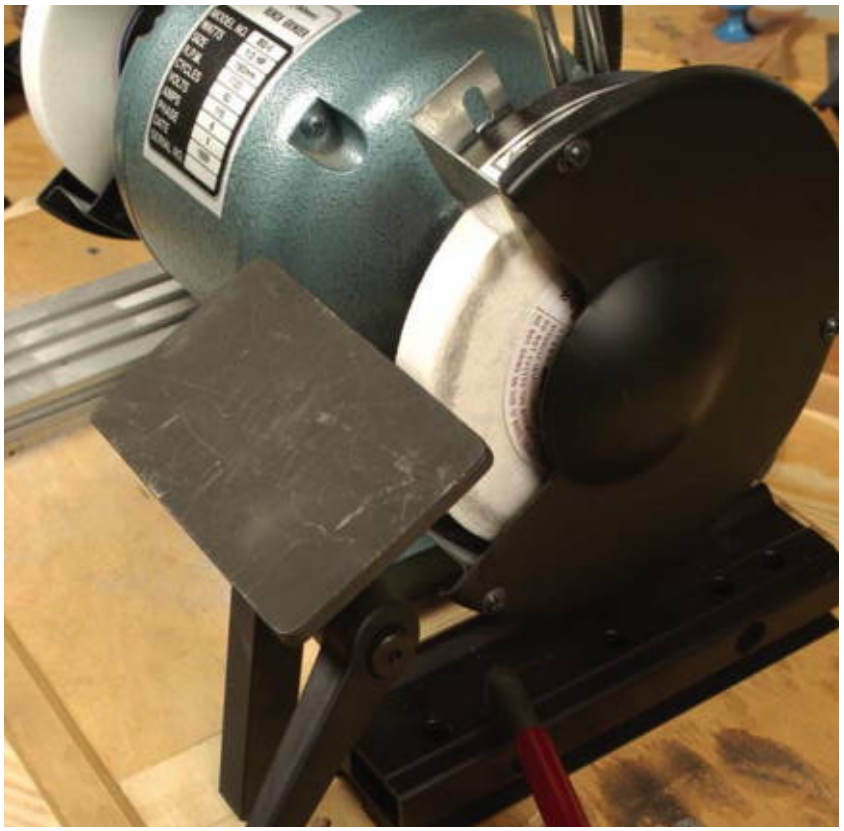
Jigs Make the Process More Reliable

With practice, turning tools can certainly be sharpened freehand. One common way to check that you are grinding the full width of the bevel is to raise the handle of the tool until you see sparks coming over the top. Each time you regrind, however, you are likely to be increasing the bevel angle until it is no longer correct. Then you have to start over by completely regrinding the bevel to the correct shape.

A good jig is helpful not only because it makes sharpening fast and accurate but also because it gives predictable results. This allows you to focus on turning wood and not struggling to use an improperly ground tool. Using a jig allows you to put the tool on the grinder at the same angle as the last time you sharpened it, which means faster sharpening and less tool steel being turned into expensive dust. A few quick passes restore the edge. For sharpening a deep-flute bowl gouge with a side grind, a jig helps you to repeat accurately what is a difficult profile to grind freehand.

I asked Steven Gleasner, a professional turner in Maine, to demonstrate how he keeps his tools sharp for the demanding job of turning his laminated Baltic birch bowls and vases. He uses the One-Way Wolverine grinding jig. This is really a system of tools that consists of a base mounted under the grinder and several adjustable jigs that lock into it. They include a platform jig for grinding angles, a Vee Arm jig for grinding gouges, a jig for grinding skew chisels that fits on the Vee Arm, and a bowl jig for side-grinding deep-flute bowl gouges. There are other systems on the market as well, and many professional turners, for whom time is money, use them to get the job done correctly

The Wolverine grinding system includes a platform jig, a locking base, a gouge jig for side grinding, a skew jig, and a Vee Arm gouge jig.



Wolverine's platform jig provides a stable base for grinding.

The adjustable Vee Arm attachment for the Wolverine system allows a gouge bevel to be ground accurately.

A good way to test for sharpness is to place the tool against a piece of scrap and rotate the lathe by hand. The tool should produce clean shavings.

and quickly. Steve set up his grinder directly behind his lathe so it's close at hand. Make sure you have good lighting, and bolt the grinder and jig to a firm base to eliminate vibration.

Although honing is not necessary after grinding turning tools, except for skews and scrapers, some turners prefer it. Some hone to save time later because the smoother finish produced by a sharper tool reduces sanding time. It depends on the turner and the type of work he is doing. But professional turners don't want to spend any more time honing than they have to. If you choose to hone, be careful not to alter the geometry and not to round over surfaces that should be crisp.

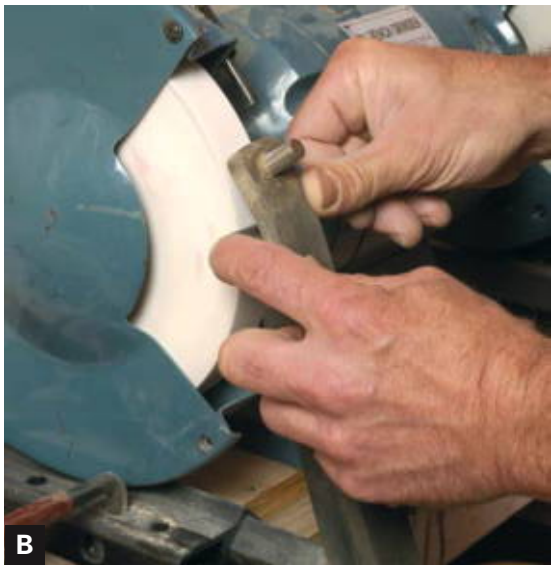
A good test for sharpness is to try the tool while rotating the lathe slowly by hand. A sharp tool will cut shavings even at this low speed.

