On the Edge

An overview of grinding and honing for the carpenter, wherein the author argues for more skill and fewer gadgets

by John Lively

I revered my Arkansas stones, until I met Apolinar. He worked as a carpenter in a Texas shop that made custom doors, windows, interior trim and furniture for rich clients. He came across the river from Mexico, where the guild system that followed the conquistadores into the New World still spawns craftsmen who serve out formal apprenticeships. Apolinar at the age of 50 was a master of his trade, with a measure of self-esteem to match his skills. He could not be coddled or coerced into sweeping the floor, he thought it entirely beneath his station to maintain or adjust any of the machines in the shop and he steadfastly refused to use sandpaper. He got paid by the piece, worked his own hours, and made about six times the money he would have earned in his native Mexico City. Not bad for an illegal alien.

Apolinar didn't have any whetstones. Yet his chisels and plane irons were always impeccably sharp. Nobody ever saw him sharpen a single tool, yet every morning there they were, freshly honed and ready for another day's service at the bench. One night when I was working late, I noticed Apolinar fussing around his bench in an unaccustomed way. He was getting ready to go home, and kept acting like he'd forgotten something. Finally he gave a demure grin and a resigned shrug, and said he'd touch up the edges of his tools before he left. So at last I got to witness the Apolinarian mysteries of sharpening.

He disassembled his three planes and lined up his six or seven chisels. From under his bench he produced a dirty 8/4 board, about 16 in. long and 6 in. wide, with a cleat nailed along the bottom, like a keel. He reached under his bench again and came up with a small cardboard box, which was fairly filled with neatly cut strips of, God forbid, sandpaper—240-grit, 400-grit and 600-grit aluminum-carbide wet/dry paper, to be precise. He clamped the board up in his vise, squirted some viscous fluid (which I later found out was a mixture of motor oil and kerosene) on the surface and spread it around with his fingers. Then he took a strip of 240-grit paper, patted it flat onto the oozing surface of the board and secured it there with two thumbtacks, using the same timeworn holes. He squirted some more fluid on the paper and began to hone one of his plane irons.

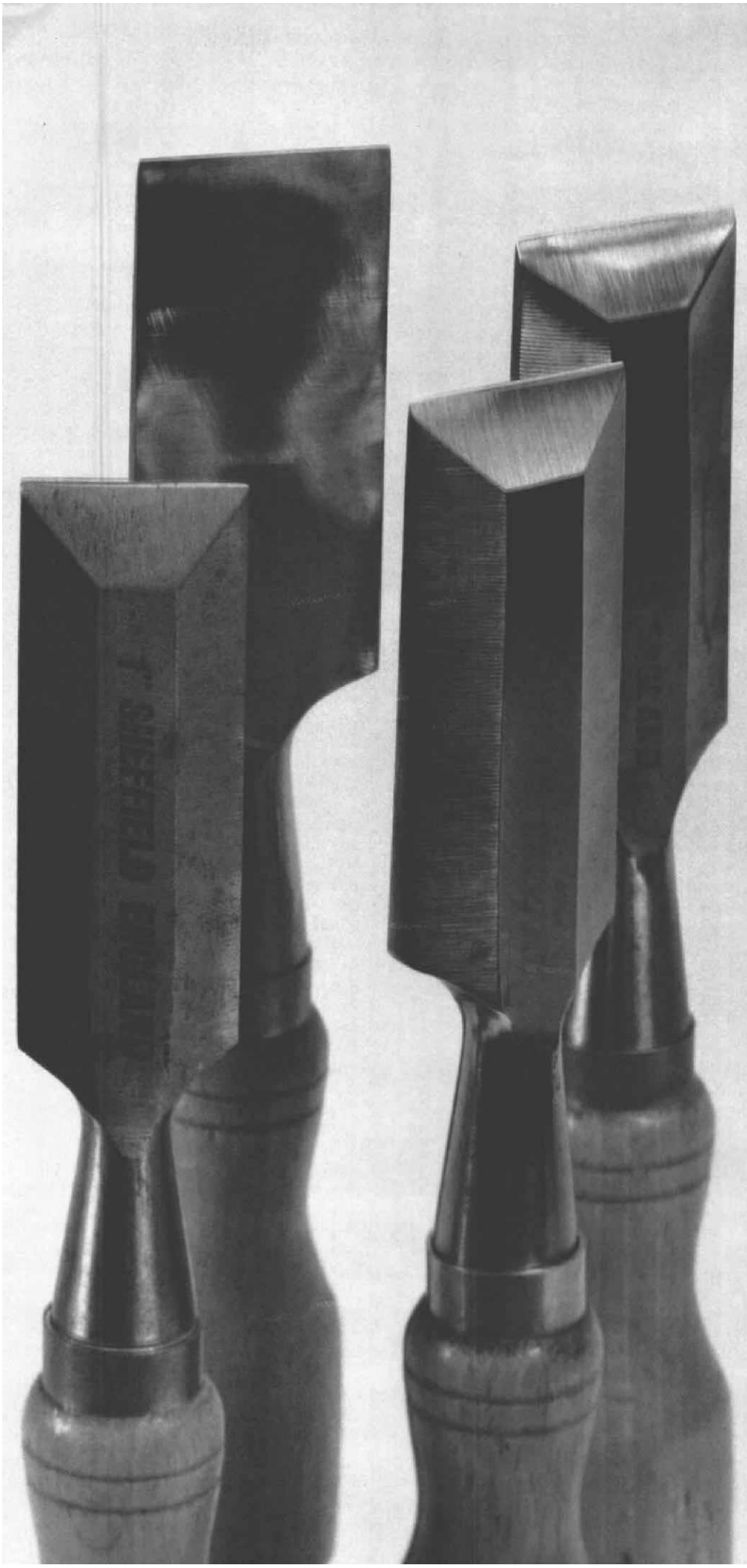
He was fast, taking no more than 15 seconds or so to have done with the bevel. He followed with his other plane irons. Next came his chisels. When the paper stopped cutting, he'd put on a fresh piece. Stage two—400-grit paper. He went through the same routine as before, making sure the paper was kept wet with the oil/kerosene mixture. Then came a final round with 600-grit paper, which went the same as the first two stages. This time, though, he finished each tool by flipping it over and backing it off—holding the back of the tool flat against the abrasive surface and rubbing back and forth for several strokes to remove the wire edge that results from honing the bevel.

