TOOLS AND SHARPENING

The list of tools required to make a violin is long and, especially, expensive. Many are highly-specialized and available only from unusual sources. I don't recommend that you set out to buy them all at once, and so I've chosen to discuss tools not in one section, but rather in context as they become needed in the making process.

It's not necessary to own many of the ones designated as "violin makers' tools", and I have specific ideas to avoid purchasing some of the specialized ones, so hold off spending money until you get to the point in the process where I discuss specific tools for that process. Many of the tools made especially for violin making are ineffective as manufactured, or just a bad idea in the first place. In the relevant spots in the building process I have ideas for modifying commercial tools to make them better, specialist tools to avoid entirely, and suggestions for home made tools that will do a job just as well. Sometimes I might seem cheap, and in other cases it may seem like I'm spending more than necessary. In all cases, I have chosen the path I've taken based on getting maximum quality and utility for the money and time expended.

Handling and Storage

The maintenance of tools centers on sharpening, and a lot of sharpening can be avoided by proper care and sharpening technique. There are some general rules regarding tool care that are worth learning and remembering. First, it's considered impolite to handle another craftsman's tools without invitation. Some people are quite sensitive about how their tools are handled, especially about having the sharp edges touched, even with a fingertip; others don't care at all, so ask before you touch. That general rule is also a warning that you should be just as careful with your own tools as others are expecting you will be with theirs. Most edge tools depend on having a perfect edge, with no tiny nicks. Even one bump against something hard can send you and the tool back to the sharpening bench. When you are planning your tool storage, keep this in mind.

Planes should always be laid down carefully. Woodworkers traditionally store and lay them on their sides, so the blades never touch anything except when being used. Some people will retract the blade before they put a plane away, or be very careful how and

where they place their planes (this is one reason that drawers in tool chests have felt bottoms). Knives are especially vulnerable, and should be stored so the edges won't contact anything. Files should never be stored touching each other (and this means you shouldn't just drop them all into a drawer together), and scrapers (which will be sharpened just as sharp as knives, all around) should be stored in their own envelopes or some other protected manner. It's easy to make individual slip covers for files and scrapers with a piece of paper and a bit of tape, rolling or folding the paper around the tool and then taping the paper. I also make paper rolls for storing my reamers. Chisels and gouges should also be stored so their edges are protected from touching anything similarly hard.

One storage possibility for all of these tools is wooden drawers with dividers. I store many of my files and smaller scrapers in blocks of wood with slits of different widths and depth cut to receive various sizes. For file storage it's easy enough to take a block of one inch thick wood about seven inches square and run it over the table saw to make a number of slits that don't cut all the way through for files to live in, and this is a more efficient use of space than laying them flat. My scraper storage block is the same, but done with a thinner handsaw. My knife compartment is just long enough so the knives only bump into the wooden end, and likewise for chisels and gouges. Truthfully, my storage drawers look like a mess, but every tool is carefully placed in that mess. When I travel, I push the ends of all sharp tools into wine corks, wrap files in roll-ups of paper towel, and put scrapers in envelopes.

Tools for Sharpening Tools

All of the tools of violin making are sharpened in slightly different ways, depending on the jobs for which they are to be used. Since sharpening of some sort is common to many of the tools a violin maker uses, I'll give the list here of what I have in my sharpening kit and consider to be the necessary minimum to do the job:

·1000-grit (red) Japanese water stone, about three by eight inches.
·8000-grit (gold) Japanese water stone, also three by eight.
·One cheap hardware store two by six inch india stone (for dressing the water stones)
·Small hand grinder with a pink or white stone of 80 or 120 grit, a grey dressing stone, and a really good (Veritas, specifically) tool rest.
·Another small hand grinder with a 1"x6" hard felt wheel, and a bar of rouge buffing compound (iron oxide in wax) to prepare the wheel. This is used instead of the 8000-grit stone for a few specific tools.
·Safety glasses. Regular glasses aren't hard enough, nor protective on the sides. Safety glasses are particularly strong, and have shields on the sides which help keep all flying particles out of the eyes. When using a grinder or any other power tool, it's important to

ALWAYS wear safety glasses. There's very little work available for blind violin makers.

