SCRAPING for the Home Shop

Part Three

BY MICHAEL WARD

MAKING A CARBIDE SCRAPER

Now that we have mastered the techniques for making carbon steel scrapers, let's take a look at carbide. There is no doubt that a carbide scraper is a superior scraper; it simply holds its edge much longer and makes scraping items such as hardened beds a reasonable (if not less challenging) proposition. If you have a lot of scraping to do, it's definitely recommended that you make or acquire a carbide scraper. The style I make is simply a length of steel with a file handle on one end and a bit of carbide brazed on the other (Photo 66).

A carbide scraper is something of a good news, bad news scenario. The good news is a carbide scraper is not that difficult to make, or they are commercially available. The bad news is it's going to take some specialty tools to put/keep an edge on your scraper.

Carbide can't be sharpened by the regular aluminum oxide wheel on your grinder. It's too hard. You may know that silicon carbide wheels (the green wheels) will grind carbide but they do a poor job. Especially when we need a very fine edge. The edge formed after grinding with a silicon carbide wheel will likely be chipped and a long way from a usable condition.

To move up to carbide, you've got to move up to diamond sharpening equipment. Ideally, you'll have a diamond grinding wheel to grind the crescent shape on the end and a diamond lap to put on the sharp edge. I say ideally, as you can form the crescent shape with the lap; however, it's a lot of lapping!

I've a lot of scrapers. I tend to make them in batches and have experimented with different lengths and thicknesses of the body, or shaft, of the scrapers. I like to grab a handful at a time when I head to the lap and keep scraping until they're in need of another tune up. I have the traditional, long handled versions that machine tool scrapers would use, as well as short versions that are preferable for smaller bench-work projects.

The batch I photographed for this article are long handled scrapers, two 12" and two 14" long shafts, with one of each being of 1/8" thick steel and one of 3/16" to allow a variety of shapes and sizes and to ensure enough photo ops. I ground some as square end scrapers; handy for getting into the corners that sometimes present themselves. I've also made some shorter handled scrapers that are convenient for finishing and bench-work, some narrower scrapers (not of much value), and some very thin scrapers using 1/16" carbide to allow me to reach into the corners of small dovetails.

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Over time, I've developed the opinion that my shorter, 4" or 5" bladed models are more convenient and they see more use. I generally use the power scraper for heavy stuff and the shorter hand scrapers end up much more convenient for finishing and bench-work. As they aren't very much effort to make, you might consider making a variety pack until you find the most comfortable size for you.

Regardless of build or buy, you will need a diamond lapping setup, which we'll cover in a later part. In addition, you will need a diamond grinding wheel to create the initial shape on the carbide. These wheels are expensive, but if you are using carbide in other places in your shop, perhaps it can serve multiple functions.

Theoretically, you could use the hand held diamond "stones" to put the curve on the end of the blade; however, I don't think there is a substitute for the rotary lapping operation we'll cover later.

I started by cutting to length blanks for the body of the scraper, as well as some shorter, thicker pieces that will be used for tangs (Photo 67).

I decided that the easiest method of getting a nice

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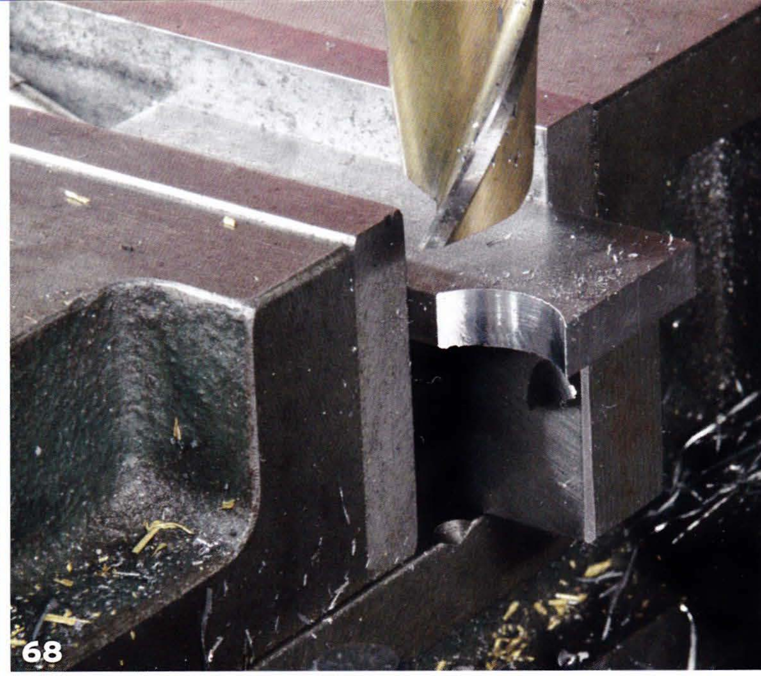

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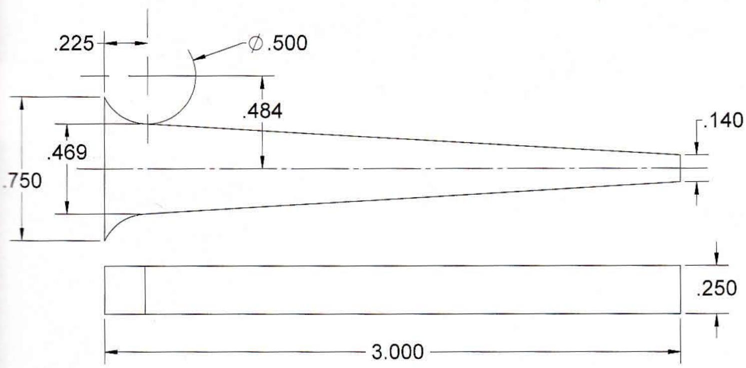
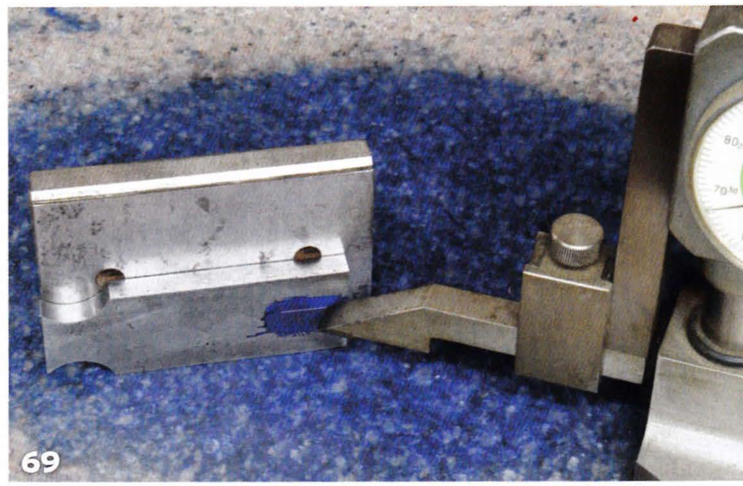