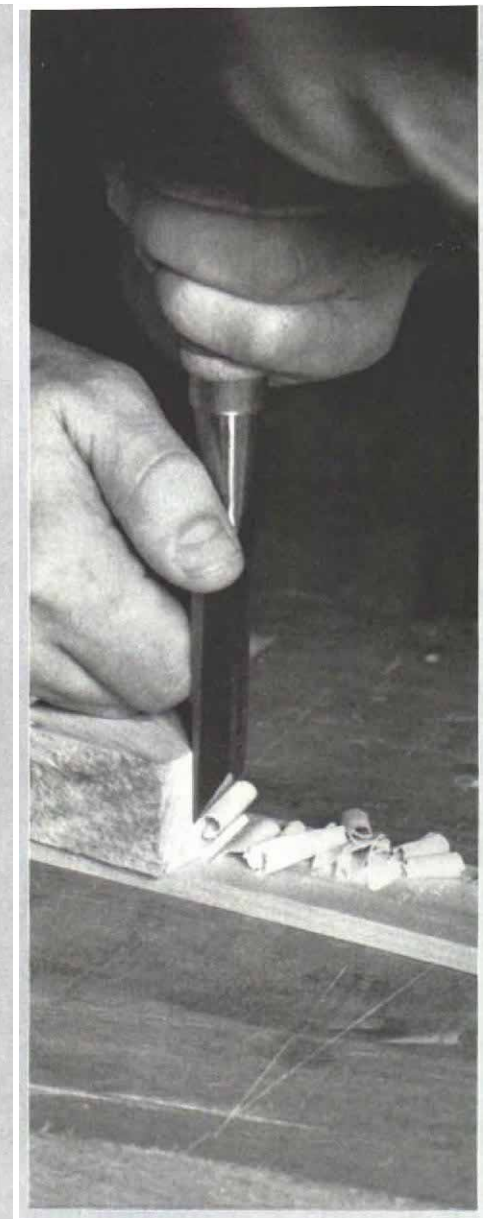
Ten minutes from the time he started, he was rubbing the oil off his fingers with a handful of jointer shavings. I stood there aghast. It seemed almost immoral that with all the honing jigs and grinding rigs on the market and with all the hush-toned lore surrounding this sacred subject, Apolinar should get such serviceable edges from strips of sandpaper and a grungy board.

The lesson is clear and direct. You don't need expensive sharpening equipment to get sharp edges. What you do need is to know what you're doing, to understand what happens when steel is rubbed against an abrasive surface and the effect this has on the edge. Once you have this understanding and have practiced the mechanics of grinding and honing, sharpening tools stops being an onerous, contraption-cluttered task that's consigned to weekends and rainy Monday afternoons.

The fundamentals of sharpening are learned early in a society that still values apprenticeships, but in our own country many builders and craftsmen are self-taught, and so seek instruction from tool catalogs and other self-taught tradesmen. There's no shortcut to acquiring these skills, but once you've got them you won't have to put up with dull chisels and planes that jump and chatter down a board. If your kind of carpentry involves considerable joinery, finish woodwork and cabinetmaking, you need efficient sharpening skills because your work requires using chisels, gouges and planes, and because these tools just don't work unless they are sharp. And even if most of your work is confined to rough framing, nothing takes the place of a chisel or plane when you need one.

To maintain edge tools you have to know how to grind and how to hone. Grinding shapes the bevel on the tool, and honing fin-





How sharp is sharp?

Look at the forearms of some timber framers and cabinetmakers, and you might see patches of scabby-looking bare skin where they've pared the hair away, testing their chisels and plane irons for razor sharpness. As a dramatic gesture (and testament to one's sharpening acumen), nothing beats showing the amazed onlooker that a fat hunk of tool steel can shave one's arm. While testing your edges on your arm can give you an indication of relative sharpness, it's not a method a dermatologist would recommend. A better way to assess the sharpness of an edge is to see how easily the blade will slice tiny slivers of wood from the edge of a board. The smaller the slivers, the sharper the edge. Another way is to pare away wispy curls of end grain, as shown above. If the wood powders and flakes, your edge is dull, but if you can slice off translucent, tissue-thin pieces that stay in one piece, you've got a sharp, serviceable edge. A third way to test for sharpness is to rest the edge, bevel up, on your thumbnail and slowly raise the back end of the tool. The lower the angle at which the edge will bite into your nail, the sharper it is. —*J. L.*

ishes the edge by removing the small ridges and ruts left by grinding. The edge can be further refind by buffing or stropping.

Grinding—Shaping the bevel of a tool by grinding (backs of blades are never ground) is something that should happen infrequently. There are only three reasons to take your tool to a grinder. The first and most common is that the edge has been nicked or dinged, and you need to regrind the bevel back into undamaged steel. You can minimize dinging up your good chisels by keeping them sheathed and using a junk chisel for nasty work that doesn't call for a sharp edge. A second reason to regrind is that the width of the micro-bevel (more about this later) has become too wide, and you have to restore the original 25° bevel. Lastly, you might want to regrind a new tool to alter the angle the factory put on it.