This may seem like too small of a kit for all of the jobs that need doing, and a bit strange by some standards, but you'll see that this is all that is necessary. Most of the makers I know have been through many different stones, have a drawer somewhere filled with rejected ones, and eventually settle on a few favorites. I like water stones because they cut very quickly, and water is easier to clean up than oil. The disadvantage of water stones is that they wear and scratch easily, so there's more involved in keeping them flat and undamaged. You'll see in a bit why I use only two widely-spaced grits.

Hand grinders can often be found in antique stores, and some come with an old red garnet wheel, which can be sufficient until you can locate a more modern wheel. The type of tool rest I use is a modern one, by Veritas, and something similar is absolutely necessary, regardless of what you use for a grinder. The rest has to wrap around the sides of the stone, as on the Veritas guide, which has a slot cut for the stone, unlike conventional guides, or you won’t be able to properly sharpen knives.

A good source of grinders is Ebay. Buying them can be hit-or-miss, because they are often worn out or damaged in some way (make sure the feet and the clamping screw are there and unbroken; often the tool rest is broken off or missing, but you won't need that), but old ones are better made than the new options, and much cheaper. There are a few quality hand grinders made currently, and you can track them down through online stores that sell Amish farm supplies. Since I started promoting the use of hand grinders online about ten years ago, I notice many other violin makers have adopted them. Their advantage in sharpening small tools slowly and precisely are substantial and immediately self-evident.

I don’t like power grinders, but one can be made to do the job; the stock tool rest won’t suffice, however, because it's not large enough nor finely adjustable, and doesn't have the slot for the stone. Electric shop grinders really aren’t made for sharpening, but rather for grinding hunks of metal to shape, and with one you can ruin a hand tool in a microsecond. Burning the tool is a constant hazard. Special sharpening grinders turn at low speeds, and often use a water bath for cooling both the stone and the work. If you're forced to use a bench grinder for fine sharpening, at least replace the grey stone that it came with--pink or white stones grind tools both cooler and quicker, and keep a cup of water nearby to cool your tools before they get too hot.

It is important that the grinder stone is kept clean and true. As particles of metal build up on the stone, they clog and cover the cutting abrasive grains in the stone. Stones may be softer in some places than others, resulting in out-of-roundness, and abuse of the stone by always working in the same spot scratches grooves in the circumference. All of these

problems are cured by dressing, which means using a tool harder than the stone to resurface it.

There are three types of dressers. The most expensive is a chip of diamond, held at the end of a metal wand. This cuts are tiny area, and in use the wand is swept over the stone like the needle on a record, lightly, while the grinder is cranked quickly. The diamond cuts off the high spots on the wheel, eventually truing and cleaning it. Diamond dressers are relatively expensive and fragile, and work slowly. The oldest type of dresser is a star dresser. This is a handle with a set of five or size very hard metal stars mounted on an axle on the end. When the stars are pressed against the moving stone, they turn loosely and chatter away bits of the stone until it's dress. The concept is inelegant, but very efficient. Unlike the diamond dresser, which is used to dress various fine contours on the stone for different types of grinding, the star dresser is only capable of putting a flat surface on the grinding stone, which is fine for our use. The third type of dresser is a stick of hard material exactly like that of the harder grey stones that come on motorized wheels. This is pressed against the moving stone and cuts off whatever sticks out. It doesn't do as good of a job as the star dresser, nor does it work as quickly, but it's cheap. Either a dressing stick or a star dresser is best for our purposes.