Dimensions to fit Lutz #8 File Handle

Figure 7



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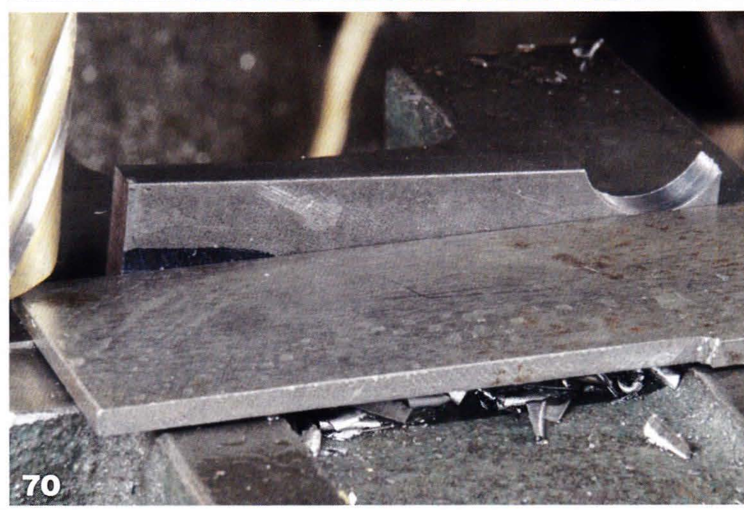

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handle on the file was to use Lutz file handles. They are nicely made hardwood handles and are inexpensive. To use them, we need a shape like a file tang on the end of our scraper, so our first task is the unlikely job of making a file tangs! I have to chuckle at myself, and maybe you will to, for making file tangs, but making tangs and using commercial handles seemed the easiest route to get a decent handle on our scrapers. When I've done so it's been in batches, which maybe makes it seem less silly; much less time per piece this way.

To get a proper bite with the handle, I deemed the shank itself too thin to machine a tang on so I carved out some file tangs from 1/4" stock. Using a Lutz #8 file handle, which I think makes a comfortable scraper handle, I tried various files until I found one whose tang fit the handle nicely. Figure 7 shows these dimensions.

1/4" steel, hot- or cold-rolled, will do nicely for the tang(s). Start by cutting a piece of 3/4" wide material to 3" long and clean up one end in the mill. Having a bunch to do, I set up a 1/2" slot drill (two-fluted end mill) in the mill, offset to the end of the work. A vise stop let me plunge one side, turn the work over and plunge the other (Photo 68).

You could, of course, just cut a tapered piece and braze it on. I chose to replicate the fanned shape of the end of a file, primarily so it would create a larger surface area to silver solder between the tang and the body of the scraper. The narrow end of the tang should measure about .140" wide. With a height gauge set at .570", it was quick work to scribe two lines on the end the proper width (Photo 69).

This is a long way from high precision work and the quickest way to finish the tangs is with some eyeball


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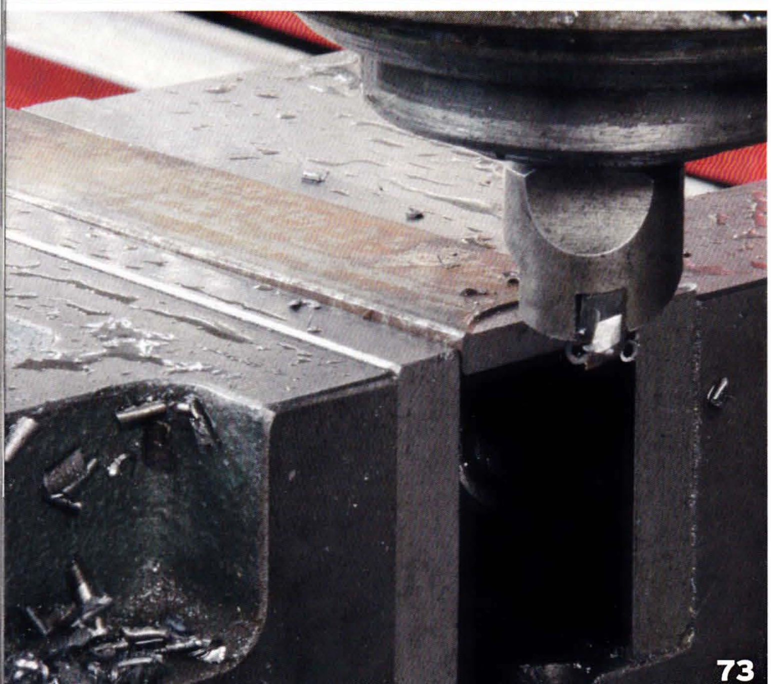
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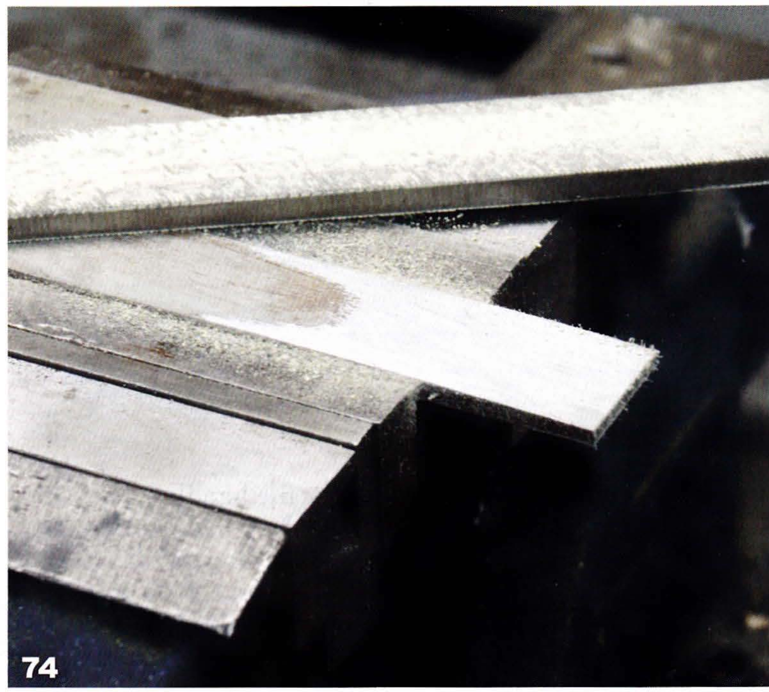
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alignment. Place a parallel across the top of your vise jaw and align the work in the vise such that the scribed line at the end of the tang and the curved cutout section both touch the top of the parallel (Photo 70). Mill down until this taper section smoothly meets the radius. The thin parallel is just an aid to set the scribed line against and is, of course, removed before milling.