Most grinders can be taken onto a building site if necessary, but it's usually more convenient to do your grinding at home, where the machine and its accessories can be permanently set up. To avoid investing in a commercial grinding machine (and to make do in emergency situations), you can improvise, I know a cabinetmaker who uses a plywood disc faced with 100-grit sandpaper and fitted with a mandrel so it can be chucked in a drill press. I've seen others use a belt sander turned upside down and clamped to a table.

The two most common types of grinders have abrasive wheels (bench grinders) or abrasive belts. There are rules of use that apply to them both. The abrasive surface—whether an emery or vitrified aluminum-oxide wheel or an aluminum-oxide belt—has to be kept clean. Clogged wheels and glazed belts don't cut effectively, and they cause you to apply excessive pressure to the tool. This overheats the steel and ruins its ability to hold an edge. To get around this, dress the wheel often or replace worn belts. They're a lot cheaper than new chisels and plane irons.

While grinding, quench the tool often in a can of cold water. Watch the little beads of water at the edge of the too! as you grind. When they begin to fizzle or evaporate quickly, dunk the tool again. All the grinding and honing you do will be wasted if you overheat the tool and ruin its temper, and the edge—no matter how sharp you get it—won't last. A brittle, distempered edge will fray, splinter off in tiny pieces, and soon become too dull for anything but spooning yogurt.

If the steel turns blue, the edge has been heated beyond its original tempering temperature. The only way you can salvage the tool is to grind past the blue area into good steel. So take your time when you grind, holding the tool against the wheel or belt with a firm but light touch. Keep the steel cool, and inspect the bevel often to make sure you're removing metal in the right place, in the right amount.

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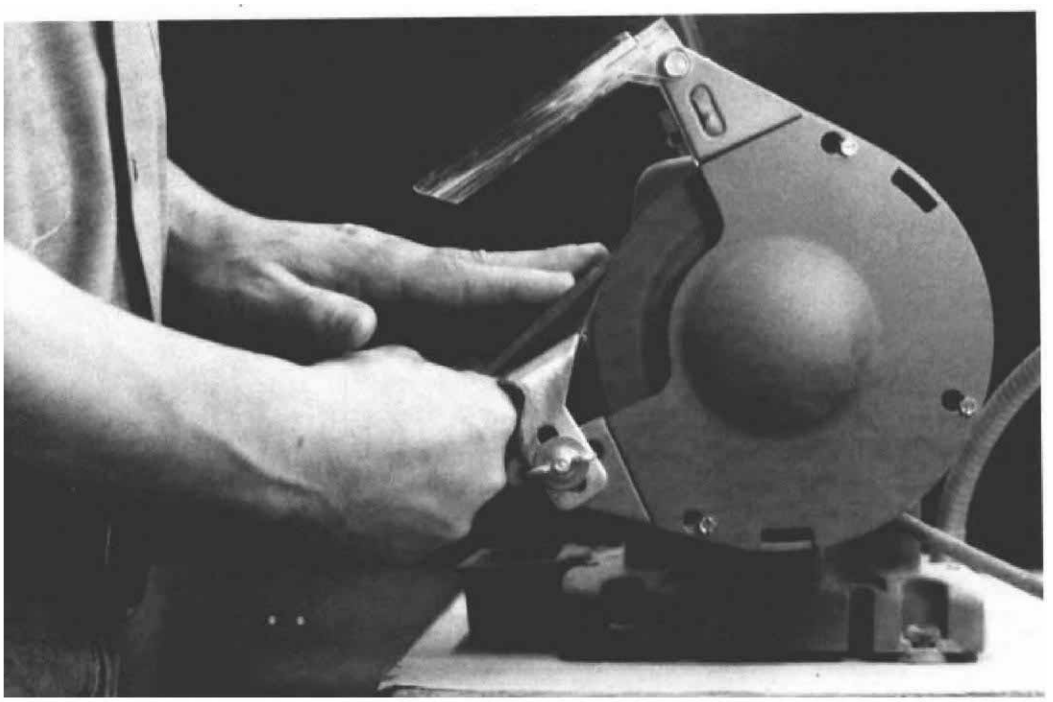
Bench grinders—Most motorized bench grinders accept 7-in. or 8-in. dia. wheels, one coarse-grit, the other fine. Many people think that you shouldn't grind a good tool on a coarse wheel, and so make the mistake of using the coarse wheel only for the rough shaping of metal parts. The truth is that a coarse wheel (say, 36-grit), freshly dressed, will cut faster, cleaner and cooler than a fine wheel After all, the point of grinding is to shape the bevel, not to finish it. A fine wheel will glaze over quickly, and even if it's clean, you'll have to apply more pressure to remove the same amount of steel that requires less pressure on the coarse wheel. This means you have to spend a lot more time grinding, and that you risk burning the tool. A coarse wheel will yield an edge that's quite fit for honing.

Because of the relatively small diameter of grinding wheels, the radius of the hollow grind they produce is correspondingly small. This deeply hollowed bevel, as opposed to a bevel with a shallower concavity or a flat bevel, is fragile at the edge, and requires considerable honing to get a flat surface wide enough to give support to the cutting edge.