Sharpening

There are essentially three ways to sharpen tools, defined by the surface of the bevel on the edge: hollow-ground, flat-ground, and a rounded, convex bevel. If we take a chisel as our example, if the bevel is ground on the round circumference a grinding wheel, the resulting bevel is ground slightly hollow, matching the curve of the outside of the wheel. The smaller the wheel, the deeper the concavity it makes, obviously. A flat bevel is the natural result of careful grinding on a flat bench stone, perhaps using a guide, like the commercially-available roller fixtures. An initial grinding might be hollow, but as the bevel is honed on a stone, the two ends of the bevel--the cutting point of the tool at the front of the bevel, and the heel of the bevel--are progressively ground larger and larger until they touch in the middle, forming one flat bevel. If the tip and heel of the flat bevel are then further ground more than the middle, as would happen with sloppy grinding on a flat stone, the bevel turns into a convex surface, rounded.

Generally, for our type of work, a bevel is at the proper angle if the length of the bevel is twice the thickness of the tool. This works for double-bevel knives, too. Knives used for fine work on soft wood, and never on hard wood, can have slightly longer bevels—the knife I reserve only for cutting soundposts is a good example, as is my f-hole knife. Both are used only for those jobs, which aren't hard on a blade.

Each type of the three basic bevel types has advantages and disadvantages. For instance,

in block planes the blade is used bevel up. A hollow grind which is honed only at the very tip works with much less resistance in a block plane because the shaving doesn't rub on the bevel as it comes off the edge-the hollow lies away from the path of the shaving.

Also, honing a hollow-ground tool can be very fast. I grind all of my chisels and plane blades hollow initially, and then go directly to a gold stone, polishing only a thin line at the tip and heel, rather than working through a progression of grits, in effect grinding on a part of the bevel that will never be used to cut anything. Since only the very edge needs to be polished, it's very quick to polish just the fine line at the tip and heel of the bevel. The heel gets polished at the same time not for any functional reason, but because in order to assure that I polish at the same angle each time I lay the bevel solidly on the stone, touching at both the point and the heel of the bevel.

As I repeatedly polish the tool, re-honing it on the gold stone it when it gets dull, the polished areas get larger, and honing takes longer because more metal surface is being cut. When that happens to the extent that I feel like I'm spending more time honing than I want, I carefully set my grinder to take out the middle of the bevel, and hollow grind at exactly the same angle as I did previously until the polished flats are almost entirely removed, but not so far that I touch and roughen the actual cutting edge with the wheel. Then I have ten or so more easy honings ahead of me again. This same strategy works for bevel-down bench planes and fingerplanes.

Another similar approach (by which I mean sharpening without honing the entire bevel), which works only on certain tools, is to hollow grind the edge, and then tip the tool up a bit on the stone, and hone just the tip, at a slightly higher angle. This method is called microbevel sharpening and is popular among general woodworkers who don't often sharpen any tools except planes. I don't like it for my tools because it changes the angle of attack for cutting from with the bevel flat on the wood to some indeterminate greater angle that isn't repeatable unless you're using a jig to hold the blade on the stone. It's OK, however, for bevel-up planes, if that's what you want to do. In one shop I was in the usual way was to grind 102 plane blades at a very flat initial bevel, 15 degrees or so, and then put a microbevel on the tip at about the normal 30-degree angle. This worked well, but was too indefinite for me to adopt for myself.

When I explain how I cut a soundpost with a flat-bevel knife you'll see how the microbevel would make this job much more difficult. For bevel-down plane blades microbevel sharpening defeats one of the best strategies you have for planing figured wood easily, as will also be explained in the proper place. You can, however, put the microbevel on the flat back of the blade in this case. Again, for me this is just too indeterminate for me to be comfortable doing it. None of my tools, therefore, has a microbevel.

All gouges and some knives which are used for cutting concave surfaces (for carving the internal shapes of the bridge, for instance) work well with a slightly rounded bevel. If a hollow or flat bevel is used, the tool tends to dig in, and must be levered out, breaking it's way free (imagine, for comparison, skiing into a bump on skis with straight tips instead of ones that are turned up). A round tool bevel follows hollow contours better, resulting in a cleaner cut.