Milling like this, where there is more material protruding from the vise than clamped in the vise and with the work not supported underneath by a parallel, can be tricky. Use a gentle hand feed and orient the cutting forces so they are trying to push the work toward the fixed jaw of the vise. Flip and repeat on the other side.

We are going to silver solder, or silver braze, the finished tangs (Photo 71) onto the end of the body of our scraper. I made the bodies out of 1" wide steel, either 1/8" or 3/16" thick. Some was cold-rolled, some hot-rolled, depending on what I had in stock. I made the bodies 12" and 14" in length.

TAPERING THE BODY

I thought it advantageous to thin out the main part of the scraper where it comes to meet its carbide end. The main reason is that if lapping work is required on the carbide at some point, it would be nice to have it proud of the steel shank.

Photo 72 shows setting up a blank in the mill vise for tapering. This is eyeball engineering; cut to what looks good to you. The steel block across the jaws in the photo is held against the work while the work is being clamped in the vise. It helps to remove any angle in the Y direction as the part is clamped. Keep the work in contact with the steel block as the vise jaws are tightened. Photo 73 shows the slight taper on the end of the shank being milled with a fly cutter.

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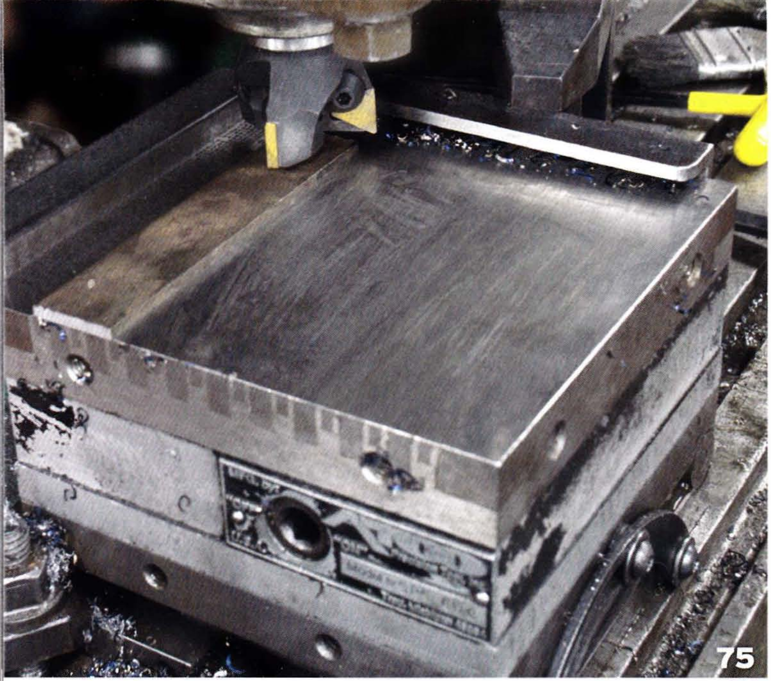

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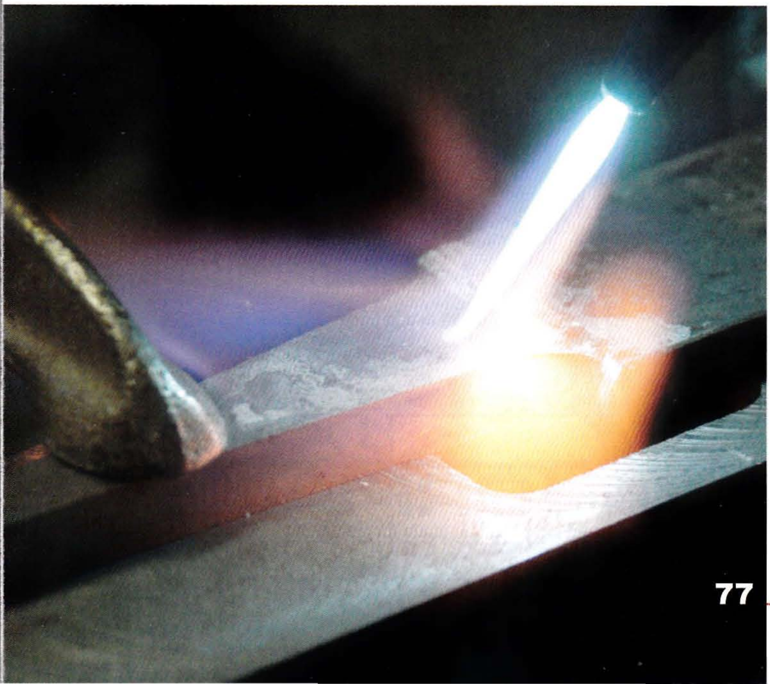

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In Photo 74, I'm doing some clean up; removing tool marks and fine tuning. Too fussy perhaps, but I'm the one who will have to look at them and I like to make decent looking stuff. The subsequent decision to paint makes removal of tool marks a bit superfluous – the cellulose filling primer fills the tool marks quite easily. Finish as you see fit.

The variance in length and thickness of different bodies allows you to vary how flexible the body is. By all accounts, there is no right answer to the desired flexibility. Among experienced scraper hands it is a matter of personal preference. I'd thought us home shop types unlikely to scrape enough acres to develop strong preferences; however, I find myself grabbing more for the 1/8" thick ones than the 3/16" thick ones. Try a few different thicknesses and see what you prefer.

Photo 75 shows an alternative approach to tapering the shanks. A recent addition to my tooling shelf is this nice little magnetic sine plate. Normally a grinding accessory, it worked well for this light milling job. You'll note the scale between the fence and work. The magnetic force alone is not strong enough to hold things for milling, so the fence must be used and light cuts taken.

