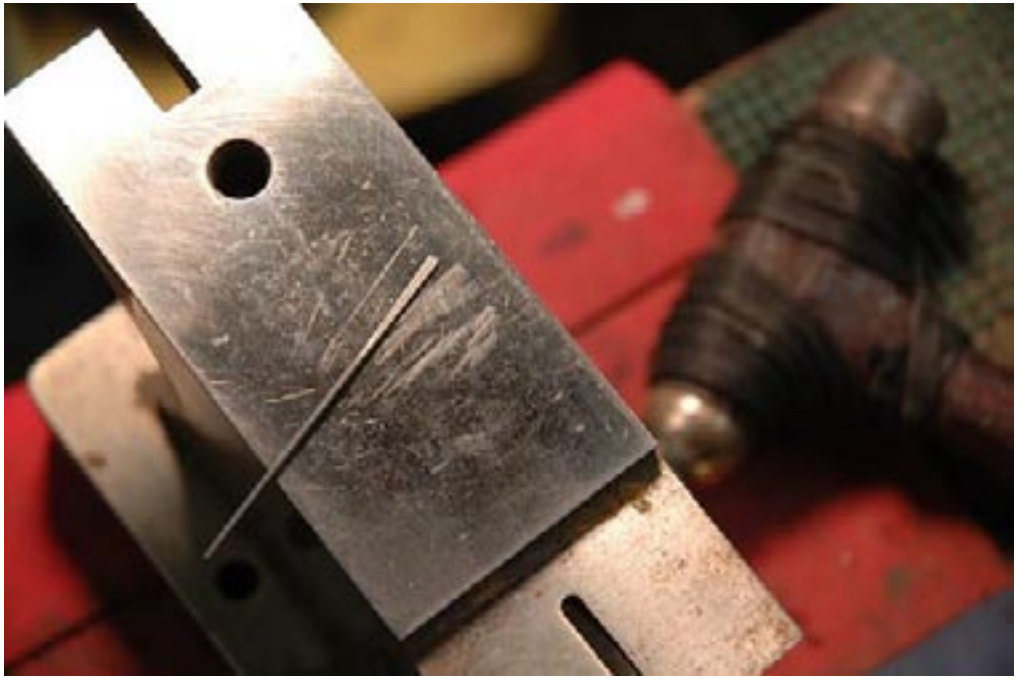
Making Micro Chisels - Created by DFogg. Making small carving chisel from music wire

Step 1: Music wire - You can buy music wire in various gage thicknesses. It is tool steel and makes good chisel stock.