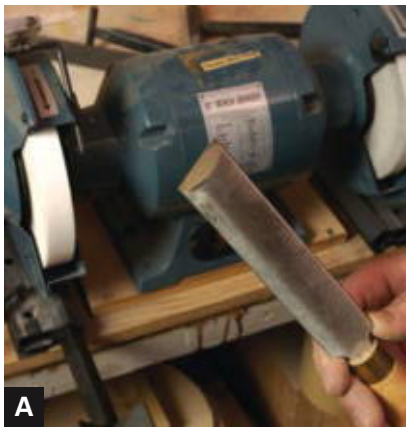
WARNING Always wear eye protection when using a grinder.

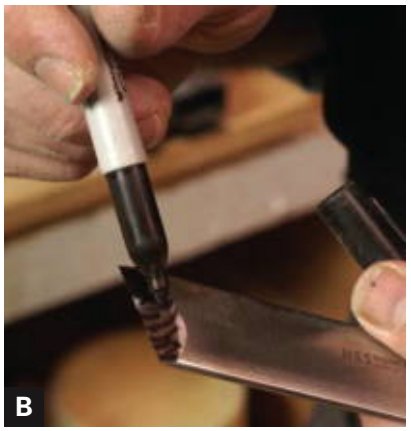
Dressing the Wheel

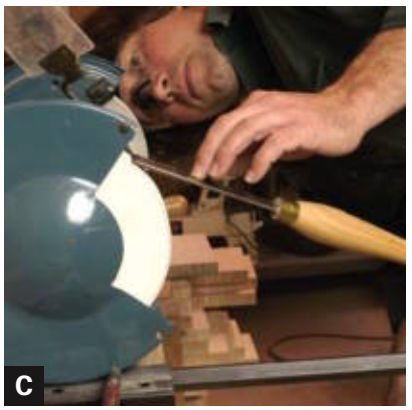
This dresser is made for the Wolverine grinding jig. It comes with a single-point diamond cutter **(A)** fixed to a long arm that is inserted into the base of the jig. The arm pivots across the face of the stone, and a knob on the front sets the depth of cut. With the grinder off, rotate the wheel by hand, and adjust the dresser until you can hear the diamond just touch the wheel. Swing the dresser off the wheel, and turn the grinder on. Take a pass to check. Advance the diamond into the stone by turning the knob about a half-turn, then move the dresser across the face of the stone with a light touch and smooth motion **(B)**. Listen for the sound the dresser makes, and learn to judge how much material you are removing by the way it sounds. When the face of the wheel looks square and clean, take one final pass, nice and slow, at the same setting.


A


B


A


B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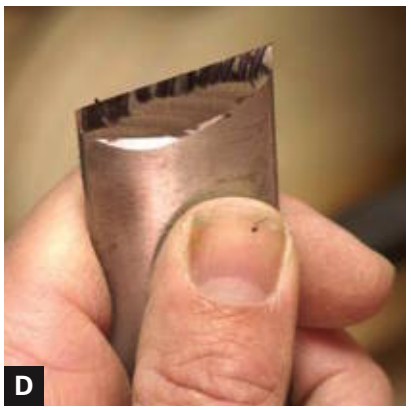
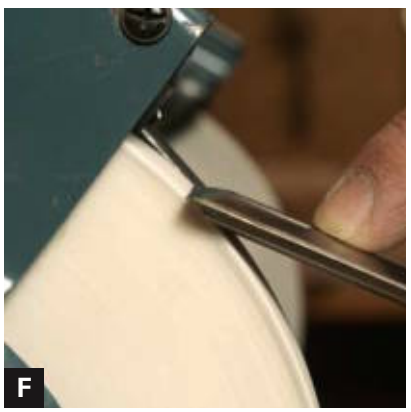

D


E


F

Skew Chisel

The business end of a skew chisel is at about a 30-degree angle from square and is beveled on both sides to a total included angle of about 25 degrees **(A)**. You can sharpen skew chisels freehand, but a mechanical aid such as the Wolverine jig is helpful. When you resharpen the tool at the same setting using the Wolverine jig, you'll waste much less metal and get the job done in just a few minutes.

Mark one bevel of the skew chisel with a felt marker **(B)**. Place the tool handle in either the right- or left-hand jig pocket, and lay the bevel flat on the stone **(C)**. Moving the stone by hand, check the bevel, and adjust as necessary to bring as much of the existing bevel as possible into contact with the stone **(D)**. The jig has the side-to-side angle built in. Begin grinding **(E)**. You don't need a death-grip on the tool—just let the weight of the tool do the job **(F)**. Move the tool lightly back and forth over the stone, being careful not to grind too much off the corners, especially when you reverse direction. It is helpful to think of the jig as a guide to help you do the job, but you control the grind with pressure and motion. When you are satisfied, grind the second

side. Once you are done **(G)**, mark the location of the arm of the jig with a scribe so you can put it back in the same position the next time you need it for this tool **(H)**.

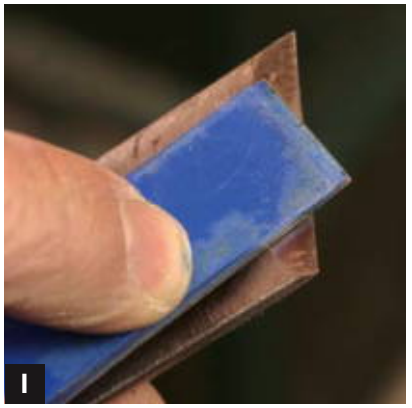
You do not need to hone the skew after you've finished with the grinder, but you do need to remove the burr formed where the two bevels meet. A superfine diamond hone laid on the heel and toe of the hollow-ground bevel and drawn back away from the edge, not toward it, will remove the burr with a couple of strokes on each side **(I)**. Test the edge by running your fingernail along the edge **(J)**. It won't be completely smooth; you'll feel a little "tooth." A skew chisel is used for both rough and finish work. This tool is sharp enough to leave a surface that can be sanded with 400-grit paper. You should get light shavings with a planing cut **(K, L)**.