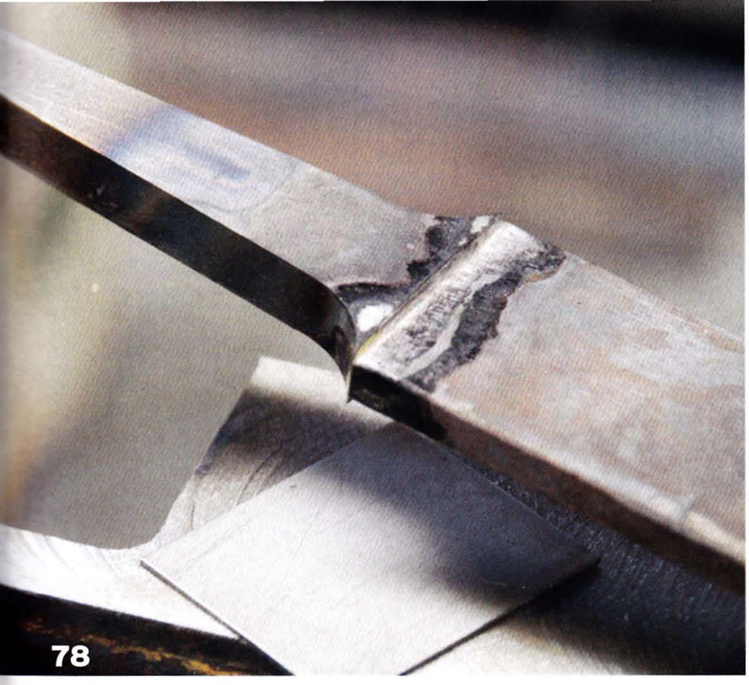
Once you have the taper cut, make sure the ends of the body are cleaned up and square in preparation for soldering. I made a simple little fixture to facilitate silver soldering the tang to the body. I took a piece of 2" angle iron, a little less than a foot long, and milled a section out of one side. I then did a skim pass with a fly cutter to make sure the surfaces on both sides of the milled out pocket were on the same plane (Photo 76). The scraper body is clamped to one side of the fixture and the tang to the other as seen in the photo.

The tang is thicker than the body, so I used some shims underneath the thinner body to ensure it would be centered on the tang. If you are new to silver soldering, the key is to make sure the two ends are clean (not even fingerprint oil) and, as is always the rule with silver soldering, apply copious amounts of flux. I use a flux made specifically for silver solder and would recommend the same.

Usually I silver solder by carefully creating an assembly, figuring out some method of holding the parts in alignment, and placing small lengths (1/16" – 1/8") of 1/32" diameter silver along the joints. The parts are often small and are surrounded by air or, if larger, insulated fire brick. Propane/air is the fuel of choice as it doesn't get hot enough to burn the flux or damage the silver solder.

With this job, I departed from my standard methodology and fired up the oxy-acetylene torch. We have a lot more metal here than my typically fidgety little silver solder assemblies and the angle iron will also act as a heat sink. So, we need to apply more heat, more quickly. Photo 77 shows how the oxy-acetylene flame is directed away from the joint and flux, as its temperatures are too high to apply directly to the solder and flux.

I place a small piece of silver solder along the joint, where it serves as the perfect indicator that everything



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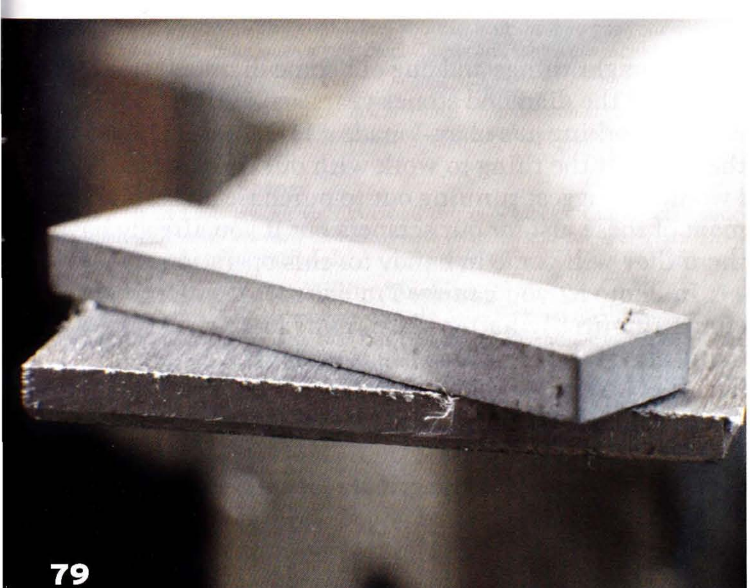
is at the right temperature. It is very easy with acetylene to go too high in temperature, resulting in a weak and brittle joint. Direct the flame away from the joint, alternating from piece to piece. I keep applying heat until the little lengths of silver solder are wicked in. The solder beautifully and immediately fills the joint and forms a nice fillet.

If you feel there is not enough silver solder, take a length of silver solder whose end was immersed in the flux container and touch it to the joint. However, in my opinion, better work results from placing the right amount of solder (judging the right amount comes with a bit of practice) on the joint prior to heating. The reason being is when the solder is applied to a hot joint it is more difficult to control how much solder is used, often resulting in blobs of excess solder. I judged there was enough solder present on the pieces and called the job done (Photo 78).

The next item of business is to silver solder the carbide end to the body (Photo 79). Note how the body



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has been thinned such that the carbide end will be thicker than the steel. This is a small, non-essential improvement but it does make it easier to do additional lapping on the top and bottom of the carbide should it be necessary.

WORKING WITH CARBIDE

With either carbide or tool steel, it's important that the flat sides of the scraper that meet the breast forming the cutting edge are very well finished. As noted previously, an edge is the intersection of two surfaces, so if we want the intersection to be good and sharp, each surface must be very well finished. If these surfaces are rough, it will be impossible to get a good edge on the tool. If there are scratches or chips, they will result in ridges on the scraped work.

The primary cutting material for working with carbide is diamond. Photo 80 shows a selection of diamond stones. These diamonds are much less expensive than buying a ring, are useful, and require minimal ongoing maintenance. The most difficult part about working with carbide is overcoming our frugal nature and springing for some diamond stones. Throughout this article you will see diamond stones, diamond lapping compound, and diamond grinding wheels – all of which play a role in creating and maintaining our carbide scraper edge.

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The carbide blanks I used came from KBC Tools and Machinery. I bought an assortment of sizes, with the most common ones I used being 1" × 1/4" × 1/8". The smallest blanks, used on the little dovetail scrapers, were 1/16" thick.