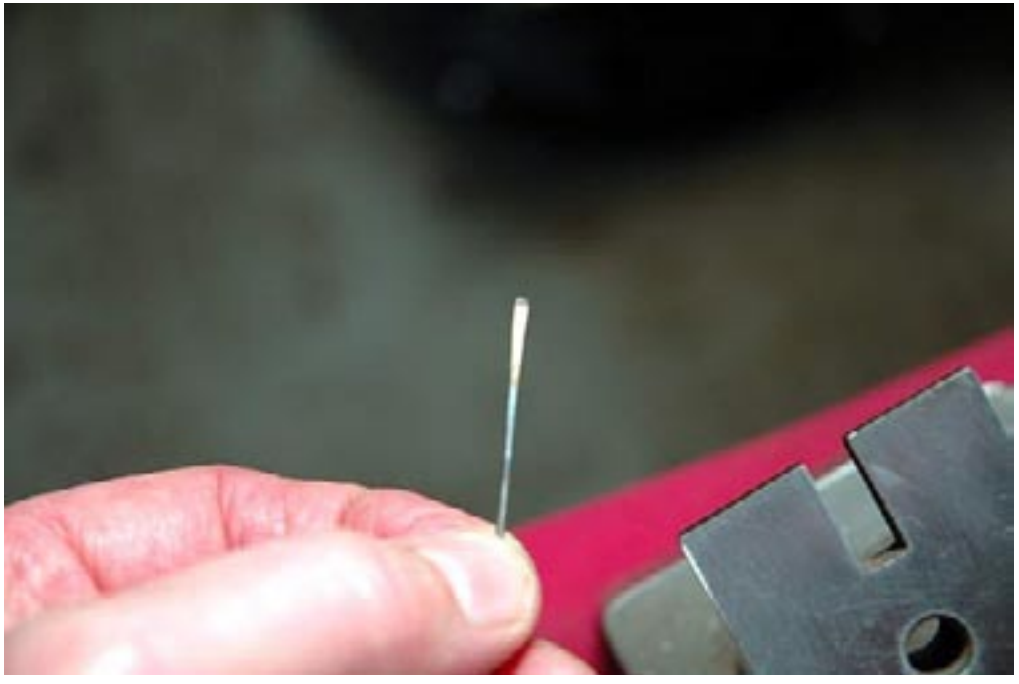


Step 2: Cold work - Flatten the wire cold. You can form it over a round to induce slight curve.

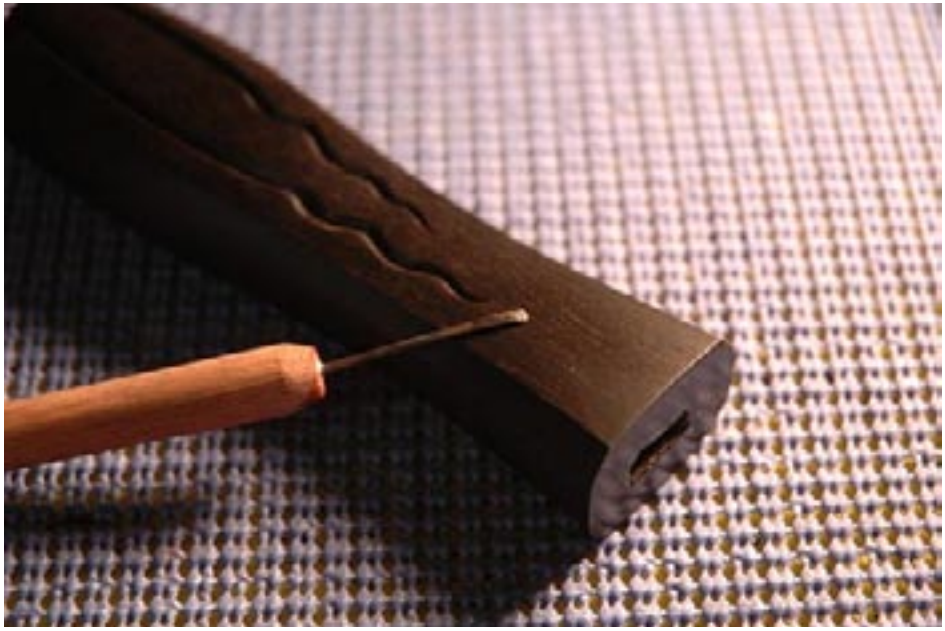
Step 3: Finish form - Slight curve.

Step 4: Hardening - Heat with a propane torch to a nice even color and quench quickly into mineral oil. Check with a file, if it has hardened the file will skate without biting. If it didn't harden reheat and get it a little hotter and requench.

Step5: Tempering - Sand off the chisel to bright metal and place on a hot plate. Turn to medium high and watch the colors on the bright section. Take off the hot plate when the color gets to bronze. Let cool.



Step 6: Temper color - Bad picture, but you can see the temper color in the piece.



Step 7: Mount in dowel for handle - Mount in a piece of dowel and sharpen. You can quickly make specialized chisels and knives for micro carving.

