"WRABA Tips and Techniques"

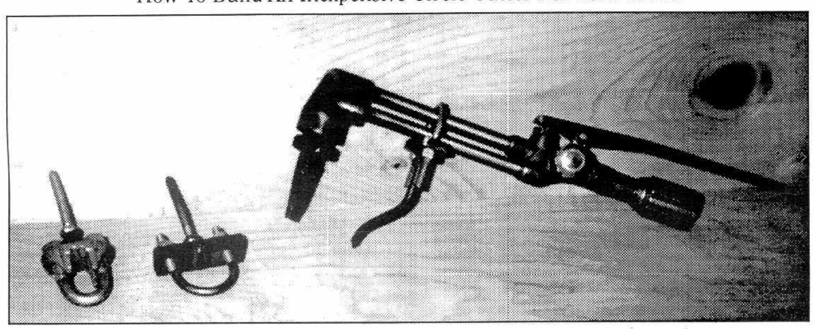
Issue 5
2010

This is a yearly collection of newsletter tips and techniques originally published in other affiliates newsletters

In Side This Issue!

TORCH CIRCLE CUTTER ATTACHMENT

How To Build An Inexpensive Circle Cutter For Your Torch



Try using this simple compass arrangement to clean up your fabrication! (See diagram on page 17.) No slides to get torch spatter on. No training wheels to go over slag and ruin your cut--just a pivot point to shoot from. Try it. You will probably find it makes your job easier. – Ralph J. Sproul Bear Hill Blacksmith

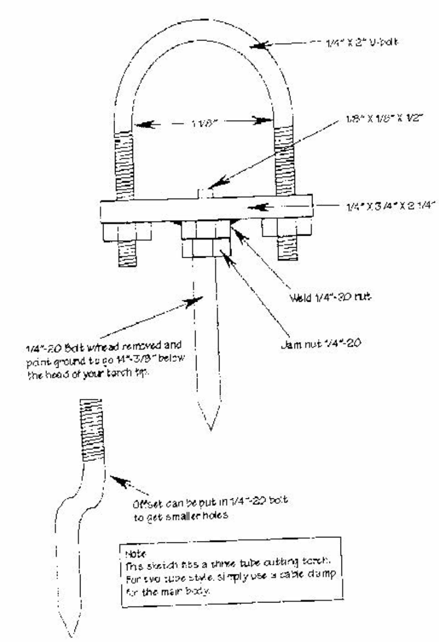
Sodium Bisulfate Pickle

–Information posted on the "TheForge" – My apologies to the author, I've somehow managed to expunge all ID's! (Editor)

I've been an advocate of using vinegar to pickle scale from steel. One downside to this is that vinegar is volatile, and the smell gets bad (metallic) with steel pickling inside. So, I finally got around to trying a sodium bisulfate pickle. Sodium bisulfate is availabe at pool supply stores for keeping the pH of pool water neutral. It comes as fine white crystals, packed in one- or two-quart containers. After some experimenation, I used about 1 to 2 cups per gallon of water. (I used a rectangular plastic storage box - available in NJ from Cost Cutters - as my vat.) The crystals go into solution fairly easily, producing no discernable heat on dissolving. (Strong acids produce lots of heat when mixed with water.) Much of the scale soaked off the steel within a couple hours. Some was more persistent, but came loose with overnight soaking. The resulting steel was nearly charcoal gray in color. Where it was not under the solution, the steel acquired a lovely rust patina - probably more from the humidity than anything else - but this largely sponged off. The scale did not completely dissolve. Much of it simply fell to the bottom of the vat. I plan to filter this off through a cloth when I transfer the acid solution to a jug for storage. I did this on my kitchen counter. There was virtually no odor.

Once or twice I splashed a little solution on my hands. I rinsed them soon after, and experienced no problems (acid burns). I DID wear glasses, however. I don't care to get this stuff in my eyes.

TORCH CIRCLE CUTTER DIAGRAM



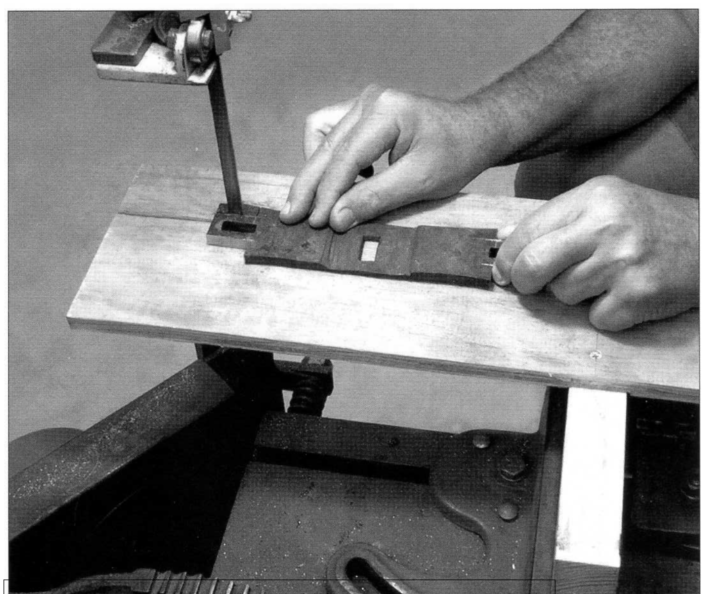
CHEAP TRICK FOR A METAL CUTTING BANDSAW

By: Tommy Ward

The blades on many horizontal bandsaws can be moved to a vertical position for freehand cutting, but operation in the vertical mode without some means of supporting the work can be difficult, with accuracy hard to achieve and a real possibility for broken blades and physical mayhem.