The first task is to put a very high finish on the two sides that intersect with the end to form the cutting edge. The little pieces of carbide are much easier to work with now, rather than after attachment to the body, so let's start by putting a very fine, lapped finish on them.

I was surprised at how curved the surfaces seemed to be (Photo 81). This photo shows the results of taking the carbide blank directly to a lapping operation. With the carbide this out of shape, lapping would take some time

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so I rethought things and dug out some diamond stones. I acquired the diamond stones years ago during a bout of woodworking (it's okay, I made a full recovery) and they are just the thing to work with our carbide bits. I wouldn't suggest running out to purchase an assortment of these just for our scrapers but if you already have them they will come in handy for this operation.

In Photo 82 you can see I'm using three diamond stones to initially flatten the carbide bits. As with many abrasive operations, life is easier if we start with a coarse stone and sequentially use finer grits.

In this case, I was glad to have the coarse stone. Photo 83 shows the carbide being worked on the coarsest of stones and the grit size is quite visible. Once the curvature was removed, I worked towards the finest stone, removing the previous stone's scratches. Make sure to use water to help carry away chips.

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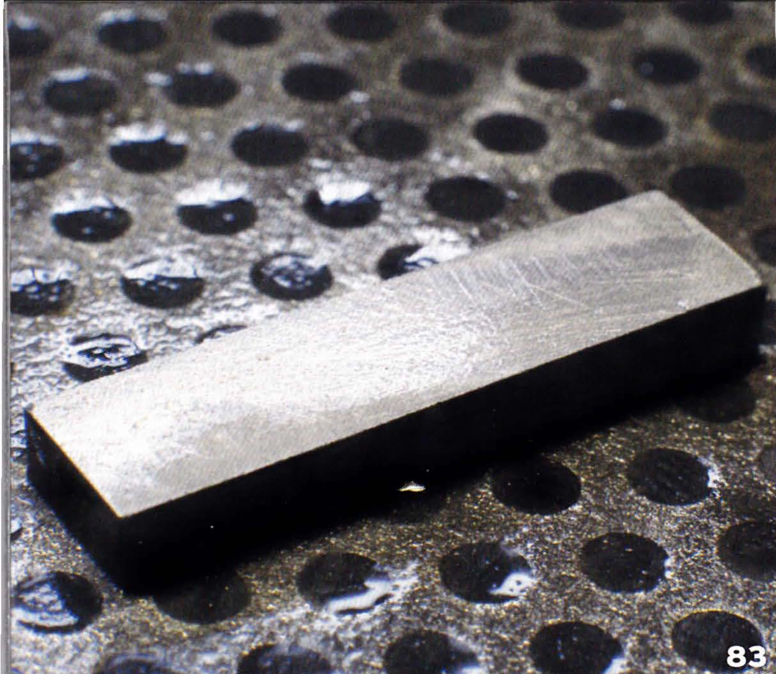

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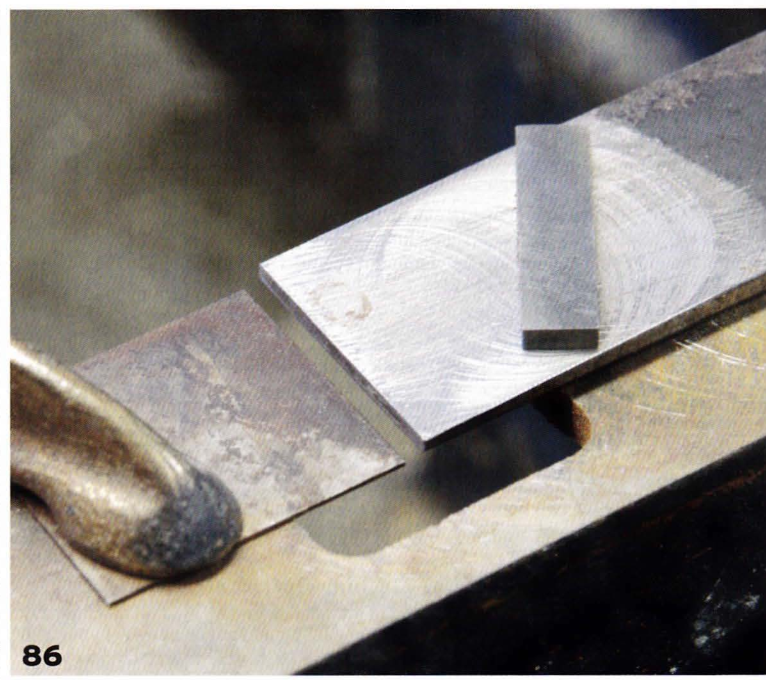

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PUTTING A POLISH ON THE BLANK

After using the finest diamond stone, we'll be using a fine diamond lapping paste (#9) to put a mirror finish on the carbide. Diamond lapping compounds are color-coded, with the green I used being #9, or a 9 micron particle size. This is categorized as "super fine" and the range (at least what's commercially available to me) goes from 90 microns down to 1/4 micron. #9 seems to be commonly recommended and has worked well for me.

While I'm accustomed to thinking cast iron is a better choice than aluminum for a lap, I had a scrap of aluminum cut from a channel that needed to be used and it worked well. I fly cut the aluminum piece and, using an old Torrington bearing on a shaft, pressed the compound into the lap (Photo 84).

This is the general principal of most laps. The lap is "charged" by having the abrasive grits pressed into its surface, which are then used to cut the work. Use maybe a couple of pin heads worth of diamond paste and roll it out with the bearing like grandma on a pie crust. Keep going until the mirror finish shows up across the carbide blank. A little water helps (Photo 85).

SILVER SOLDERING CARBIDE

The carbide blank gets silver soldered to the end of the steel body. The trick in silver soldering carbide is to clean the oxidation layer off first, as any oxidation will prevent a good joint. As we just proved with the diamond abrasives, carbide is a bright, silvery color. However, it oxidizes, giving it the dark grey color we're accustomed to.

While emery won't cut carbide, it will cut the oxidized material on the surface. Rub the edge with some fine emery to prepare for silver solder.