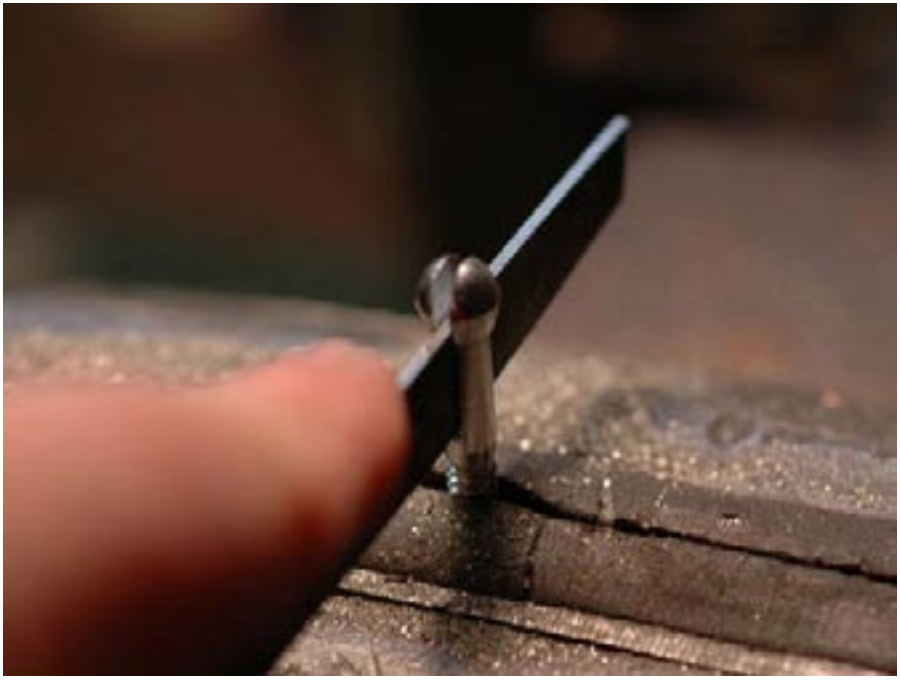
Making Carving Tools - by Don Fogg

Layout - Use lay out die and scribe the blade shape

Grinding blade - Profile the blade with a hard wheel grinder

Filing blade - Cut out the blade profile with a saw and hard wheel grinder. The bevels can be filed in.

Fit to handle - Try fit the tang to handle.

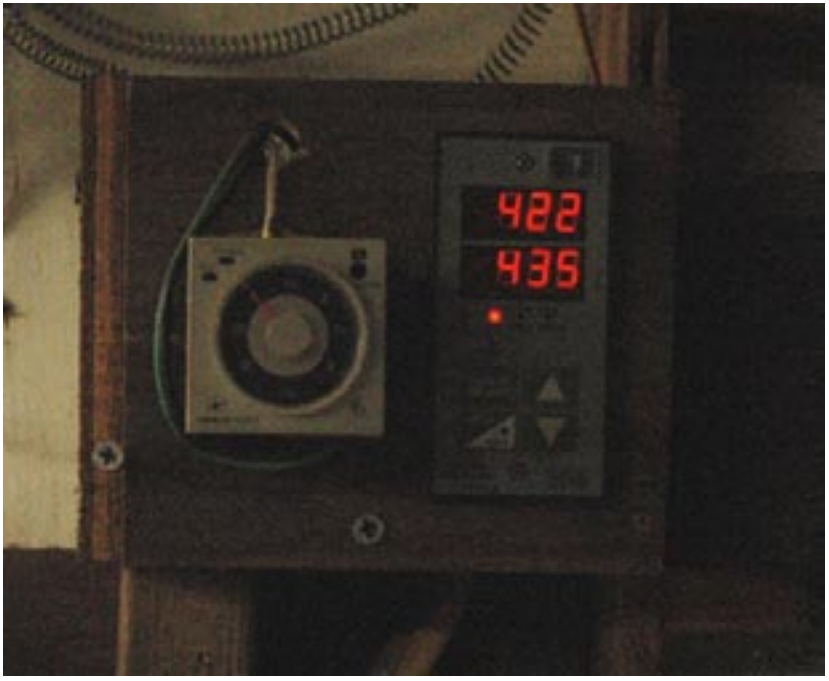


Filing collet - Depending on the size stock you use for the blades you may have to widen the collet by filing to accommodate the thickness

Collet - Finished widening the collet

Fit stock - Snug fit on the stock

Hardening blade - Using a plumbers torch heat the blade to an even orange heat and then quickly plunge into canola oil



Tempering - Heat in oven at 425 degrees F for one hour.

Carving blade - Finished carving tool

The screw is the base of the collet for this knife. Xacto makes it and they sell for around $2. I just widened the collet so it would take the slightly large stock I am making the blades from.