Some turners prefer to grind a slight radius on the skew. The skew-grinding attachment will not work for this, but the radius can be established by grinding both bevels using the platform rest. Then switch to the gouge jig with the skew handle in the Vee Arm, and finish grinding by rolling the tool across the face of the stone like a gouge.

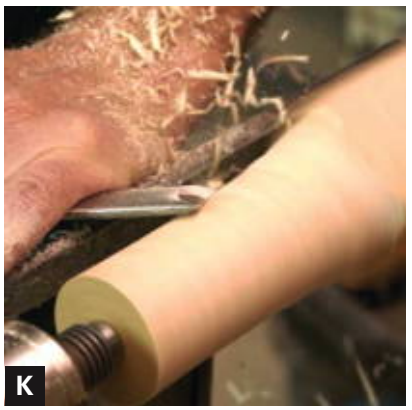
➤ See *"Roughing and Bowl Gouges"* on p. 188.

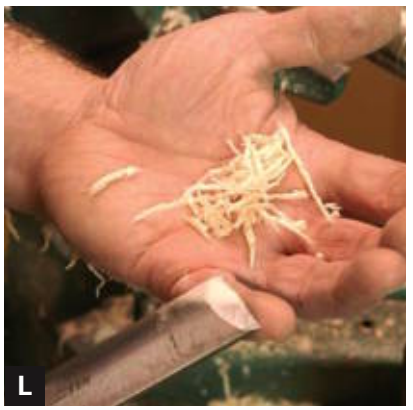

G


H


I


J


K


L


A


B


C


D


E

Roughing and Bowl Gouges

Bowl gouges and roughing gouges **(A)** can both be sharpened with a platform tool rest alone **(B)** or with the Wolverine Vee Arm bowl jig. The end of a roughing gouge is ground square with a bevel angle of about 45 degrees. Some bowl gouges also are sharpened this way. To grind or regrind a fingernail tip on a shallow gouge, use either the platform tool rest or Vee Arm gouge jig, and set the bevel angle to about 45 degrees. The top corners of the tool are ground back 10 degrees to 20 degrees, depending on personal preference, to form a radius on the end of the tool. The platform jig controls the grinding angle, but by rotating the tool as you grind **(C**, **D**, **E)**, you can form the shape you want.

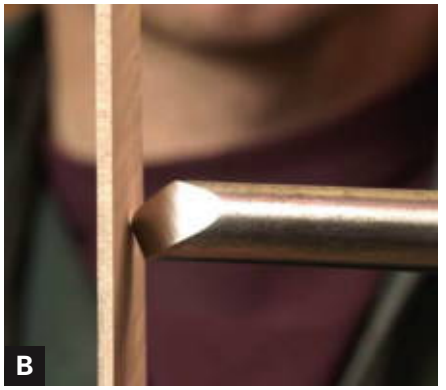
Deep-Flute Bowl Gouge with a Side Grind

Deep-flute bowl gouges **(A)** are often sharpened with the sides of the bevel tapering back from the tip to create a long cutting edge behind the nose of the tool. This is a versatile grind. Different parts of the bevel can be used for different purposes, from aggressive roughing to precise shaping. The bevel is quite blunt, about 65 degrees, a more acute angle being more aggressive but also harder to control **(B)**.

This style of grind is not easy to do freehand, but the Vari-Grind gouge jig **(C)** holds the tool at a consistent angle while allowing you the movement necessary to get the correct shape. Grind one half of the gouge first, then the other, blending the nose last. To use the jig, make a stop block that will allow you to set the front of the tool 1¾ in. from the front of the jig each time you use it **(D)**. Mount the gouge in the jig, and mark the bevel using a felt-tip marker. Placing the bevel on the wheel, sight the angle to make a rough adjustment **(E)**. Turn the wheel against the tool by hand, and check the bevel **(F)**. Make any needed adjustments so the bevel fully contacts the wheel, then mark the position of the jig on the base for future reference.

(Text continues on p. 190.)


A


B


C


D


E


F


G


H


I


J


K


L

Start grinding with light pressure, letting the weight of the tool do the work. Listen to the cut on the grinder as you roll the tool from the front to the side and grind the ears back. Adjust your pressure to keep a light cut, and roll the tool across the face of the stone **(G, H, I, J)**. If you are establishing this grind for the first time, quite a bit of material will have to come off the sides. Take your time and go slowly. Grind each side, then blend the nose carefully. The tool is ready to use **(K, L)**.

Diamond Parting Tool

The edges of a parting tool **(A)** are beveled. The tool is thickest in the middle, so the bevels have to line up exactly with the thickest part of the tool **(B)**. Using the Vee Arm jig in the Wolverine system helps you control symmetry **(C)**, but you have to watch carefully so that both bevels meet on the centerline of the tool. Keep the tool vertical to get an even, square grind all the way across the front edge. Grind one side to the center, make sure the end is square **(D)**, then turn the tool over and grind the second side **(E)**. If it's critical to have a good finish—when using the parting tool to form beads, for example—hone both bevels using a diamond hone **(F)**. If you are using the tool to mark out diameters, it will work just fine without honing **(G)**.