With this type of tool I only grind it when it needs reshaping-otherwise I just work on flat stones, which eventually results in a very slightly convex bevel. Since a slightly rounded-over edge is fine, I usually use the 1000 grit stone for roughing, and then polish on the felt wheel. Unless used extremely carefully, a felt wheel will almost inevitably result in a ronded over edge. While carving scrolls or arching, once in a while I do a quick buff to refresh gouge edges when I feel they could be cutting better. I do something similar with my bridge carving knives.

[WARNING: When using the felt wheel it is EXTREMELY important that the wheel be used turning AWAY from the edge. If the edge is pointed in against the direction of the wheel, it will cut into it and THE TOOL WILL BE THROWN. This destroys the wheel, as well as the operator. I once watched someone else throw a knife 20 feet after bouncing it off the wall behind the grinder by approaching a soft wheel from the wrong direction. He was very lucky the knife missed him on its way across the room. Do not make this mistake even one time!]

Very few tools require a perfectly flat bevel. The only ones I sharpen this way are my soundpost knife, the one I use for fitting bridge feet, and the one I use for cutting f-holes, because they need to be able to cut a flat surface in a straight line. For posts, it works best if the flat of the bevel is pressed hard against the end of the post so the wood is compressed slightly and the bump which rises in front of the edge is then trimmed off with a straight cut. Tilting the edge down until it grabs the wood and digs in suddenly, as you would have to do with a less precisely sharpened edge, makes an uncontrolled cut at an angle down into the wood. I sharpen flat bevels directly on the 8000-grit stone, straight off the grinder. This requires careful control to hold the bevel completely flat on the stones at all times, and with a freshly ground hollow bevel the sharpening goes very quickly. Soundposts and f-holes aren't hard on edges, and if stored carefully all these knives need is a bit of touching up each time they're used.

When I want to hold a tool flat on the stone on its bevel, as with plane and chisel blades and the soundpost knife I do it by holding the tool handle lightly in one hand, but applying most of the downward pressure with the index fingertip of my other hand exactly above where the tool is touching the stone, pressing down on the very end of the

tool, over the bevel. I slide the tool on the stone in only one direction, as though I was shaving the stone, and then lift the tool to bring it back to the starting position. Moving back and forth tends to be too unstable and can round the edge.

When I hone gouges on the stones, to get a more casual, rounded bevel, I first find the bevel on the stone by feel, without doing any honing, then I hold the end of the handle in my fingertips and lock my wrist against my waist so it stays at the same height, thus, the same angle, and scrub back and forth sideways on the stone, keeping the appropriate angle.

When I hone gouges on the felt wheel I place the back of the bevel on the moving wheel and then rock the handle upwards so the contact point on the bevel gradually moves towards the point of the tool. When the tip is reached—the very point I want to be polishing—the sound changes from a "whoosh" into a sizzling whisper, telling me I'm right where I want to be. This might be the best time to mention that wood carvers sharpen their gouges so the corners are longer than the middle, neophytes think to sharpen a gouge like a chisel-straight across-but violin makers sharpen gouges like the end of a fingernail-longer in the center than at the edges. You'll understand why this is done when you carve a scroll and try to nip away wood down deep in the turns—for other operations it won't make much difference.

The back of all tools—the flat back surface opposite the bevel—should also be honed in a manner appropriate to the tool. This means laying plane blades flat on the stone, for instance, and honing the whole back, not just the tip. The insides of gouges can be carefully polished on the corner of the buffing wheel, just lightly, once in a while, being careful not to round over too much, but usually any burr that's been formed can be easily taken off by slicing into a piece of wood, using the edge as you would a knife, in a twisting motion. Do at least attempt not rounding over this surface, though. If using the felt wheel is too free-form for you, add a gouge slip (a conical sharpening stone) to your sharpening kit.

Japanese chisels and plane blades have their flat backs slightly hollowed away from the edge (and not extending out to the sides of the blade, either) so that the honing is concentrated near the perimeter and the cutting edge even though the blade is flat on the stone, reducing the task of honing multiple square inches of steel that will never will see cutting duty. You can do this hollowing yourself on regular blade with a grinding wheel, if you're careful. Don't grind deeply. Grind only enough hollow just that the flat of the back of the blade doesn't rest on the stone (isn't polished by the stone) except around the perimeter. Don't make this hollow run up too close to the edge, for obvious reasons.