To heat treat small thin blades like the ones you would be using in carving all you need is a plumb-

ers torch. After you have your blade profiled and ground or filed to shape, hold the blade by the tang with a pair of vise grips and pass it back and forth through the flame until it gets a nice even orange color. It will come up to temperature quickly and when it does, immediately quench it in a can of canola oil, peanut oil, vegetable oil whatever.

Hold it in the oil until it cools to the touch. Then pop it into an oven at 425 degrees F for one hour. I use a toaster oven, but have a very accurate digital controller running it. Don't trust your oven settings they can be off a lot, you need to temper at 425 degrees F and no hotter. I would use several independent thermometers so you know that you are at the right temperature.

After an hour take the blade out and let it cool. You might want to make up several blades at the same time to be efficient.

The clamp that is holding the blade while I filed it is just a pair of vise grips. If you go to industrial supply like MSC you can buy them and the steel to make your blades.

I made up several blade shapes, but the one I wanted was a pull scraper, really narrow to do the bottoms of flat panels. It is pictured as the first blade in the layout picture and basically just has a hook on the end. The curved carver was just a shape I wanted so I made it and another that was ground on the straight edge of the same shape.

There is a lot more to heat treating, but you don't need to know any more than this to make good tools. With a few simple tools you can make all the specialty cutters that you need, when you need them.

Question: (by Ragnar) I have found that when making my tools I prefer to just harden the tool and forget about the tempering as they hold the edge longer. But you do need to put your edge on the tool before the hardening. Is there a reason you use such oils? And don't some metals quench better in water then oil?

Answer: (by Don Fogg) Water quench will work, but it can crack your blades and in these thin pieces oil is plenty fast enough.

I always temper my tools. For a few points in hardness you gain an amazing amount of toughness. Also on a very thin edge it is more prone to chipping when it is full hard. It is a matter of preference.

(by Jim Kelso) I've had good results tempering in an alcohol flame (keeps the steel clean so you can see the color).

You pass the steel through the flame back and forth slowly until you see the color change. I take it to a light straw. Not as precise as the oven, but it seems to work well. I use reflected light to watch the color. In other words, not direct, strong light, but you do need to see it well.

Question: (by Janel) Is the length of time held at a specific temperature also important?

Answer: (by Don Fogg) Yes, tempering is a function of time and temperature. The method Jim describes will work, but the oxide colors are really unreliable and it is easy to get the blade too hot.

When you are grinding an already hardened blade it is important to not allow it to get too hot for the same reason. If you show color you can take the hardness right out of the tool.

Question: (by Jim Kelso) My understanding is that high-speed steel (HSS), as distinguished from carbon steel, is unique in that it is designed to maintain hardness while running red-hot, during lathe turning, for example. This means to me, that you can grind it without worrying about losing the temper. I've found this bears out in practice. It makes it very convenient to shape and sharpen a tool and get to work. The down side is that you have less control over the hardness and toughness, but when cutting the materials I use (wood, ferrous and non-ferrous metals) I get a very fine edge that lasts a long time. I do occasionally make a tool from carbon steel (blank stock or old files) and harden and temper them and I think all carvers at some point should know how to do this. Working with the properties of the steel is a rewarding and semi-mystical experience.

Again, it's always a matter of balancing your needs.

Don, does my explanation of HSS seem right? Is it air-hardening? You are the Wizard Of Ferrous.

Answer: (by Don Fogg) You are right, HSS has been designed to maintain its hardness at higher temperatures which makes it suitable for rotary tools, milling cutters and lathe tools. Heat treating this type of steel is complex and requires control and equipment that is beyond the normal shop, but fortunately we can regrind and adapt existing tools for our purpose without worry of ruining them.

A handy tool is the simple bench grinder. You can find one at Harbor Freight for very little money. If you add a green silicon carbide wheel you can grind carbide tools and anything else. The rocks that come with them will wear out fast.

(by Jim Kelso) Old small or needle files make great scrapers. Can be shaped (by grinding) and polished without re heat treating if done very carefully.