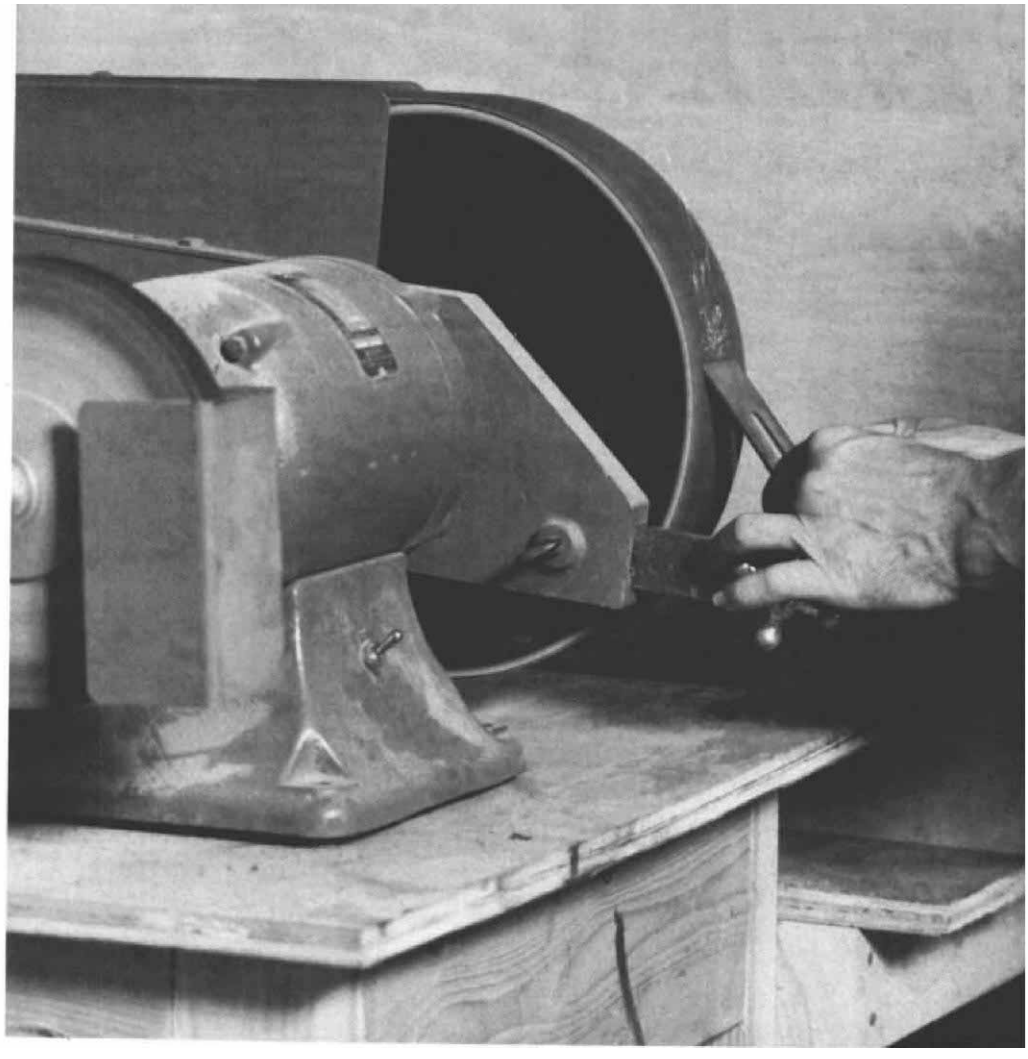
The purpose of grinding is to produce a uniformly flat or hollow-ground bevel on the tool. But holding a chisel or plane iron at the proper angle, using nothing more than the little tool rest that comes with most bench grinders, and being able to return the tool to the same position repeatedly after numerous quenchings isn't easy. And those unpracticed at grinding often end up with multifaceted bevels and cutting edges that aren't square to the sides of the blade. That's why there are several sliding tool rests on the market that will attach to a grinder, hold the tool at the angle you choose and guide it past the wheel. But these devices have drawbacks. Using a sliding tool-rest attachment can double your time at the grinding wheel. To set one up, you have to adjust the angle of the tool rest, clamp the tool on the slide and then unclamp it when you're done. The ones that have a rack-and-pinion feed mechanism keep you from feeling what's going on between the wheel and the edge of the blade because you're turning a knob instead of holding the tool.

Freehand grinding—For grinding on a wheel, the best method I know uses nothing more than the stock tool rest on your grinder, yet gives you a high degree of control over the grinding angle and lets you regulate the pressure against the wheel with considerable sensitivity. Quite simply, it involves using the tool rest as a fence rather than as a surface to rest the tool on. Set the angle of the too) rest so that it's slightly lower than the bevel angle on the tool. With the motor turned off, place the edge of the tool against the wheel so that grinding will happen across the full width of its bevel and so the blade contacts the outer edge of the tool rest.

Now grip the tool firmly, thumb on top and forefinger underneath, perpendicular to the blade, and push your forefinger smartly against the edge of the tool rest (photo left). This grip turns your hand into a jig and lets you use your forefinger to gauge the distance from tool rest to wheel. You just slide your entire hand back and forth, keeping your forefin-



Freehand grinding **uses the standard tool rest as a fence rather than as a flat surface for supporting the tool. The blade is gripped so that the right forefinger passes underneath and perpendicular to the side of the tool. With the forefinger pressed firmly against the edge of the tool rest, you can move the blade from side to side to grind the full width of the bevel. The distance from the tip of the tool to the forefinger determines the grinding angle. Fingers on the left hand deliver pressure to the cut, and sense when the steel heats up.**



Belt grinders, **like Woodcraft Supply's Mark II sharpener shown at right, can cut cooler and faster than abrasive wheels. The 11½-in. urethane contact wheel grinds a shallow, sturdy hollow bevel, and the 2½-in. wide belt means plane irons and big chisels can be ground without having to move the tool back and forth across the abrasive surface.**

ger pressed against the tool rest and using your thumb to deliver pressure to the cut. If your grip remains firm, you can remove the blade from the grinder as often as you wish to inspect the edge or quench it.