A


B

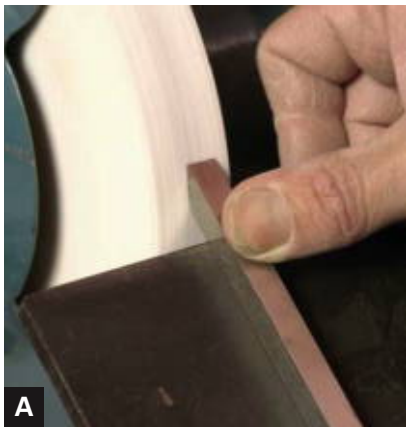

C


D


E


F


G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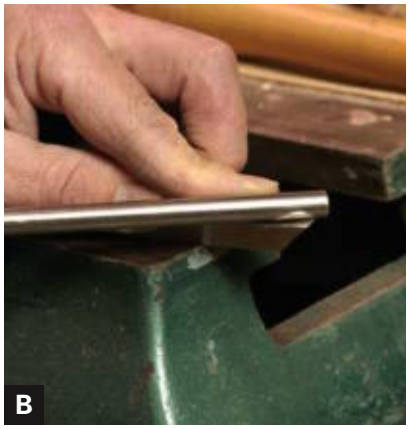
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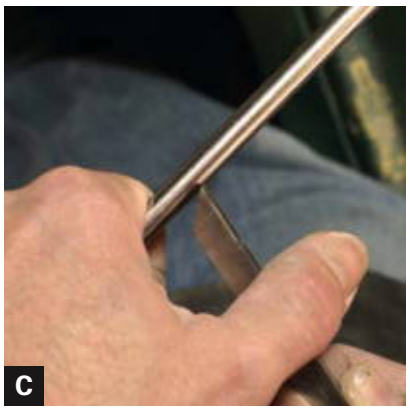
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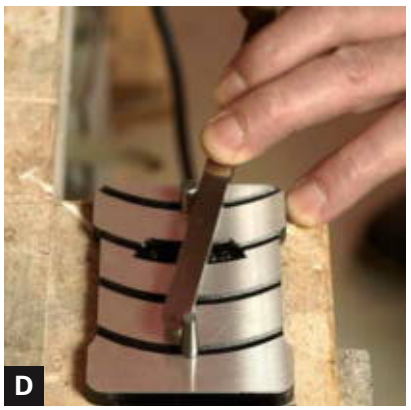

D


E

Scraper

Grind the end of a scraper using the tool platform set at about 75 degrees to the face of the stone **(A)**. Remove the wire edge by honing both the top and the bevel. You can use the scraper without any further work, but the edge won't last long. It's better to roll a burr with a burnisher before putting the tool to work. Start by holding the burnisher flat on the top of the scraper, and burnish with a forward motion to further smooth the top surface **(B)**. Then burnish from the bevel side, starting with the burnisher about parallel with the bevel and working up to 90 degrees to the top face of the scraper using firm pressure **(C)**.

Alternatively, you can use a burnishing jig like the one made by Veritas. The leverage that this jig provides makes rolling a burr easier **(D)**. The shank of the tool pivots against a pin. Rotate the tool with firm pressure against the carbide burnishing rod to form a burr. A properly sharpened scraper will cut shavings **(E)**. When the tool produces dust instead of clean shavings, it's time to resharpen.

Hook Tool

A hook tool **(A)** is used to turn end grain **(B)**. You can sharpen the inside of the hook with a diamond burr **(C)** in a drill press or with a flexible shaft machine. Finish up with diamond files **(D)**, and hone the outside with a superfine diamond hone **(E)**.


A


B


C


D


E

Power Tools

Jointer & Planer

- Honing Knives with a Hone-Mate (p. 200)
- Honing Knives with a Shopmade Jig (p. 201)
- Honing Knives with Diamond Stones (p. 203)
- Grinding Knives with a Tormek (p. 204)
- Adding a Back Bevel (p. 206)

Router Bits

- Honing a Router Bit (p. 207)

Chainsaws

- Sharpening a Chainsaw (p. 208)

In the last decade, carbide and carbide-tipped cutting tools have become much less expensive and a lot more common in small woodworking shops. Carbide has largely replaced tool steel in some kinds of cutting tools. Finding an old-fashioned steel table-saw blade, for example, isn't easy these days. Most circular-saw blades, including inexpensive ones, are carbide tipped. Even jointer knives are available in carbide, although they remain much more expensive than those made from high-speed steel.

In at least one way, this trend has been a help to woodworkers. We now have tools that stay sharper much longer than before, and that's good. But we also have tools that are very difficult to sharpen. For most people, it just isn't practical to sharpen carbide tools in their home shops. In part that's because carbide is very hard and abrasion resistant. That's what makes it good for cutting tools, but it also means that carbide can't be sharpened using conventional abrasives. You'll have to use diamond abrasives for the job. Green silicon-carbide grinding wheels will cut carbide but not as effectively as diamond, and they tend to generate too much heat, which is bad for carbide. High-speed steel and carbon tool steel, on the other hand, can be ground and honed using standard grinding wheels and stones.

JUST WHAT IS CARBIDE?

Carbide is a mix of fine particles of carbon and carbide elements, such as tungsten carbide, that are mixed with cobalt and compressed under high pressure and heat in a process known as sintering. The material is formed into a usable tool shape, such as a bar or rod. Small pieces of carbide are made into cutting edges on a variety of tools for woodworking, such as circular-saw blades and router bits. Some cutters are made entirely of carbide.

The material is extremely hard, although somewhat brittle, and it withstands high temperatures well, which gives excellent tool life. But the material is too hard for common abrasives. Diamond tools must be used to grind carbide.

The particle size of the compounds that carbide is made from is important to tool life, and it varies from maker to maker. In general, the finer the grain structure, the better it will work on a cutting tool—edges will stay sharper longer and will cut wood more easily. This advantage is why some carbide tooling is advertised as "fine grained" or "micro-grain."

There's another reason why woodworkers should not try to sharpen most power-driven cutting tools at home. With a few exceptions, the practice just isn't safe. Shaper cutters, for example, rotate at very high speeds, and they are relatively heavy. An out-of-balance cutter is dangerous. Getting a sharp edge on a carbide tool, as well as maintaining the right blade geometry, takes special equipment.