My setup for silver soldering is shown in Photo 86, using the same piece of notched angle I used for silver

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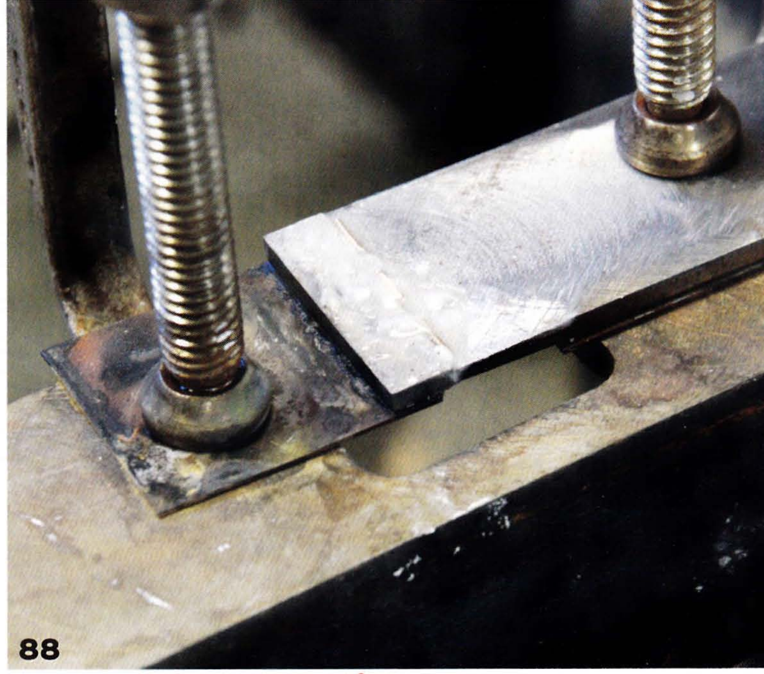

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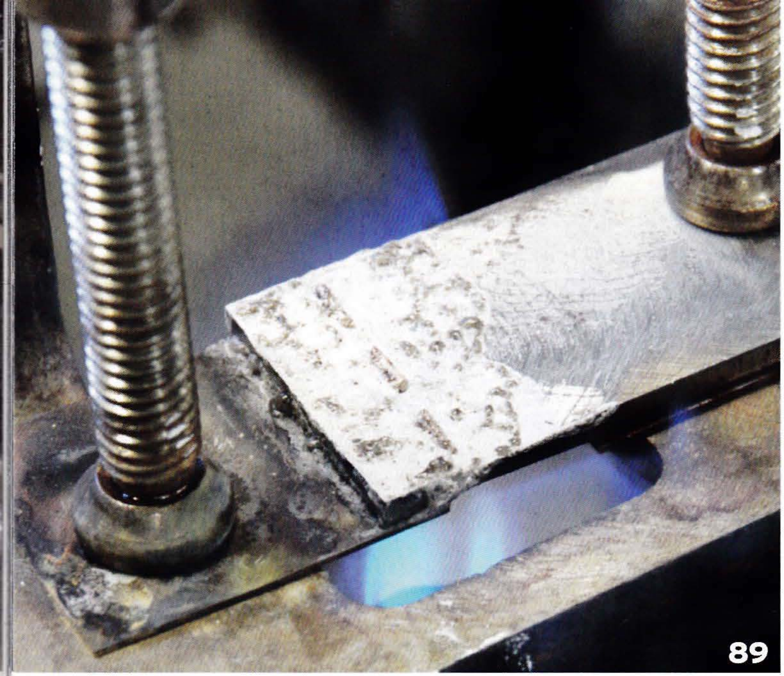
soldering the tangs. The carbide rests on a thin piece of sheet metal while there are other shims under the body, raising it to the right height. The thickness of the packing is such that the end of the blade gets soldered to the middle of the carbide blank.

Make sure to remember the keys to silver soldering. First off, make sure the surfaces are clean. Secondly, use lots of flux. Fix everything in position and place small pieces of silver solder along the joint, just as when soldering the tangs on. I use 1/32" diameter silver solder (Photo 87). Gently warm things evenly between the two pieces and, when ready, the silver solder beautifully wicks in with no extra blobs or globs.

Silver soldering (also correctly called brazing) seems one of the subjects where those new to it are full of questions and perhaps a bit of trepidation. I thought it might take some of the mysteries out of it if the process was presented in pictures.

Photo 88 shows everything ready to go. Both workpieces are clean, fluxed, and clamped to the fixture at the right heights. The job is well fluxed and ready to go. The small pieces of silver solder are visible in the flux along the joint.

This time I used a propane/air torch. Propane burns at a temperature that is more than hot enough for most silver soldering. The time to abandon propane air in favor of higher temperature equipment such as oxy-acetylene is when a workpiece of larger mass requires more heat. Oxy-acetylene, burning at much higher temperatures, can deliver much more energy in a short period of time, letting us get larger assemblies to silver soldering temperature. The advantage of propane is that it burns at a low enough temperature that it can be applied directly to the fluxed joint. Given the small size of the carbide piece, being able to apply the flame directly is a lot easier than the indirect approach required with oxy-acetylene.



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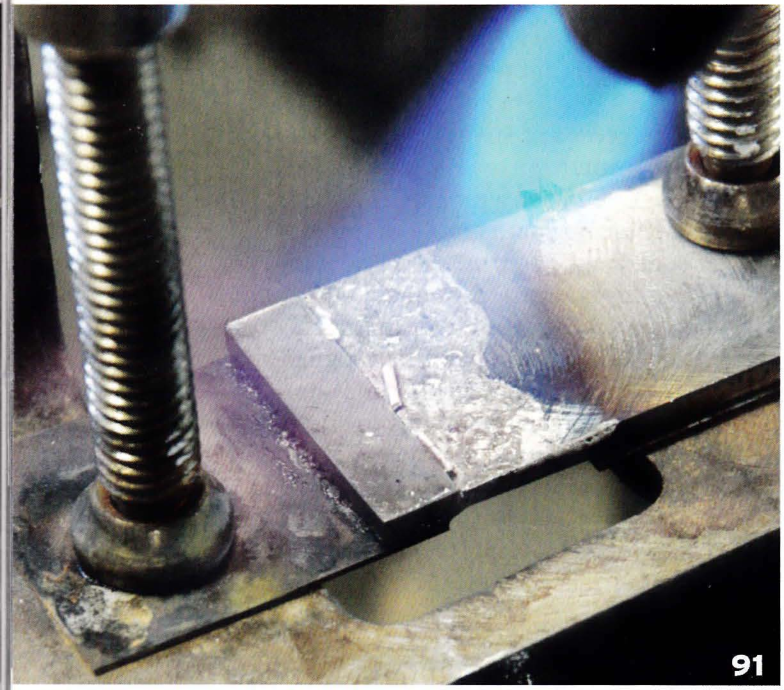