Dressing the wheel—The point of dressing a wheel is to remove a very small layer of clogged and dulled abrasive particles from its edge, and thus expose a new surface of clean, sharp particles. Some diamond-tipped wheel dressers lock onto a jig that slides on the grinder's tool rest. The jig ensures that you dress the edge of the wheel at 90° to the sides. But you can use a diamond dresser freehand by making several deft, deliberate passes across the edge of the wheel with the tip. Excessive pressure can cause you to remove too much material, gouge the wheel and end up with an uneven grinding surface.

Other kinds of dressers—star dressers and carbide dressers—are also available, but a diamond-tipped dresser lasts longer and cuts cleaner. Dressers are sold by industrial-supply houses and mail-order tool companies.

Belt grinders—There are quite a few belt grinders on the market. Rockwell makes two different types—one is a 7-in. grinder/finisher equipped with a grinding wheel on the right of the motor unit and a platen-backed, 2-in. wide belt on the other side. It's more expensive (about $600) than their sander/grinder ($120 to $235, depending on the model), which comes with a single 1-in. wide belt, a tilting table and a platen to back up the belt.

The Mark II Sharpening System sells for about $500 at Woodcraft Supply Corp. (41 Atlantic Ave., Box 4000, Woburn, Mass. 01888). Like the expensive Rockwell belt grinder, the Mark II would be a good investment for professional shop carpenters and timber framers. But unless you do a lot of grinding, a cheaper machine would be a wiser choice. The Mark II (photo above) has an 11½-in. dia. cast-urethane contact wheel that drives a 2½-in. wide, 60-in. long belt around an idler that contains the belt-tracking device. Because of the wheel's large diameter, the hollow grind it produces is minimal, and the edge is therefore more substantial than one ground by a small-diameter wheel. The grinding side of the machine is fitted with a sliding outrigger arm that has a block at the end for holding the butt of a chisel or plane iron. By sliding the arm in or out, you adjust the grinding angle the tool makes with the contact wheel. On the left side of the arbor there's a muslin buffing wheel, something I'll comment on a little later in the article.

Rockwell's belt grinders, because the belts are backed up by a platen, produce a flat bevel on the tool. And both come with standard tool rests, rather than with the arm-and-block rest that's part of Woodcraft's machine. The craftsmen and tradespeople I've talked to who own belt grinders prefer them to bench grinders. They say that the belts cut faster and cooler, and that they have more control over the tool. The wider the belt, the better, as you can grind butt chisels, framing chisels and plane irons without having to slide them back and forth across the cutting surface.

As with wheels, coarse-grit abrasive belts will cut faster and clog less quickly than fine-grit belts. Don't use anything finer than 80-grit or 100-grit belts, or you risk overheating the steel. You can clean grinding belts with the crepe sole of an old sneaker, or you can go buy a bar of the stuff (sold as a "dressing stick") for about $9. But after several cleanings the abrasive particles will have been dulled, and many of them worn away; so it's best to replace the belt.

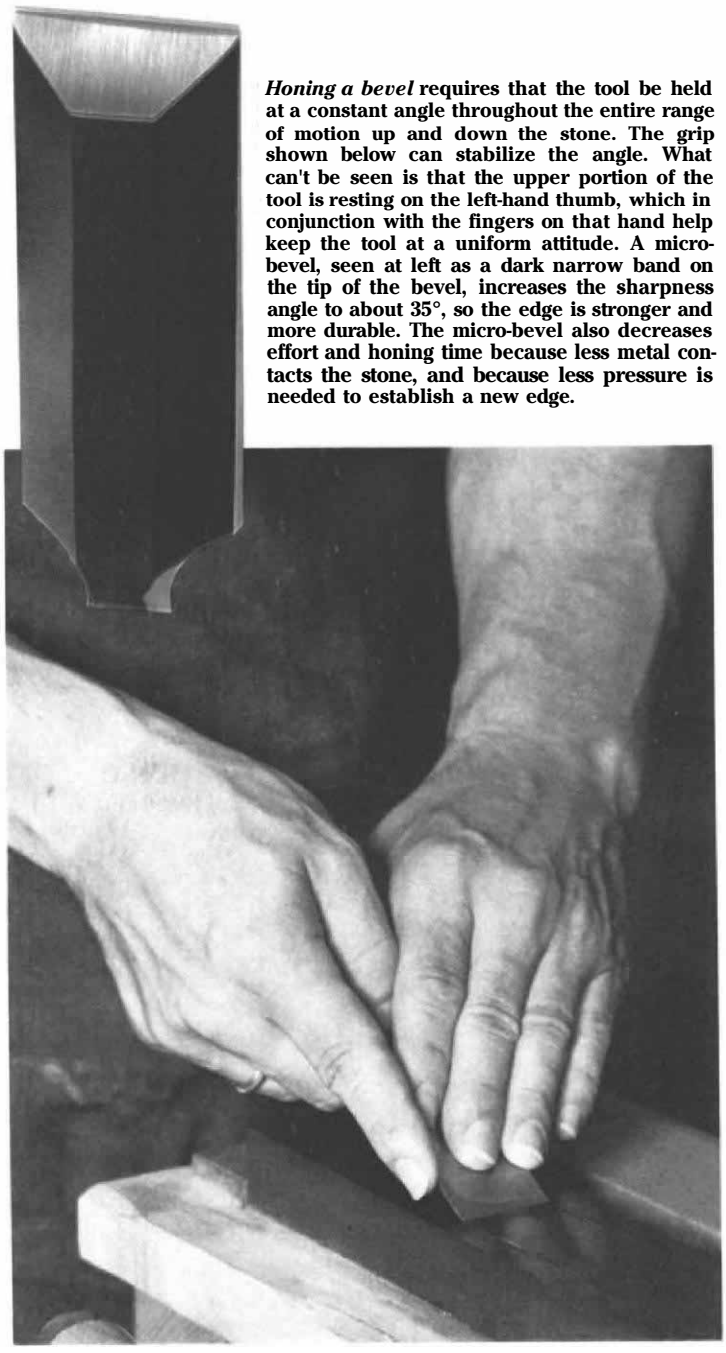
One last thing about grinding. Wear goggles.