There's nothing wrong, however, with touching up a carbide or high-speed steel router bit. Light honing will extend the life of the bit, and the relatively low mass of most router bits makes small imbalances less of an issue. Very large router bits, such as panel-raising bits, are an exception. They should be treated like a shaper cutter and left to a professional sharpening shop. When honing a router bit, you should only hone the flat faces, never the beveled edge. Be careful to use the same number of strokes on each face when honing so the cutter doesn't become unbalanced. After touching up your router bits a couple of times, or if honing them doesn't seem to improve the cut, send them out to a professional shop.

Touching Up Jointer and Planer Knives

For some types of cutting tools, there is little that can be done to improve on a professional sharpening. You can't, for example, do much to a carbide-tipped table-saw blade once it

Although it takes a few minutes to set up, the Tormek system works well for honing planer and jointer knives.

Surprisingly simple jigs, such as this block of wood with three angled saw kerfs, can be used to hone planer and jointer knives accurately and quickly.

comes back from the shop. Jointer and planer knives are an exception. Both carbide and high-speed steel knives can be touched up in the home shop using simple jigs and tools. There are commercial jigs available for grinding and honing jointer/planer knives, or you can make simple jigs yourself and use sharpening stones you already have.

You'll have to use diamond sharpening stones for carbide tools, but you can use waterstones and silicon-carbide paper to hone high-speed steel knives. Be careful to remove the same amount of material from each knife in a set. Even so, after touching up the edges a few times, it's a good idea to send the knives out for professional grinding to even them up.

Inspect your blades carefully when you get them back. Properly ground blades will not show grinding marks on the bevel. If they

A jointer knife that has been sharpened carefully does not show deep grinding marks on the beveled edge.

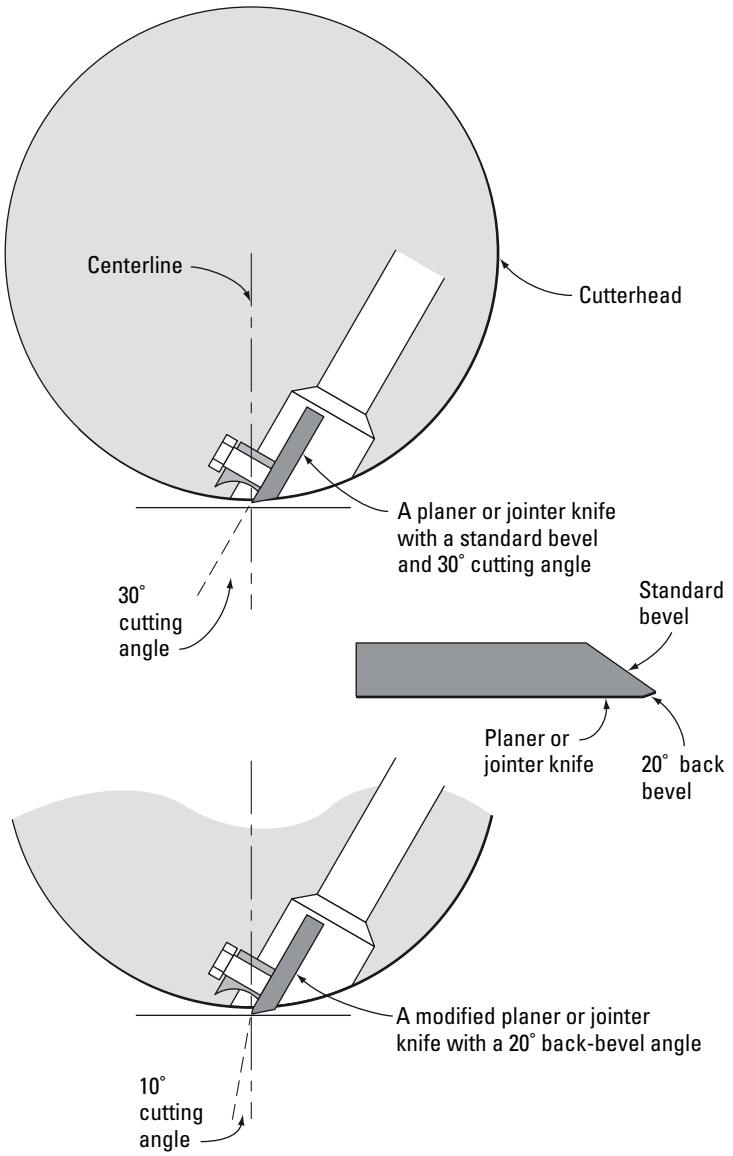
do, a light honing will make them cut much better. If there are a lot of deep grinding marks, think about using a different sharpening service next time—not every sharpening service does a great job. Being able to sharpen, or at least hone, planer knives means you'll continue to get a good surface for a longer period of time, and you'll have to send the knives out less frequently.

Sharpening your own jointer knives also gives you a chance to alter the manufacturer's original bevel angle (typically in the 35-degree to 40-degree range). You can add a secondary bevel, just as you would with a handplane blade, to improve edge life and surface finish.

Another possibility is honing a back bevel on planer knives, which can lead to dramatic improvements in the surface of woods that tear out and chip easily. A back bevel changes the angle at which the knife meets the wood. In his booklet "Double-Bevel Sharpening," Brian Burns calls this the cutting angle. Picture a line from the center of

Planer knives that have been back-beveled produce a clean surface on notoriously tough woods, such as this piece of curly maple, left. At right, part of the same board is shown surfaced with conventionally ground knives.

KNIVES WITH BACK BEVEL



the cutterhead to the cutting edge of the knife—that would represent a 0-degree cutting angle. A cutting angle of 30 degrees is common in many planers, but Burns recommends a cutting angle of 10 degrees (see the drawing above). If you want to try this approach, you might start by measuring the cutting angle in your own planer or by asking the manufacturer for the information. If your knives are at a 30-degree cutting angle, honing a 20-degree back bevel will make a big difference on difficult woods that won't otherwise machine smoothly. The bevel should be from 1/32 in. to 1/16 in. wide.