Making Scrapers - by Don Fogg (mostly)

I am discovering that tool making is a large part of doing carving. One of the tools that I found myself making were scrapers. What I did was adapt a cheap Exacto handle to accept a thicker shaped scraper.

For the steel, I used 3/32nds 15N20 tool steel. This is a high nickel content steel that even unhardened has good toughness. It can be bought in small quantities from Swain Spring Shop, Jeff Carlisle, 1-406-452-1246.

The collet in the Exacto handle is set up for a much thinner blade so the first set is to open the collet with a file. It is made from aluminum so it files easily. You will need a file the same thickness as the blade material or thinner. Fit stock to collet to check.

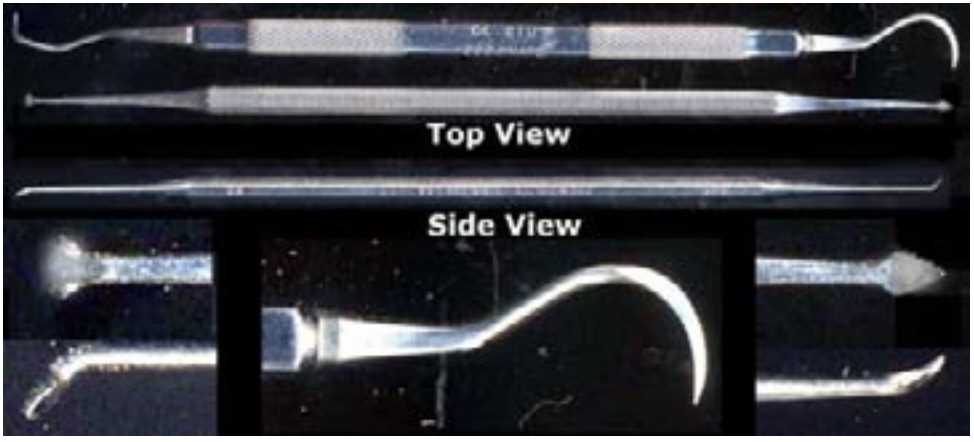
The blade is shaped using a simple rock grinder. I had to tie up one hand with the camera, but you get the idea.

I beveled the curved edge so that I could get the blade right up to the perpendicular section that I was carving. Wood scrapers are sharpened by rolling a burr up on the edge. A good tool for this is a worn out carbide end mill. They are common in my shop, but you can pick one up from a local ma-

chine shop for next to nothing. Carbide is great because it will not scratch and can be mirror polished by chucking it up in a drill press or lathe and turning it with diamond paste. To use it on the scraper, position it on the corner of the outside edge and draw it across the length of the blade.

With a micro burr on the edge you can pull dust off the carving with little effort. The finished scraper is ready to use in a useful and inexpensive handle. You can make the blade to any shape with a grinder or file and fit them to the handle quickly. Notice the fine burr on the curve.

(by Tom Sterling) Don, it never fails to amaze me how you knife guys can go through steel like beavers through trees! I always find working with hard metals difficult and sometimes quite onerous. And then trying to temper small tools.



Since the carving materials I like to use are very hard, I often find it more expedient to use scrapers than knives. I make my own scrapers from sharpened dental tools. Your dentist may have old ones to give you, if you ask nicely. If not, they are available from dental supply houses, and sometimes from carving supply catalogs.

Note that there are some dental tools that look more like tapered, bent wire, and are round in cross section. Those are not the ones to use; they can't be sharpened into scrapers.

The bottom tool (shown in top and side views) has a leaf-shaped end, and one that is round. Their faces are flat, and I sharpen all sides. The hook shaped tool is triangular in cross section on both of the business ends, and I sharpen the inside edges of the hooks. I've added several magnified views of the business ends. Since these are scrapers, I find it useful to burnish the edges with a hard piece of steel (usually I use the smooth end of a drill bit). Burnishing will cause the fine edge of the dental scraper to curl over slightly and improve its cutting action. Don't remove the wire edge from sharpening and burnishing. Scrapers require this tiny, rough wire edge to cut with.