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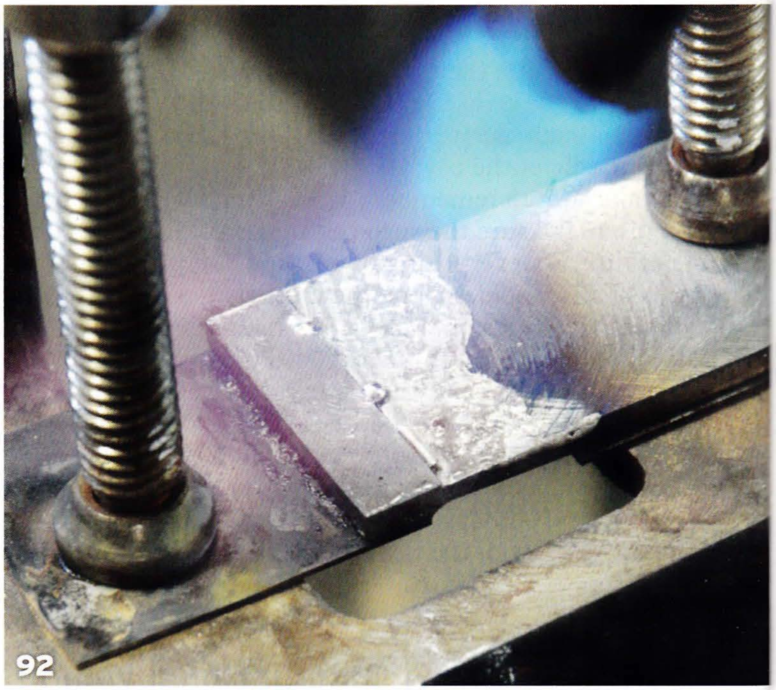

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At first the flux is quite active, as the water in it boils away (Photo 89), and care is needed to avoid blowing away the bits of silver solder. Occasionally, the boiling will move the solder and it will need to be nudged back into position (I use tweezers for this and for placing the tiny pieces).

In Photo 90 the water is almost all gone and the flux looks sticky, with just a bit of sheen to it.

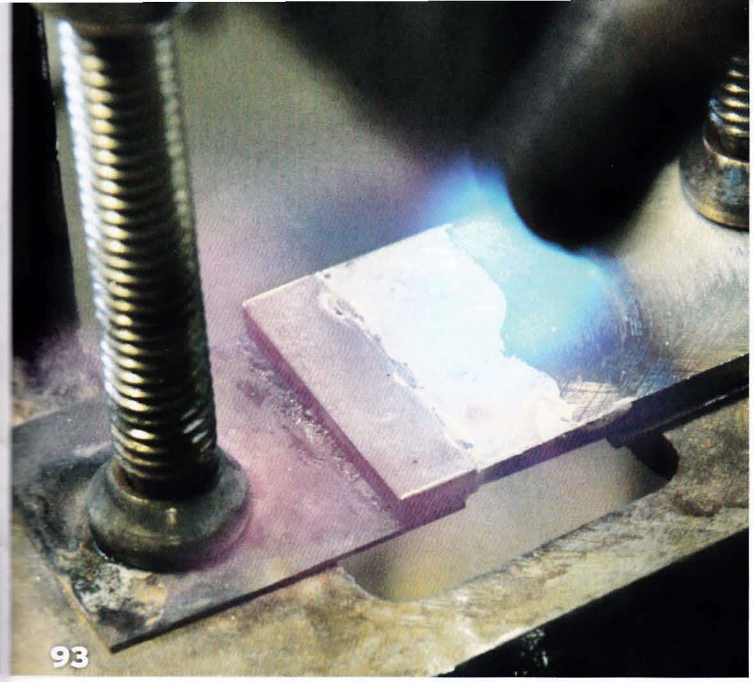
As you get to the point where the silver solder wants to melt, the flux will look like it has mostly disappeared (Photo 91). The flux is still there, it's just that all the water in it has boiled away.

Although you can directly apply the propane torch to the joint, do keep the torch moving. Ideally, both pieces of work will come up to temperature at the same time and the solder will wick in nicely. It's easy to melt the silver solder by concentrating the flame on it but this accomplishes nothing; we need to bring the work and solder up to the right temperature together for a good joint to result.

In Photo 92 the solder on the far side has started to melt, while the closest has not. I'll concentrate heat now toward the near side and to the shank. Again, we're using the flame to warm the entire area, using judgment on which pieces are bigger heat sinks and therefore require more attention from the flame.

At the point of Photo 93, we're essentially done. I will play the flame over the bottom of the assembly just to make sure it is warm enough all over for good flow; however, that is probably braces and a belt. If we've got the joint to temperature by gradually heating the surrounding work material, we can have confidence that the joint will be good throughout.

And we're done! Wash the scrapers in hot water to



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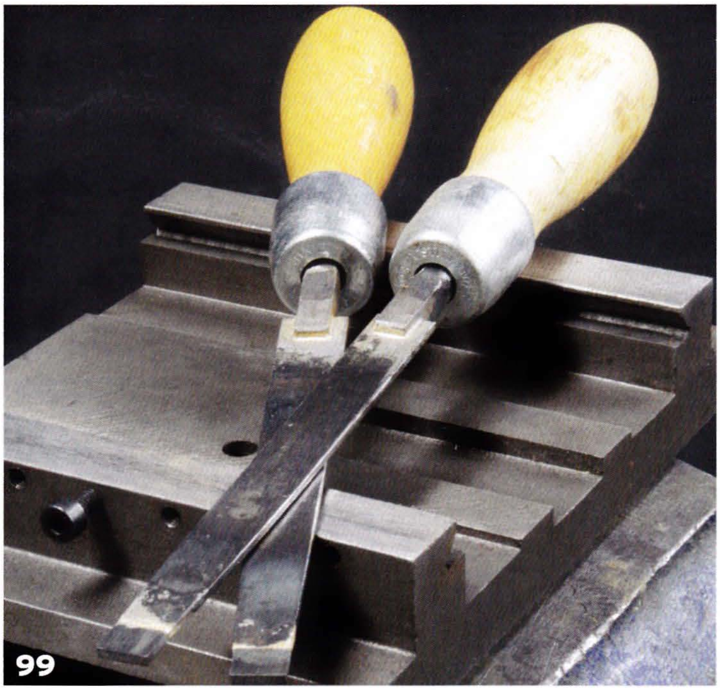

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remove the flux (I used an acid pickle, but hot water works just as well) and paint if you like.