Scrapers are a special case. Unlike carpenters' scrapers, which are ground square, all

scrapers used for violin making are sharpened on their edges to a 45-degree angle.

Before you grind a scraper for the first time, use a straight edge or steel rule on both sides and in all directions to discover if the steel isn't flat. You want to grind the bevel so that the flat side of the scraper is slightly concave, so that when you lay it flat on the stone only the cutting edge touches. If the steel is too flat, I will pound the middle of the scraper with a hammer on my bench top, which forces that side concave. You can tell when you've pounded enough by trying to buff the flat side of the scraper on the stone. When only the edges touch, that's enough.

I make a scraper by grinding a bevel a bit sharper than 45-degrees with the hand grinder, being very careful to keep the edge to as smooth and straight a line as possible. A hand grinder, turned slowly, is great for this. Then I move directly to my 8000-grit stone, but I don’t rely on my hand to keep the angle: I have a block of wood that looks like a cube sawed diagonally in half into a prism. One short side of the prism floats on the water on the stone, and I press the scraper against the diagonal 45 degree surface while sliding the edge down to touch the stone as I carefully hone the edge.

Technically, what I’m making is a micro-bevel: the bevel is made of two flats, a sharper one that’s ground, and then a steeper short one just at the cutting edge. After the bevel is sharpened, the back is honed flat on the stone, just as with a plane blade, the edge is sliced through a piece of wood to smooth it out, and finally the edge is turned by burnishing.

Burnishing uses a hardened, polished rod wiped relatively lightly along the bevel as if to form yet another micro-bevel, but which is actually pulling over the edge slightly into a tiny curl that does the cutting. I’ve seen people work hard to bend this edge over, but all that’s necessary is the lightest stroke that's able to turn just the very tip of the cutting edge. At that point it has tapered to nothing, and nothing is very easy to bend! This edge can be freshened by flattening it back with the burnisher held flat on the underside of the scraper, as for flat honing, and then re-burnishing to turn the curl. As this is repeatedly done after each time the scraper becomes dull, the edge is drawn out, thinned, and work hardened, meaning for the five or six times you can do this before resharpening the scraper the edge actually gets better each time it’s turned. When the edge becomes either dull or ragged, it must be re-honed on the stone.

The last special case I’ll deal with is fingerplane blades, which have their bevels facing down. Intuition says to grind the blade to a sharper angle than necessary and it will cut better. Intuition is wrong. The bevel on the blade should be just sufficient to be clear of touching the wood by about five degrees. A fingerplane blade with too sharp of a bevel tends to dig downwards into the wood (because, if you think of it, that’s where it’s

pointed), and then rip out the shaving as the blade is pushed forward. A fingerplane with a minimal bevel cuts a cleaner, smoother path, since it isn't pointed down into the wood as much (a blade goes in the direction that is the average of it's two cutting surfaces), and will even work relatively well in curly maple, a material which often requires a toothed blade.

Toothed blades are sometimes useful in fingerplanes and block planes. I use a toothed blade only for thinning ribs, and explain how to make one when I discuss setting up a Stanley 102 block plane.

I use only one regular bench plane, a 14" jack plane, and there's nothing too special about the way that is sharpened. It's a bevel-down plane like fingerplanes, but clearance under the bevel isn't as important an issue as with fingerplanes. I sharpen the edge two different ways, depending on whether I'm shooting center joints or making purfling. In either case, because both jobs are so fussy, I sharpen it as required before each use.

Modifying and hardening steel

Many of the gouges I've bought—even the expensive ones that were supposed to be good—turned out to be much too soft to be useful for fine work. I have a couple of ancient carving tools, and they're harder than diamonds, it would seem—they hardy ever need to be sharpened, and they're very thin and lightweight. Files are some of the hardest tools we use, and my best fingerplane blade is one I made myself by grinding the teeth off a file. Descriptions of tools in catalogs hint at the problem, I think: "hardness of Rockwell 58-62C." Don't give me the one that's 58C--I want the 62C one! Or maybe I want 65C.