The harder the wood and more difficult the grain, the lower the cutting angle should be. You might want to try a back bevel even greater than 20 degrees, although the 10-degree cutting angle recommended by Burns is a good starting point. Just as with a handplane, a planer with back-beveled blades needs more power to cut through wood, so this technique may not be practical on a lightweight planer, and you may have to take shallower passes. A sharpening service should also be able to back-bevel blades for you if you give them precise instructions about what you want.

Circular, Bandsaw, and Chainsaw Blades

If you are very careful and patient, it is possible to resharpen impulse-hardened bandsaw blades with diamond files or with a carbide burr mounted in a Dremel™ or flexible-shaft tool. But bandsaw blades, except those for large resaw machines, are quite inexpensive. The effort involved in trying to sharpen one is probably not going to pay off for most people. That's why I don't cover it here.

Nor are most circular-saw blades well suited for sharpening in a home shop. Not long ago, there were a lot of specialized circular-saw blades on the market with ordinary steel teeth. Carbide-tipped blades made today last a long time before they must be

resharpened. They should be sharpened by someone with the right equipment and knowledge to return them to as-new condition with the correct tooth geometry. If you do use steel table-saw blades, however, you can sharpen them very much as you would a handsaw: Joint and set the teeth after every two or three filings, and hand-file a rip or crosscut, or in some cases a combination, tooth pattern. In truth, though, not many people seem to use these blades, and learning how to sharpen them probably isn't worth the time it would take.

On the other hand, chainsaw blades are easy to sharpen yourself, which is a good thing because a chainsaw that sees much use should be filed frequently. All you need is the right diameter round file for the teeth and a small flat file for the depth gauges, the small fins between teeth that control depth of cut. Follow the existing geometry on the tooth, making sure to keep all the teeth the same length. Unless you have to remove nicks or the chain is very dull, a few strokes with a file is all that should be needed.

After you've sharpened the blade two or three times, file down the depth gauges. If the depth gauges are too high, the saw will cut slowly or not at all. If they are filed too much, the saw will be too aggressive and may be dangerous to use. A number stamped into the side of the tooth tells you the correct height of the depth gauge in thousandths of an inch. Your dealer can supply a matching metal guide to make the process nearly foolproof.

Most saw chains are filed for crosscutting with the leading edge of the tooth angles from 22 degrees to 35 degrees. Chains for rip cutting (in a chainsaw mill) are sharpened straight across.

Sharpening a chainsaw requires only simple tools: a round file of the right diameter and a small flat file for the chain's depth gauges.

Honing Knives with a Hone-Mate

First, unplug the jointer. Move the guard out of the way, or remove it so you have access to the cutterhead. Clean the knives using a little light oil **(A)**. The Hone-Mate **(B)** has a small lip that acts as a guide to hold the stone on the bevel of the knife. Position the Hone-Mate on the bevel of the first blade **(C)**, and hone with a full-length stroke on the knife bevel using moderate pressure. After taking several strokes, check the edge. Be sure to take the same number of strokes with the same amount of pressure on each knife so the knives remain balanced and the cutterhead runs smoothly. If you feel a burr, lightly deburr the back of the knife with the Hone-Mate **(D)**, but don't round over the back.

WARNING **Always unplug a power tool before working on its blades or cutters.**

Honing Knives with a Shopmade Jig

High-speed steel jointer knives can be honed with waterstones or oilstones in a simple jig **(A)**. To make the jig, use a piece of scrap wood slightly longer than the knives (a piece of 2x6 works fine). Make sure the face is flat; joint or plane it if necessary. Check the angle of the knife bevel **(B)**, and set your table-saw blade to that angle. Make a test cut to check depth.

Set the depth of cut to leave the bevels of the jointer knives slightly exposed. Also be sure that the jointer knife will slip in the kerf snugly but easily. Make two or three parallel kerfs **(C)** in your jig, depending on the number of knives your machine takes, but have the two outside kerfs angled toward each other. Place your jointer knives in the kerfs **(D)**. Check to make sure that

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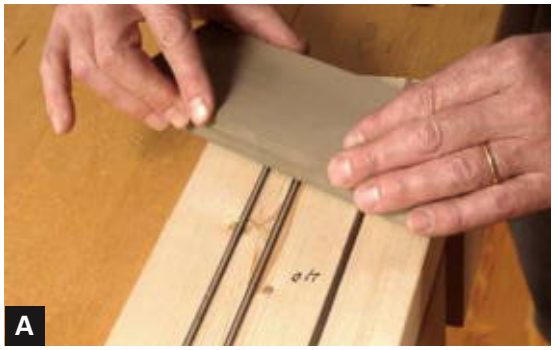
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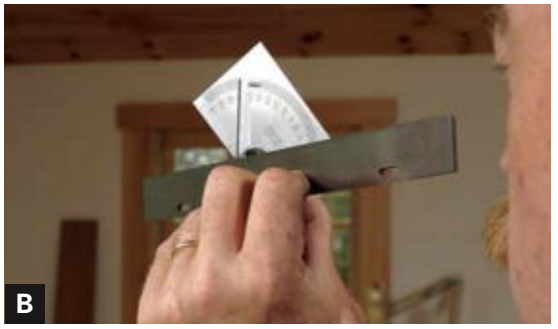
B


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the bevels are at the same height **(E)**, and darken the bevels with a marker so you can see your progress **(F)**. Take long strokes down the knives using a medium (1000-grit or 4000-grit) stone. Finish with a finer stone if you prefer.