Our collection of scrapers can be seen out of the pickle in Photo 94 and with handles installed in Photo 95. I ended up painting the bodies to stave of rust.

OTHER FORMATS

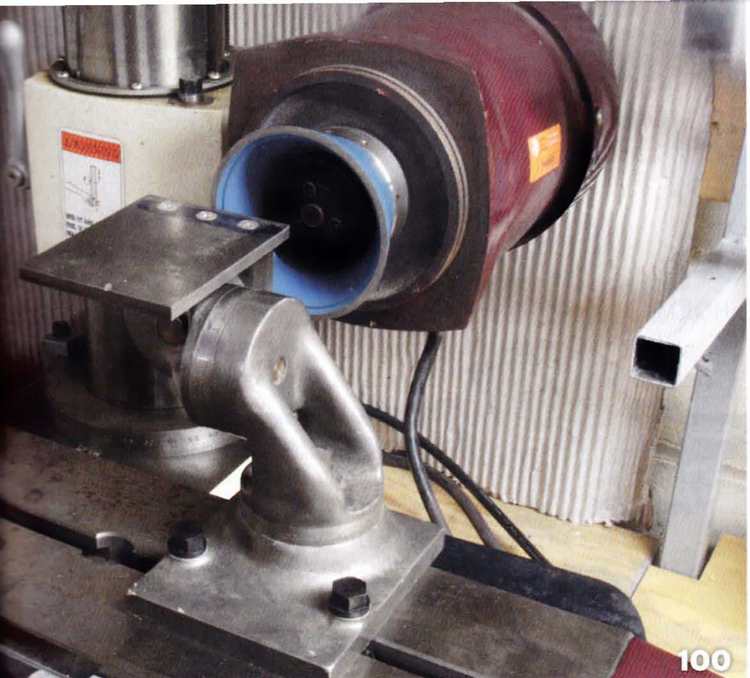
The short blade scrapers on display in Photo 96 are probably my favorites. I've made them with 1/8" thick carbide as well as 1/16", which is just the thing for tight places such as dovetails. As shown in Photo 97, the blades for these were tapered. I'm not sure if it's aesthetics or if it contributes to the blade having the right flex but it seems the right thing to do.

I've made one other style that is quite handy, shown in Photos 98 and 99. These are small and use very thin 16-gauge steel with a 5/16" × 1/4" × 3/32" piece of carbide. You could easily bend the blade in your hand, so they are not a robust tool. However, small dovetails can be very constricted and small scrapers are just what is needed.

RADIUSING THE BREAST

The end, or breast, of the scraper requires that a radius be put on it. There's no magic to this and Connelly suggests it is particular to the individual scraping hand. He suggests a 12"-18" radius, which is consistent with what I've seen on others and what I use myself – although I must confess I have not measured the actual radius.

Constructing the breast is a task that requires a diamond wheel. I use a diamond cup wheel for my bench-top tool and cutter grinder for this operation (Photo 100). It is a frustratingly expensive purchase for something that is only needed for creating the curve on the breast. Perhaps readers could outsource this operation to a friend with a diamond wheel. While it's



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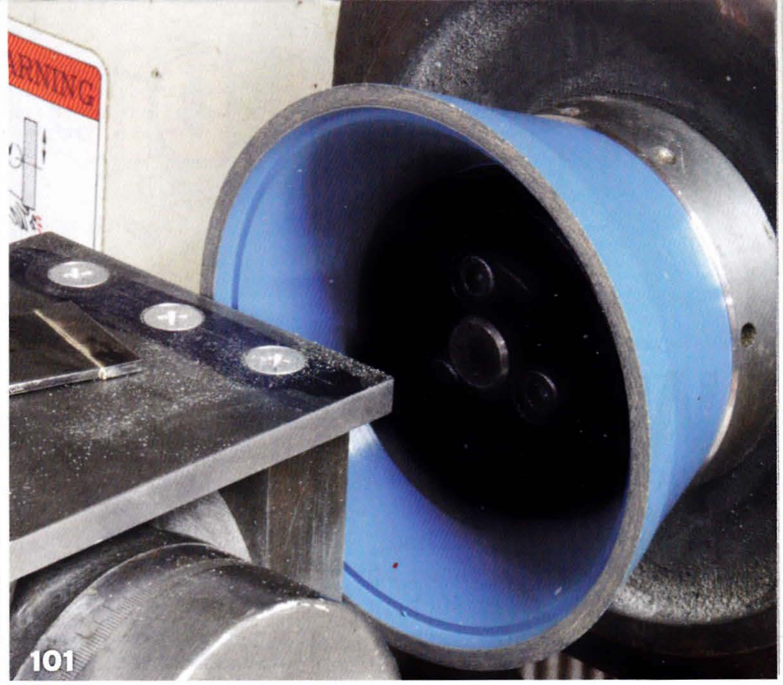

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quite an extravagance if only for scraping, the wheel will, of course, handle more than just scrapers.

The green silicon carbide wheels are too likely to chip the edge and we need a perfect edge for these tools. An alternative to purchasing a diamond wheel would be to use the coarse diamond stones mentioned earlier. Held against the edge of a bench, or something similar, working the scraper against the stone should put a radius on in a not entirely unreasonable length of time.

The other possibility is to use a rotary lap. While the lap is intended for fine finishing, I suppose it could be used for removing more material to create the radius. It will be slower than a diamond wheel, but will save on purchasing a wheel.

SAFETY ISSUES WHEN GRINDING CARBIDE

Be aware that the dust resulting from grinding carbide is hazardous. Cobalt is used as a binding agent and shouldn't be inhaled. I have no knowledge as to at what quantities it becomes dangerous, but where safety is concerned, erring on the side of caution is a good way to make up for ignorance. Longer term, my plan is to rig up a mist coolant system that should dramatically reduce the amount of airborne particles resulting from grinding.

I made a simple little rest to work with my bench-top tool and cutter grinder's homemade uni-vise (Photo 101). The cutting edge should have an included angle of close to 95°, although personal preference again enters into this, even though I may never scrape enough to develop such a preference!

Remember when I said one of the most difficult parts about scraping is getting an edge on a scraper? Well, we're not done yet. The ground surface is not near fine enough to make an effective scraping edge. In the next part of this series, we will start in on building a rotary lap to give our scraper the edge it needs.

Photos and drawing by Author