Honing—With a magnifying glass, you can see that grinding gouges the steel. Even to the naked eye, a freshly ground edge looks a little ragged out on the tip. Such a sawtooth edge might even be sharp, but after a couple of cuts into wood the fragile slivers on the end will bend and fracture, and you'll have a dull edge. The purpose of honing is to polish the bevel, to smooth out all the ridges and trenches left by grinding and to produce an edge that ideally is straight across. A polished edge is sharper and sturdier because there are no unsupported slivers of steel to break off.

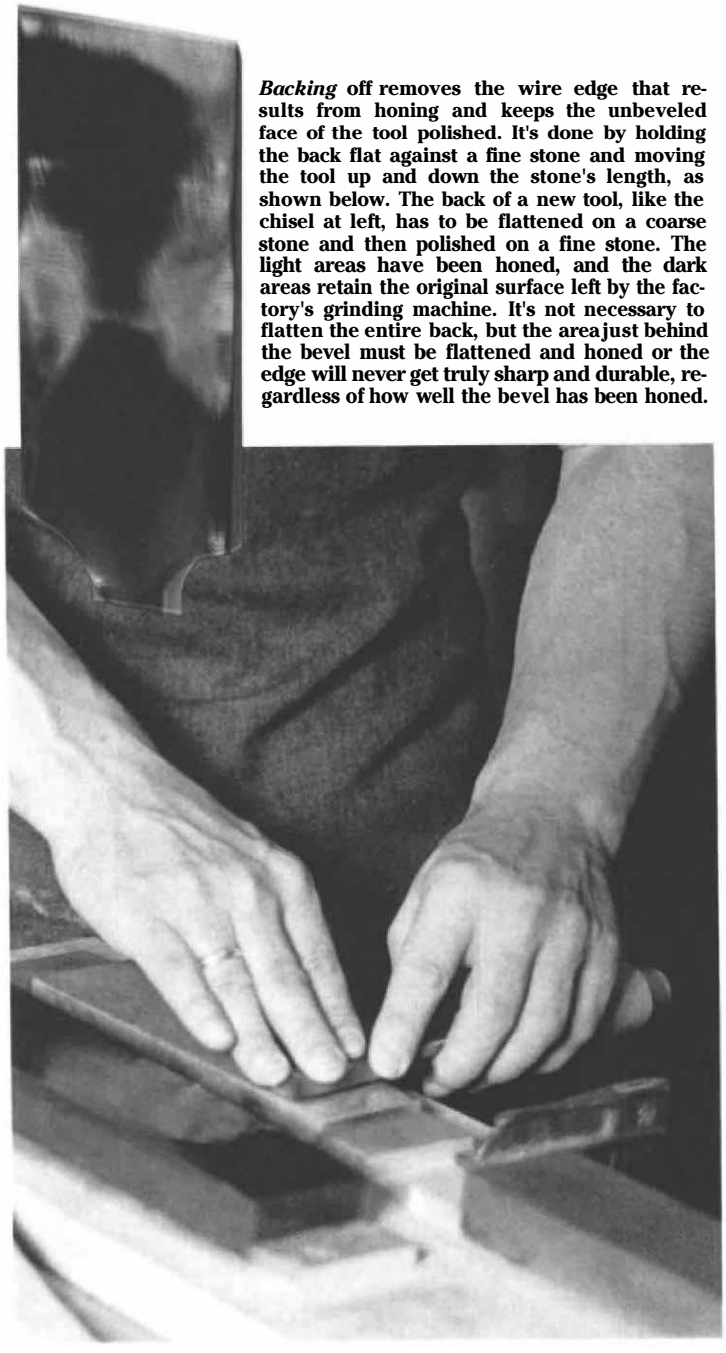
Honing is done on stones that are usually about 2 in. wide and 8 in. to 12 in. long. Arkansas stones are natural; other stones—Carborundum, Crystolon, India, and Japanese waterstones—are manmade. You begin with a fairly coarse stone, progress to a medium-grit stone, and end on a fine-grit stone.

The more finely honed an edge is, the sharper it will be and the longer it will last. And, paradoxically, the more frequently you hone a tool, the less time you spend at the stones. Because honing is tedious, messy and repetitive, and because it requires discipline and practice to hold a too! at a constant angle while rubbing it on a stone in a back-and-forth or figure-eight motion, many carpenters never develop an effective, reliable technique. This is why the tool catalogs peddle honing guides. These roller devices hold the tool at the proper honing angle while you move the edge over the stone. As with grinding jigs, these things just get in the way, slow you down and discourage you from developing a valuable skill.