I do know that some of the best gouges I have are the ones I re-hardened myself, in the most low-tech of ways. I took a couple of propane torches, and heated the tools between them up just as hot as they'd get (a bright red—if the steel isn't glowing red, you don't have enough heat to do the job) held them at that color for a few seconds, and then plunged them into a bucket of water, straight down to avoid warping the tool from uneven cooling (oil is usually recommended over water, and shocks the steel in the tool less: if you have some, use it), and then tempered them according to the plan I'll explain. I'm sure there's something technically wrong with it, but whatever technical errors I unknowingly made, I have gouges that are much better than what I can buy. Perhaps I can console myself that what I don't know about hardening steel is probably about on the same order of what Antonio Stradivari's tool maker didn't know.

The process I described above puts the maximum hardness in the steel. The result is an edge that's hard, but brittle like glass. If you sharpen it to a normal angle, the sharp edge disintegrates quickly--it crumbles. "Tempering", a word that is often confused with

“hardening”, is the act of softening excessively hard steel by reheating it, not hardening it. As hardened steel warms, it gradually softens, and each temperature range, and hardness, is visible as an oxidation color on the polished surface the steel. The plan, then, after hardening steel to its maximum by heating it until it glows, and then quenching, is to polish the whole gouge back to bright silver (hardening has given it a black coat of oxidation), and then gently and very, very slowly, heat it with the torch to gradually bring the temperature up, while watching for color changes.

Because heat concentrates at the tip, where the steel is the thinnest, the right place to heat is far back from the tip and watch the desired color crawl forward to the tip. Ideally, you can heat so slowly that most of the steel remains the same color, rather than running bands of different color from the torch flame on out, so work very slowly—it gets away from you fast, and by the time you start recognizing a color change, it may be too late. Start by looking for the lightest color—a light yellowish-straw—and try that for the minimum of tempering. The only way to tell if you're satisfied is to sharpen your tool and see how it works. If you feel like it's too brittle, you can go back later and move up the scale to something softer, to a darker straw color—there's no need to do this process all in one day.

I've only done this to a couple of crucial tools, and they're a pleasure to use, get deadly sharp, and rarely need resharpening. They go well with my laminated Japanese knives, which are also extremely hard (they're made from a very hard layer down the center, with softer pieces on either side for flexibility), and with the high speed steel plane blades I've made. High speed steel is a different beast, and doesn't harden the same way as I've outlined above, so don't mess with it. It does, however, make great tools if you have the patience to work with it.

While you're messing with your gouges, there's one other thing you should do. Most gouges, direct from the factory, are made for pounding on. I've taken many of mine and thinned them on a belt sander. Working perpendicular to the flow of the belt so that you can do the whole length of a gouge at once and do a neat job, it still takes a while, but is definitely worth doing to make a much more sensitive tool that's scaled to violin making. For example, my favorite one inch #3 gouge, which started about 5mm thick, is now 3mm thick—almost half as thick as it came from the factory. My small scroll gouges are even smaller. Since you'll be using your gouges with about the same force as your knives, it does make sense to have them close to knife thickness, right?

Steel is a mysterious thing, by the way, so pay close attention to how it acts, and respond accordingly. I once sharpened a knife with a ball stone in a high speed hand grinder. The stone seemed to be a bit out of round, and hammered the blade as it cut. Eventually I figured out that the blade I used that grinder on was always crumbling at the edge. After

I'd stopped, and ground a few millimeters of the edge off, everything was fine again. I suspect that hammering had disturbed the crystalline structure of the steel in some undesirable way. In the same line of thinking, I once almost bought a magnetic knife rack in a kitchen store, but the clerk warned me that if I had good knives (I do, of course) it would ruin them. It doesn't make sense, but I believe it, just in case, and won't use a magnetic strip to store sharpened tools. One gouge I tried to harden the way I describe above wasn't right again until I'd ground about 6mm off the end of it—I have no idea what went wrong, but the tool was certainly telling me it wasn't healthy at the tip.