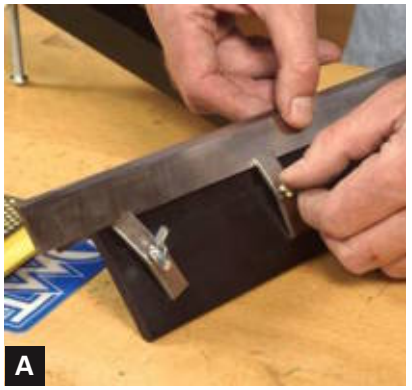
Check the edge **(G)** and finish by lightly honing the backs of the blades to deburr them **(H)**. Honing all of the blades at the same time in this way makes it easier to remove the same amount of metal from each blade so the machine will run smoothly.

This method can be used to create a secondary bevel. Just cut the saw kerfs at the angle you want for the secondary bevel. You can also use this method to touch up the edges of insert-type jointer knives, such as Tersa™ knives **(I)**. Although these knives are intended to be disposable, they aren't cheap and they can be honed lightly a few times. Using this jig really improves performance on knives that have lost their edge.

Honing Knives with Diamond Stones

High-speed steel and carbide jointer and planer knives can be sharpened on diamond stones using a jig like this one from DMT. Start by installing the knife in the jig **(A)**. Using a felt-tip marker, mark the bevel **(B)**. Select a fine diamond stone such as the red-dot 25-micron DMT stone. For longer knives, you will need two stones.

Place the bevel of the knife on the stones, and adjust the angle of the jig until the bevel sits flat on the stone **(C)** by altering the threaded-rod guide foot to the correct height. Lubricate the stones **(D)** with water or a light oil. Press firmly but not hard, and slide the knife diagonally across the stones **(E)**. Diamonds cut quite quickly, and unless you have to remove nicks, it takes only a few minutes to hone a new edge. Check the bevel visually to make sure the edge is even **(F)**, then lightly deburr the back of the blade **(G)**. Because you are honing each blade individually, be careful to remove the same amount of material from each blade by taking the same number of strokes on the stones. You can double-check by measuring the overall widths of the blades with calipers or by putting two blades back to back to make sure they are the same width. If you have three blades, check the third against one of the first two.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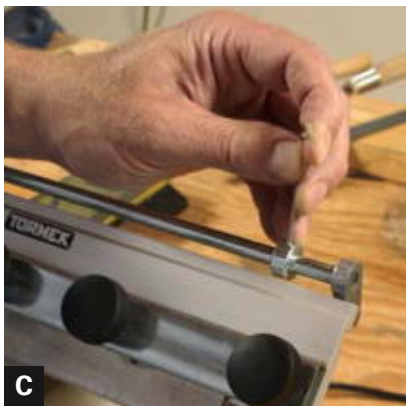

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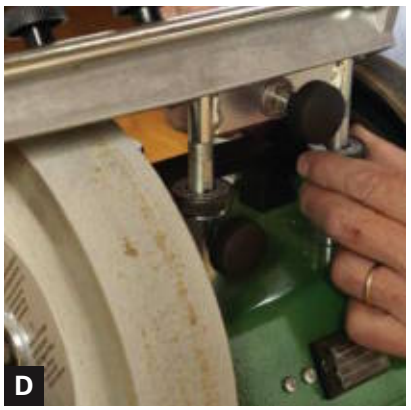
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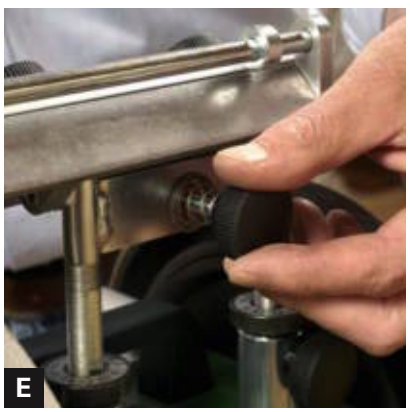
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Grinding Knives with a Tormek

If you have a Tormek grinder, you'll find that its accessory for jointer and planer knives does a nice job. It accommodates only one knife at a time, but once you have set up the machine for the first knife, the same amount of material will be ground from subsequent knives without any more adjustments. First, dress the stone **(A)** to make sure the surface is true. Insert the blade and clamp into the holder. Using a felt-tip marker, mark the bevel (**B)**.

Install the jig base on the machine, and place the blade holder on the jig. Adjust and lock the stops on each end of the support **(C)** so you can grind the full length of the blade. Next, adjust the height using the two adjustment wheels **(D)**, and adjust the angle using the angle stop **(E)** on the back of the jig so that the bevel rests flat on the stone **(F)** and the blade holder sits flat on the jig. Slide the jig across the stone, making sure the

blade is parallel to the stone. Rotate the stone by hand **(G)**, and check the bevel on the knife **(H)** to make sure the marker is wearing off the bevel evenly (if not, go back and reset the angle stop adjustment).

Finally, set the grinding depth by raising the height-adjustment wheels **(I)**, which are graduated in increments of 0.004 in. Raise the wheels equally to keep the blade parallel. Raising the wheels brings the jig closer to the stone and creates a small gap between the blade holder and the jig. Grind until the blade holder contacts the jig again. To grind, move the assembly from side to side between the stops, maintaining a firm but even pressure **(J)**. Repeat with the other blades in the set. Hone the back of the knife lightly to remove the burr. To do this, you can use the leather honing wheel on the Tormek or a fine waterstone.

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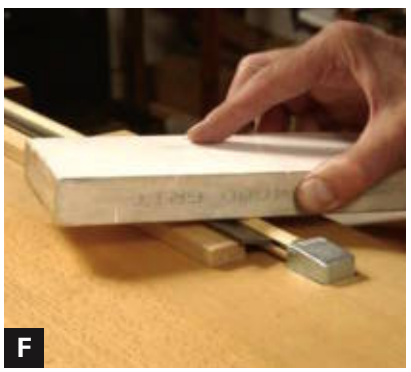

F

Adding a Back Bevel

If you want to put a small back bevel on your jointer knives, you'll need a jig to hold a stone at the right angle to the blade. One method of making a jig is to cut a saw kerf halfway through the center of a hardwood dowel. Place the planer blade in the slot, and lay your sharpening stone across the dowel and the back of the blade **(A)**.