Posture and grip—Stance and grip are critical to proper honing. The grip I'll describe enables you to hold the tool at a constant angle while honing, and it lets you work without getting tired. Grab the blade in your right hand with your forefinger extended down the right side of the tool so that your fingertip is about



Honing a bevel **requires that the tool be held at a constant angle throughout the entire range of motion up and down the stone. The grip shown below can stabilize the angle. What can't be seen is that the upper portion of the tool is resting on the left-hand thumb, which in conjunction with the fingers on that hand help keep the tool at a uniform attitude. A micro-bevel, seen at left as a dark narrow band on the tip of the bevel, increases the sharpness angle to about 35°, so the edge is stronger and more durable. The micro-bevel also decreases effort and honing time because less metal contacts the stone, and because less pressure is needed to establish a new edge.**



Backing **off removes the wire edge that results from honing and keeps the unbeveled face of the tool polished. It's done by holding the back flat against a fine stone and moving the tool up and down the stone's length, as shown below. The back of a new tool, like the chisel at left, has to be flattened on a coarse stone and then polished on a fine stone. The light areas have been honed, and the dark areas retain the original surface left by the factory's grinding machine. It's not necessary to flatten the entire back, but the area just behind the bevel must be flattened and honed or the edge will never get truly sharp and durable, regardless of how well the bevel has been honed.**

an inch from the edge (photo above left). Your right thumb sits on the blade. Place your left thumb under your right thumb and across the underside of the blade; then put your left-hand fingers on the face of the blade about ½ in. up from the edge. Wide tools like plane irons can accommodate all four fingers. Narrow blades take fewer fingers. The thumb on your left hand acts as a fulcrum, while the fingers on that hand serve to deliver even downward pressure across the width of the blade. Your right hand stabilizes things laterally and delivers energy to the stroke of the cut.

Position your feet a comfortable 18 in. or so apart, bend at the waist and touch the bevel to the front end of the stone, which should be about 10 in, in front of your belly. Work the tool up and down the length of the stone. Let your arms (not your body) do the work. Flex only at your elbows, keeping your back and shoulders still. If you shift your upper body, you'll alter the angle of tool on stone, and end up with a convex bevel. To hold the tool at the proper angle while you're learning this technique, cut a scrap block at a 35° angle and set it by your stone as a visual reference. With practice, you'll be able to find the correct angle automatically.

Try to distribute your strokes over most of the stone's length and width. If you don't, you'll gouge a rut down the center of the stone. Keep the stone amply lubricated. If you're using oil, wipe the stone clean when the oil gets thick and black from metal filings and apply fresh oil.

Micro-bevels—Most edge tools are ground to a sharpness angle of about 25°, just fine for a nice easy cut, but not so good for a durable edge. A second angle of about 35° honed at the tip of the bevel, called a micro-bevel, can lengthen the life of an edge without adversely affecting its cutting efficiency.

Whether the bevel is flat ground or hollow ground, working with a micro-bevel increases the speed of honing because substantially less steel contacts the stone. And honing is less tiresome because it takes less pressure than honing the entire face of the bevel. With each honing the micro-bevel widens, and once it gets so wide that you can't get a new edge in a minute or so at the stone, you have to regrind a fresh 25° bevel on the tool.

You can tell when your honing should stop by running your finger along the back side of the edge and feeling for the wire edge—that ever-so-small flap of steel that's produced when the surface of the bevel collapses or wears through to the back side of the tool, If the wire edge is so small (or your fingertips so calloused) that you can't feel it, eye the face of the bevel in raking rays of light. If it's time to stop honing, the micro-bevel will be flat and even from its heel out to the edge (inset, above left). But if you see a line of light reflected off the edge, you're not done yet.

Backing off—The back side of a new tool must be honed absolutely flat and kept that way. This is necessary because the backs of new tools are ground more or less flat (inset, facing page, right), and the trenches left by grinding will form little sawteeth at the edge. It doesn't matter how finely polished the bevel is; if the back of the blade isn't flat, and if the grinding lines haven't been leveled, you'll never get the edge really sharp or durable.

For a new tool, begin backing off by holding the blade flat on your coarsest stone (photo facing page, right). Keep working until you've honed a flat surface at least ⅛ in. wide behind the edge. Don't worry if you can't get the entire back flat; it's only the area immediately behind the edge that counts. Next, proceed to your medium-grit stone, and finally polish the back on your fine-grit stone. Now that the tool has been properly flattened and polished on its back side, never back it off on anything but the fine stone. The deeper the scratches, the duller and less durable the edge will be.

You should back off a tool every time you hone its bevel; eight or ten strokes up and down the length of the stone should remove the wire edge, it's not unusual, though, to go from backing off to stroking the bevel a couple of times, back to backing off again, possibly four or five times, to remove a stubborn wire edge. The lighter your touch when honing the bevel, the thinner the wire edge, and the easier it will be to remove.

Oilstones vs. waterstones—Oilstones (Arkansas stones) are novaculite. Mined from pits and caves near Little Rock, they come in four grades (grits). The coarsest is a reddish-looking Washita stone (about 800 to 1,000 grit). Next comes the mottled slate-colored soft Arkansas (about 2,000 grit), followed by the hard Arkansas (about 3,000 grit), which looks like white marble. The finest stone is a black hard Arkansas Because these are natural stones, the grit in each grade can vary from stone to stone; indeed, from spot to spot in the same stone.

Arkansas stones are fast cutting and durable, but have to be kept clean, or their pores clog with a paste of oil and metal filings. These stones should be cleaned after each use by flushing the surface with fresh oil. rubbing it into the stone and wiping it clean with a lint-free cotton rag. Badly clogged stones can be cleaned by soaking them in mineral spirits or some other solvent that will soften and remove the gunk.

It's pretty easy to gouge a Washita stone (especiallly with the roller on a honing guide), and all the natural stones will get uneven after years of use. You can flatten them anew with a diamond whetstone (from Diamond Machining Technology, Inc., 34 Tower St., Hudson, Mass. 01749).