In general, my recommendation for modifying tools is to be bold. A tool which isn't any use is a waste of money. If you totally ruin it in trying to make it work, you've at least learned something in the process—that's better than just throwing it out, directly.

Sharpening Specific Tools

The same general process applies for most edge tools: prepare the edge shape, grind, hone. The differences lie in how any given tool is shaped, the most efficient way to grind it, and specific problems in how to hold tools for honing to achieve the best edge. Shaping will be discussed for each individual tool in context, as each is used.

I grind every tool on my hand-crank grinder, using a tool rest. This step is not esoteric. Assuming the grinder's stone has been perfectly trued, the rest must be set to the correct angle to the stone, as close to it as possible, and tightened securely. Then grind.

Most tools require a specific angle, and sharpening will be quicker if the angle is the same every time. Start by adjusting the tool rest to something approximately correct, then place the tool on the rest and bring it up to the (immobile) stone. Then visually check to see if the angle is correct. After adjusting the angle this way as closely as possible, take hold of the stone, and turn it just an inch or two while holding the tool on the rest, up against the stone. Remove the tool and look for the new scratches on the bevel that will tell you which direction you need to adjust the tool rest for the scratches to be in exactly the center of the bevel. If I am very close, I tap the rest lightly with the tool to make very fine adjustments to the angle. When the scratches are in the center of the old bevel, it's time to start serious grinding.

The objective of resharpening a correctly ground tool is to extend the initial scratches outwards over the full bevel, but not do more than just touch the cutting edge, removing most of the polished area on the bevel, while doing minimal damage to the sharp edge. A nicked edge has to be ground more, though, until the nick is removed. In doing this, it's necessary to grind the whole width of the tool, in order to maintain the proper edge contour. After the grinding has removed most of the old, polished bevel, or re-established

the unchipped edge, I then move directly to the 8000-grit stone (details on that to follow).

If one is preparing a tool for the first time, the initial grinding will be more time-consuming. You can approximate the correct angle for the tool rest by setting it based on another similar tool. Then there will be quite a bit of grinding to establish the initial bevel and edge shape. It's sometimes easier to shape the line of the edge first by pushing the tool straight into the stone, and grinding the initial curve, then grinding the bevel while paying attention to the tip by looking at it straight-on, watching the narrow streak of light reflected from the tip growing smaller and smaller, and carefully grinding more where required until the line finally disappears into a sharp edge. I don't do this, myself, but do the bevel and the shape at the same time.

Plane blades are sharpened almost straight across, with just a touch of a belly to the curve of the edge so that the center of the blade projects slightly more than the edges from the bottom of the plane. This belly should be the absolute minimum when the a straightedge is balanced on the tip of the edge, there shouldn't be more than about .3mm of a curve from one corner to the other. This allows the plane to cut without the corners leaving tracks in the wood, permits local spots to be snicked off without touching areas around them, and most importantly allows one to steer edges (the joining edges of plate centerlines, for instance) into square by directing the center of the plane off-center down the joining surface, so that it takes more off one side of the surface than the other, tilting the joint.

Flat fingerplanes get the same curve, for the same reason, and this will be especially important for the smallest fingerplane, used for fitting the bassbar, where precise planing of small areas becomes very important. Round fingerplanes are sharpened to match the curve of the bottom of the plane, plus a bit extra in the center, just as for flat planes.

I use a wide mix of knives, for different purposes, but they are all double-bevel knives. My 18mm knife has a quite strong curve to it, and is used mainly for fitting bridge feet. The curve permits me to pick out small areas and cut them without cutting what's around them, as required when fitting bridge feet to a damaged, rough top.

My 16mm knife is sharpened with a perfectly straight bevel. I use that one only for soundpost fitting.

I have a 13mm knife with a long, curved tip; that one is for shaping cello bridges, and a variety of other small and delicate jobs, like cutting the ramps on the ends of saddles, rough fitting the ends of nuts, and quite a few similar jobs. Though I don't like to beat up the tools I use for bridges, this one gets quite a bit of damaging use, and I usually resharpen it when I fit a cello bridge. It works best when it's deadly sharp, anyway, so

this is good.