Another makeshift tool I find useful is one of the ruby carvers or diamond abrasive bits held in a pin vise. By choosing a bit of the right shape, you can use it to smooth many areas where conventional sandpaper or polyester pads simply can't reach. It's simple, effective, and cheap.

Question: (by Janel) The beveled edge appears twice now. Hmmm, I think that I will have to see if a couple of my tools would benefit my work by doing that! Would a polished high speed drill bit be a good burnisher?

Answer: (by Tom Sterling) Yes, a drill bit will work fine to make a burnished edge on a scraper. It doesn't even need to be polished, just reasonably smooth. All you're really trying to do is to bend the wire edge left from sharpening over a little, so it really acts like a tiny wood plane and takes off microscopically thin shavings. They look like dust to the naked eye, but if you look at them under a microscope, they're little shavings. You still need to observe the same rules about wood grain as using a blade (work downhill, or the scraper will chatter and leave a corrugated surface). Works great for ivories, bone, horn and antler as well.

If any of this is confusing, look up how to use and sharpen cabinet scrapers. All the same thing, only we're using much smaller versions in different shapes.

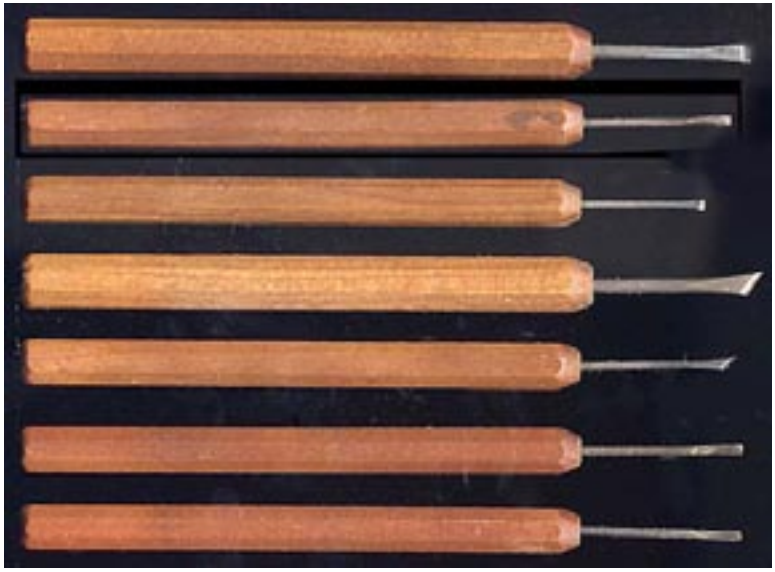
Question: (by Don Fogg) How thick are the blades that you commonly work with? I recently purchase a knife that took scalpel blades, but found that they snapped easily and really weren't that sharp out of the package.

I am getting ready for a show next weekend and don't have the time to work up a tutorial right now, but will when I get back. There is a carver that I want anyway and this would be a good excuse.

Answer: (by Tom Sterling) How thick? Difficult to answer, since I do most waste removal with an electric grinder and burrs, then move to small chisels, some purchased and some made by me.

After that come the scrapers, then abrasives like polyester pads and sandpaper, then polishing. All that is probably followed by another round of the same tools in the same order again to correct lots of little problems exposed by the polishing phase. The dental scrapers are quite thick (considering their small sizes) and do not flex appreciably.

The small chisels I use are mostly skew and flats, with occasionally some small gouges. The chisels are pretty thick for their size and only the very smallest flex at all (about the thickness of a #2 pencil lead). I don't think you want thin blades, nor gentle tapers since you're putting quite a bit of pressure and torque on them. I don't use v chisels, since in the hard materials I use the little scraper points serve that purpose. I have several knives that sometimes are useful, with fairly thin blades, although not nearly as thin as scalpel blades. I tend to use scalpels for general purpose sorts of tasks, but no heavy carving, since it's much quicker to use the electric grinder.



Here are some pictures of the tools. The little chisels with the octagonal handles are commercially available Dockyard brand, and I like them a lot. The round handled ones are just flats made by me from piano wire available at hobby shops with the balsa wood. The light colored handle is a shaker peg available a woodworking stores and a nice quick and dirty handle solution. The clear plastic tubing in the pictures is used to cover the business ends of chisels and knives for safety.