Japanese waterstones are made from abrasive particles that are bonded into bricks. The binder, which softens with water, lets worn particles on the surface float away so that the steel always contacts new sharp particles. For most honing you need only two waterstones—a coarse (say 1,000 grit) and a fine (about 4,000 grit). Before honing can begin, you have to immerse the stones for several minutes in water to let the pores fill up. Otherwise, the water you try to pour on the surface to lubricate the cut will get soaked up, and you'll have a dry stone. But it's not good to keep the stone submerged for a long time because the binder will soften to considerable depth and the stone will wear out too quickly.

Waterstones cut fast, don't clog and make less of a goupy mess than oilstones, especially if you do things right and fix the stones in a rack over a trough of water. This way you can scoop handfuls of water over the stones as you hone without getting spills ail over the table and floor. But waterstones will wear faster than oilstones, and these days they are not much cheaper (a black hard Arkansas sells for about $48, and a fine-grit waterstone for about $47). Because waterstones are manmade and therefore consistent all the way through, you get a more uniform cut with them than you do with natural oilstones, which vary in density, porosity and cutting ability. People who use waterstones like them and say that they wouldn't go back to oilstones.

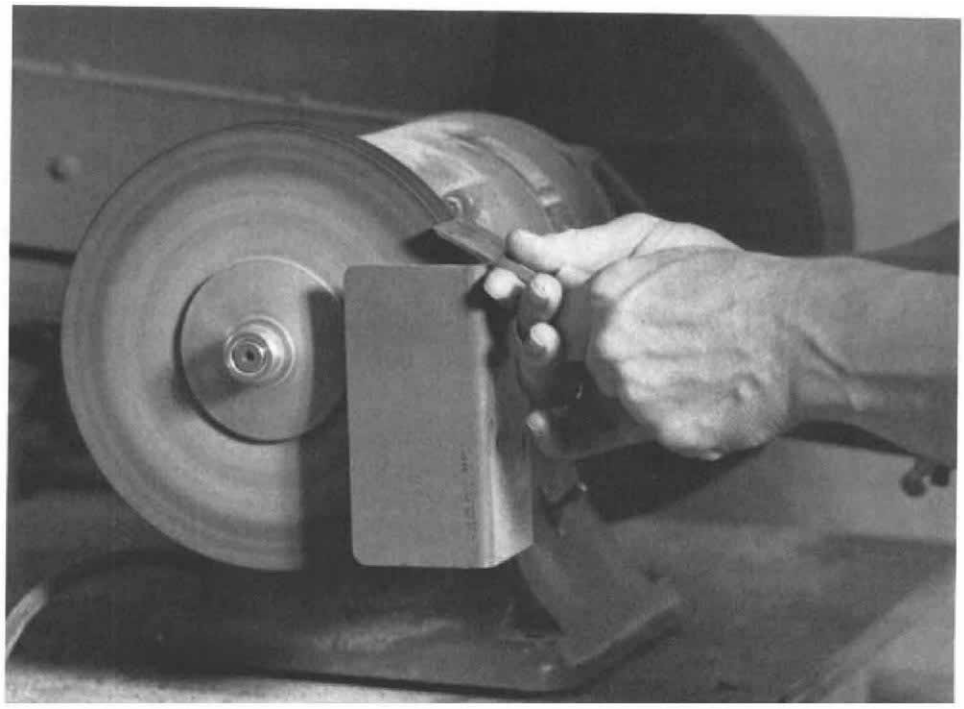
Buffing—To go that extra step toward the perfect edge, you might want to polish the bevel of a tool by buffing, a refinement that almosts gets rid of honing scratches altogether. A buffed edge is sharper and stronger than a honed one, and you can keep it sharp by frequent buffings, though eventually you'll have to re-establish the bevel by grinding and honing. Buffing is done by loading a cloth or felt wheel with a polishing compound (usually grey buff that comes in ingot-size bars) and applying the edge to the wheel just as if you're grinding it, though it's a good idea to adjust the angle to 35° to produce a micro-bevel.

A muslin buffing wheel (a stock item with the Woodcraft Mark II sharpening system) consists of 80 plies of cloth sewn together. The edge of the wheel yields quite a bit under pressure, and so can round over the edge of the tool at an angle much steeper than 35°. I think that a hard felt buffing wheel (photo below) is a better choice because its edge is firm and it won't round over the bevel appreciably as it polishes. Also the hard-felt wheel smooths out honing scratches better than a muslin wheel.

I've made the mistake of trying to buff bevels straight from the grinder, something you can do if you're in a hurry, but not if you want a good edge. You should hone the edge first, then buff it, and buff it thereafter as often as you need to. A buffing wheel shouldn't be used for backing off the blade. Several strokes on your finest stone will remove any wire edge that comes from buffing the bevel.

Compared to grinding, buffing produces very little heat, but you can lean on a tool hard enough to burn it, so take it easy, and load the wheel often with fresh compound. Because buffing is so fast and gives such good results, it's something that site carpenters, as well as shop woodworkers, ought to try. A good setup, one that could easily be made portable, is to take a common bench grinder and equip one arbor with a coarse grinding wheel and the other arbor with a hard felt wheel. Used in conjunction with bench stones, buffing can be part of a format for quick, effective sharpening.

But if you're traveling light, far from home, you can always use sandpaper, kerosene and motor oil. □



Buffing the edge **further refines and strengthens the bevel by removing grinding ruts and honing scratches altogether. The machine in the photo is equipped with a hard-felt buffing wheel that's charged with a grey buff compound. As with honing a micro-bevel, it's best to buff just the tip of the bevel to increase the sharpness angle and reduce working time. But any buffing wheel will round over the edge slightly, and it will have to be rehoned after a cumber of buffings have made it too convex and too steep to be effective.**