Next is a 10mm knife, with a straight edge. This is used only for cutting f-holes, nothing else.

Finally, I have a 3mm knife with a long, sweeping edge, used for shaping violin and viola bridges. There really isn't any other possible use for this one, since it's very small and fragile.

These are all ground the same, and because they are so small, with their edges in line with their body instead of perpendicular to it, they're a bit harder to hold on the toolrest. I use only my fingertips, gently on most of the length of the tool, rather than holding the end, as with a chisel or plane blade.

Chisels are sharpened like plane blades, and there's nothing esoteric about it. Gouges, however, get fingernail-like tips. When grinding a gouge, it's necessary to both roll the gouge from left to right, but also to turn it on the tool rest so that wherever it touches the wheel it approaches the wheel perpendicularly. This is a bit hard for some people to master, but the hand grinder allows slow, careful work, so there's no need to get off track.

General Sharpening Tips

Not all tools are sharpened the same, but there are some general rules that apply to all.

Don't sharpen more tool than you need to.
Buffing metal that will never touch wood is a waste of time, and polishing large areas of hard steel is difficult work, and time-consuming. Hollow grinding, micro-bevels, and hollowing the “flat”, back sides of single-bevel tools saves time by keeping the areas that are worked on to the minimum.

Develop awareness of the quality of the steel in your tools.
This will inform you whether they should be replaced, re-hardened, or sharpened differently. Steel that is very hard will require a greater sharpening angle than soft steel. When the angle is too acute, soft steel edges will bend over; hard steel crumbles. These feel different when you run the used edge over a fingernail in a slicing motion. Soft steel seems easier to sharpen, and to sharpen well, which may fool you into thinking the tool is a better one, but the edge may not last long. New soft steel tools often come brightly buffed all-over; hard steel is difficult or even impossible to polish to a mirror finish over large areas without a lot of special work. Very hard tools may require more obtuse angles than softer ones, and sometimes the angle on a tool may be deceptive. For instance, my smallest, 3mm knife needs a blunter angle than I would naturally give it by eye, but

works better that way. Hard steel can be very fragile, and require blunter angles: Japanese tools are particularly vulnerable to too acute an angle because the crumbling of the edge that would normally clue you to a too acute sharpening is so fine it may not be noticed.

Develop sharpening methods that give definite and repeatable results.
In the long run, this will save a lot of unnecessary grinding and honing. For each tool I'll have a specific strategy at the appropriate time.

Be gentle!
As I mentioned above, sharpening with a small stone on a hand grinder seems like a clever way to grind small edges, but probably damaged the steel in my knife by constant heavy hammering, so make sure your grinding stone is well trued before you use it. The lightest touch you can use is usually the best. On things like scrapers and fragile edges in general, pressing too hard on the stone can bend the edge of the steel so that you aren't honing the edge, but rather are polishing the steel just behind it, and the edge itself will not get honed.

Work slowly.
Grinding too quickly can burn the steel, ruining it. Once you see any color change on the steel, it's too late. A black or glowing area might as well be ground off: it's been damaged beyond recovery. On something like a plane blade or scraper, where a long expanse of straightness is needed, one errant cut with the grinder can force you to regrind the entire edge over again to remove the dent. When I'm grinding scrapers, I hold them with the tips of my fingers, lightly against the stone, so that I can avoid pressing any one area too hard against the wheel.

Sharpen often.
Sharp tools really do work better. Tools can become dull without signaling that in any obvious way. Cutting keeps getting more and more difficult, but it's so gradual that you aren't aware of it. Often when I resharpen something, I'm surprised at how bad it has gotten. That's why I stress easy sharpening methods that don't involve a lot of grinding or extensive honing: if you know it's easier to touch up an edge, you'll do it, rather than trying to push onwards with dull tools. I almost always touch up my tool edges before starting a task—it only takes a few seconds.