(by Jim Kelso) Here's one of my workhorse scrapers made from a small triangle file. You can shape the tip according to need and the extra thickness I think cuts down on chatter. I find chatter to be one of the main, perhaps the main drawback to scraping, and that a heavier tool reduces that.

All hail scraping!

Question: (by Janel) Is the triangular file a triangle in cross section, putting the cutting edge at the intersection of a greater angle than a knife? I also use the triangle principle when making my favorite tools.

The concept behind the tool on the lower left of the image came from reading the book about bone carving by Stephen Myhre. Ten years later, I was able to acquire a couple of his tools, and I learned that my tools have evolved into something different. I like his tools, and I like mine, each having their own uses.

The slanted oval face makes a good two sided scraping tool, or the end may be used as a gouge. The largest here is 1/4" in diameter, made from a Sears Craftsman pin punch. There are two qualities available, I found by chance. The more expensive one may be a higher grade of metal and hold a sharp edge longer. The smallest I use is a sewing needle, smaller than a darning needle, which is also in my tool set.

The three sided tool is ground on a whet stone until the three faces are about equal. One side is dedicated to being curved, again on the whet stone, which gives the tool two larger and rounded scraping edges, and the point is great for undercutting. Well, cutting is a relative term, more scraping occurs with the hard materials I use. The tool sizes to date are from a very tiny high speed drill bit to a larger a third or 3/32" high speed drill bit (the cutting end if the drill bit is set into the

handle). The in between sizes are Sears pin punches. It is possible that I annealed and hardened the larger tool for working with the hard metal. That was long ago, memory fails me...

Answer: (by Jim Kelso) The triangle file is just tapered on all three sides, right to the point, leaving a triangle with one face being the cutting (scraping) one. To me, there is something about having a little extra mass behind that face that I think gives more support, and hence, less chatter. Sometimes these things would be very hard to measure, and the advantage may all be in my head, but there it is, none-the-less. I'm willing to take any advantage I can find.

The slanted oval made from a round looks oh-so-useful. I'm going to make one immediately! You could use it going left and right on either side and as you say as a gouge.

Question: (by Robert Weinstock) Are you using that scraper on metal? Would you use it instead of a graver, and if so, why? I use gravers with no heel, so I suppose they could be called scrapers.

Question: (by Janel) I am very short on knowing the vernacular for metal working tools. I can guess what a graver is, but would like to know for sure what it is and its intended use, and what do you mean "gravers with no heel", what is a heel? Do they have varying kinds of shapes, uses and attributes?

I probably am using tools that would be called gravers, but until I know what words mean relative to the tool and uses I'll call them something else!

Answer: (by Robert Weinstock) Gravers are a push type tool for cutting metal. I'll post some photos when I get some taken. They come in many shapes and sizes, and I make many of my own.

Most engravers will talk about putting a heel on their gravers. It refers to the way the point is sharpened. My gravers have no heel. In other words, The bottom side of the tool is flat or straight to the point. Having a heel would mean that the bottom of the tool has a bevel sharpened on it. Not have a heel on my gravers forces me to angle the tool lower. A heel allows the engraver to hold his graver at a higher angle. I get around the angle problem with a tool that I rest my graver on and use it as a fulcrum (I'll send pictures). For me, it wouldn't be practical to sharpen a heel on every graver, because I have more than a hundred gravers in different shapes and sizes, and it would be impractical to sharpen a heel on them each time I sharpen them. An engraver might use a single tool for most of his work, so it's a little different.

(by RHGraham) I make gravers and chisels for myself and others quite a bit, I generally use O-1 "drill rod", it's ideal for metalworking, otherwise I use W-1 "drill rod" for wood and softer materials.

AKA Oil hardening drill rod (0-1) and water hardening drill rod (w-1)
I get them from industrial supply places like MSC Industrial supply, and both steels can be had in ideal sizes for the tools I see pictured here, right down to 1/32 inch if needed, I usually get both in 1/4 inch and form tools from that.