The angle you get will depend on the diameter of the dowel and the width of the knife. A ¾-in. dowel will give you approximately a 20-degree back bevel on a 1-in.-wide knife (it's actually 18½ degrees but close enough for practical purposes). If you like geometry puzzles, you can figure out on paper which diameter dowel you should use for a particular back bevel or with different knives. Cutting the slot more or less than halfway through the dowel is another way to get the angle you want. You probably will have to experiment to get the right combination.

You can cut the groove in the dowel safely on a table saw using a jig made from a block of scrap wood. To do this, cut a V-shaped groove in the block of wood to guide the dowel. Center the dowel and jig on the table saw **(B)**, then clamp the jig to the saw fence **(C)**. A small block of wood screwed over the V will hold the dowel down during the cut and keep your fingers away from the sawblade.

Place the knife in the slotted dowel **(D)**. Clamp the assembly to a solid surface **(E)** (between bench dogs, for example), and use a shim under the beveled edge of the blade to support it while honing. Hone with light strokes **(F)** with your abrasive of choice, in this case a 4000-grit waterstone, to obtain a back bevel about 1/32 in. to 1/16 in. wide (a diamond stone will cut faster).

Honing a Router Bit

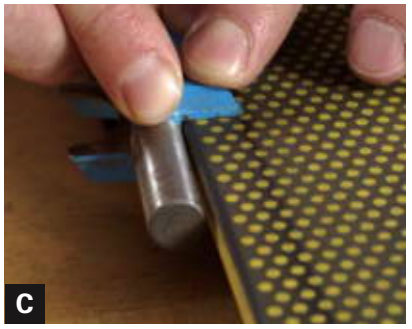
You can touch up carbide and high-speed steel router bits by honing the flat face only **(A)** on diamond stones. High-speed steel bits also may be sharpened on waterstones. Do not attempt to hone the bevel. If the bevel needs attention, send the cutter to a professional.

Start by lubricating the diamond stone with water or light oil. Mark the router bit using a felt-tip marker **(B)**, then position one face on the edge of the stone **(C)**. Make sure you keep the face of the bit flat on the stone. Hone with long strokes down the full length of the stone **(D)**, and count your strokes. Check your work and repeat as needed **(E)**. On the other face, repeat the process with the same total number of strokes. A 45-micron or 25-micron diamond stone will cut rapidly.

Router bits designed for antikickback **(F)** can't be honed this way, but you can use a fine or superfine diamond file instead **(G)**. A little oil or water lubrication helps **(H)**.


A


B


C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Sharpening a Chainsaw

When sharpening a chainsaw, refer to the manufacturer's recommendation for the correct diameter file to use. Clamp the bar of the chainsaw firmly in a vise with enough tension on the chain to keep it from slipping while you work. Mark a tooth using a felt-tip marker so you know when you've been all the way around the chain **(A)**. Chainsaw file holders marked with common sharpening angles **(B)** will help you maintain a consistent angle as you work down the chain.

Filing from the inside of the cutter to the outside **(C)**, file every other tooth, then turn the chainsaw around and file the remaining teeth from the other side. Hold the chainsaw file at an angle that matches the angle on the teeth **(D)**, typically from 22 degrees to 35 degrees. Be sure to maintain that angle by referring to the marks on the jig, if you are using one, but also by standing in a position that allows you to hold your arms comfortably and keep the file steady. You'll also need

to drop the back of the file 5 degrees to 10 degrees **(E)** to follow the angle ground on the tooth. It is important to keep the length of each cutter equal by taking the same number of strokes on each tooth. If you encounter a damaged tooth, file it back to remove the damage, then make sure to go back and refile the other teeth to the same length.

The depth gauges in front of the teeth should be at a specific height relative to the height of the tooth. Most chainsaw depth gauges are marked with that height in thousandths of an inch **(F)**. You can measure that dimension with calipers, but it is awkward. Instead, you can purchase a simple gauge tool for the depth your chain requires **(G)**. Place the gauge on the chain straddling two teeth, exposing the depth gauge. Use a flat mill file **(H)** to file each depth gauge, filing from the outside to the inside. Finally, reshape the radius on the front of the depth gauge. It may be easier to do this with a triangular file rather than with the flat file **(I)**.


E


F


G


H


I

Resources

DMT, Norton, and Tormek supplies and equipment are available from most woodworking catalog companies. The FastTrak system is available from Garrett Wade. Veritas equipment is sold by Lee Valley as well as other catalog companies. Wolverine products are available from Garrett Wade, Highland Hardware, and Woodcraft.

Garrett Wade
800-221-2942
www.garrettwade.com

Highland Hardware
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www.highlandhardware.com

The Japan Woodworker
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ABOUT THE AUTHOR

Toolmaker Thomas Lie-Nielsen brings a unique perspective to the subject of sharpening. He started making hand tools in 1981, after working in New York City at tool dealer Garrett Wade. Lie-Nielsen Toolworks now makes several dozen different high-end hand planes and saws, based on traditional designs.

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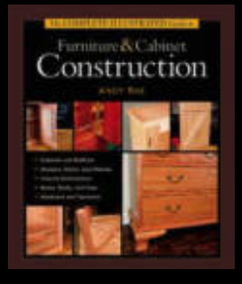

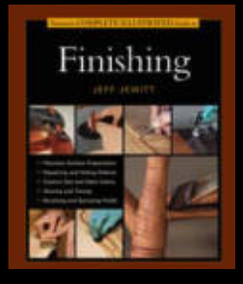

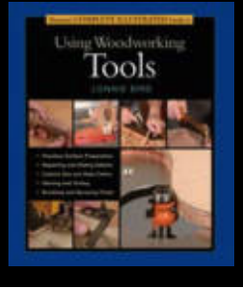

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