Both can be heat-treated in exceedingly simple bench-top set-ups as well, torch, fire bricks, and a hot-plate with a stainless container of peanut oil and very high-end heat-treatments can be done... if there is interest in something like that I could put it together in my shop and get some pics and operational info... then I won't have guilt over sucking your brains dry...

W-1 is also what I use for scrapers, the hook you can burnish onto W-1 is awesome.

(by Doug Sanders) Over the Thanksgiving holiday I dropped in on a locally owned hobby shop in Pittsburgh and found two great tools that are quickly rising to the top of my toolbox.

They are made by Squadron Tools, who sell them as a scriber and a seam/glue scraper. They're made of Pakistani steel, which in my experience isn't the best, but the profiles are very handy. The scraper, especially, has right and left-handed on either end. It's working very well where I need a flat, indented surface such as the bottom of a large inlay pocket. They sell from $9-$10 online and in shops.

Both work by a pulling action that is different than the scrapers discussed so far in this thread, and which I'm finding very easy.

(by Dick Bonham) Here are two sets of scrapers/chisels I bought at the Grizzly outlet. They are also in their catalog. http://www.grizzly.com/products/item.aspx?itemnumber=h5914

They are $5.95 for the set of 4 scrapers (model H5914) and $9.95 for the miniature chisels (model H5915). They hold an edge well.

Making Micro carving tools - by DFogg.

Here is another one using ready bought handle, the Veritas carving tool. This handle takes disposable flat blades that are much like scalpels. I love the handle. It is cast aluminum with a brass knurled head and feels substantial in the hand.

Loosen the head until the collet is as wide as it gets. Using a 5/64ths drill bit, drill out the center down to 3/4in. It will chatter some as the drill catches on the edges of the cuts, but it only takes a second to drill the soft aluminum. Try not to wallow out the hole. I did it with a hand drill.

The blades for this are made from old dental burrs. Break of the burr with a pair of pliers and then shape the point to suit. I have a diamond disk and it only took a minute or so to get a nice sharp edge.

The burr will fit into the handle and be held securely. They are really easy to change and simple to make.

Using old dental burrs to make micro carving tools.

Veritas chuck - To use with dental burrs loosen the chuck so that it spreads to maximum opening and then drill out the center with a 5/64ths drill. It will chatter some.

Dental burr cutter - Break off the end of a used dental burr and then grind and shape the tip to suit. The chuck holds it solidly and the handle is great.

(by ford hallam) First off, get hold of a set of cheap needle files, the cheaper the better. They tend to be basic tool steel and in a very hard state. Heat your selected file to a dull red, using a plumbers torch, gas camping cooker or even a barbecue, ensure that the whole tool is heated through and held at that red color for at least 1 minute. Let it cool as slowly as possible, leave it in the fire for instance. If you use the barbecue method you can simply leave the whole set of files in the fire and let it die down naturally. Probably the surest approach.

Your steel will now be in a softer state, technically speaking it's now normalized. The gray scale that will have formed on the surface can be removed with 50% solution of Hydrochloric acid (muriatic acid, the stuff you put in the swimming pool).
You can choose to file it off where necessary although it is a bit harder than the softened steel underneath and isn't kind to your files.
You can now shape the softened files quite easily using hand files, you might even try bending the ends of the files to better suit your needs. Once you've created the shape you want you need to harden the new tool. I make my tools to carve steel, so the demands on them are quite high, the stress on the cutting face of a tool used on wood or ivory is naturally less. This means that the tip can be left quite hard, as long as the body of the tool is reasonably tough. I achieve this by heating the tip of the tool for about 1/2 an inch, to a tomato/ orange red (700 degrees Celsius, ish!) and stick just the red bit into the water. As soon as red recedes completely, remove from the water. The tool will still be quite hot at this point so don't touch it!, The residual heat in the tool will move down to the tip and help relieve the hardness, thereby tempering the tool. I find that this is often adequate.

You may have to experiment a little with the few variables, but once understood, this is a simple and basic way to make your own custom tools. I reckon it should be taught in the first class for budding netsuke carvers. Although I've yet again ended up being somewhat long-winded in describing this process, it is actually quicker to make a tool than write about it.