Like any other cutting tool, safe and effective operation of a bandsaw requires that the work be stable, well supported and properly aligned.

None of which are possible when balancing a piece of stock on the diminutive blade guide plate of a horizontal bandsaw. The obvious correction for this problem would be to equip the machine with an auxiliary work table, however most saws I've seen don't have one, and even when available the auxiliary tables are often dinky little things that are ill-suited to supporting long or heavy stock and require some effort to install.



Easily constructed auxiliary work table im-proves safety and accuracy when operating a horizontal band

A recent project required a number of accurate cuts to made in 3/8" flat bar, and necessitated that I devise a way to handle the work in a safe and comfortable manner. The solution I came up with is a table that is supported on one end by the saw's blade guide plate and held securely in place by the jaws of the vise.

The beauty of this set-up is in its utter simplicity of construction and installation.

The project can easily be constructed from two pieces of scrap wood , with the work surface constructed of 1/2" - 3/4" plywood, and a support crossmember made from "two by" stock. Make the table whatever size you'd like; the only critical dimension being to cut the sup-port cossmember to a height that will allow the table to lay level on the blade guide plate.

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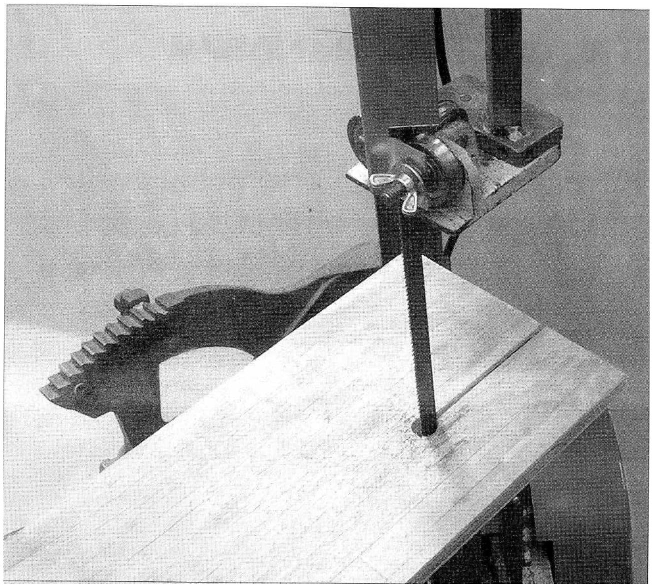

A thin kerf and clearance hole allow table to be quickly installed over the saw blade.

Cut a slit in the off end of the table to allow it to slide past the blade for installation and drill a clearance hole roughly the width of the blade where it passes through the table at the end of the slit. Then clamp the support crossmember in the saw's vise and mark its mounting location with the clearance hole properly positioned at the blade. I made a shallow dado cut across the bottom of the table and secured the support crossmember to it with carpenter's glue and a couple of flat head screws, but a simple butt joint would work too -just make sure the crossmember is square to the kerf of the saw blade.

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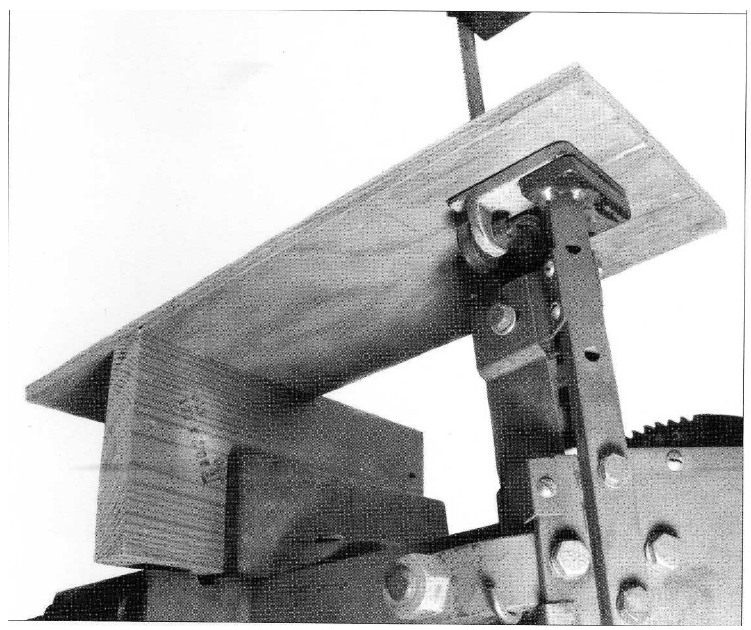
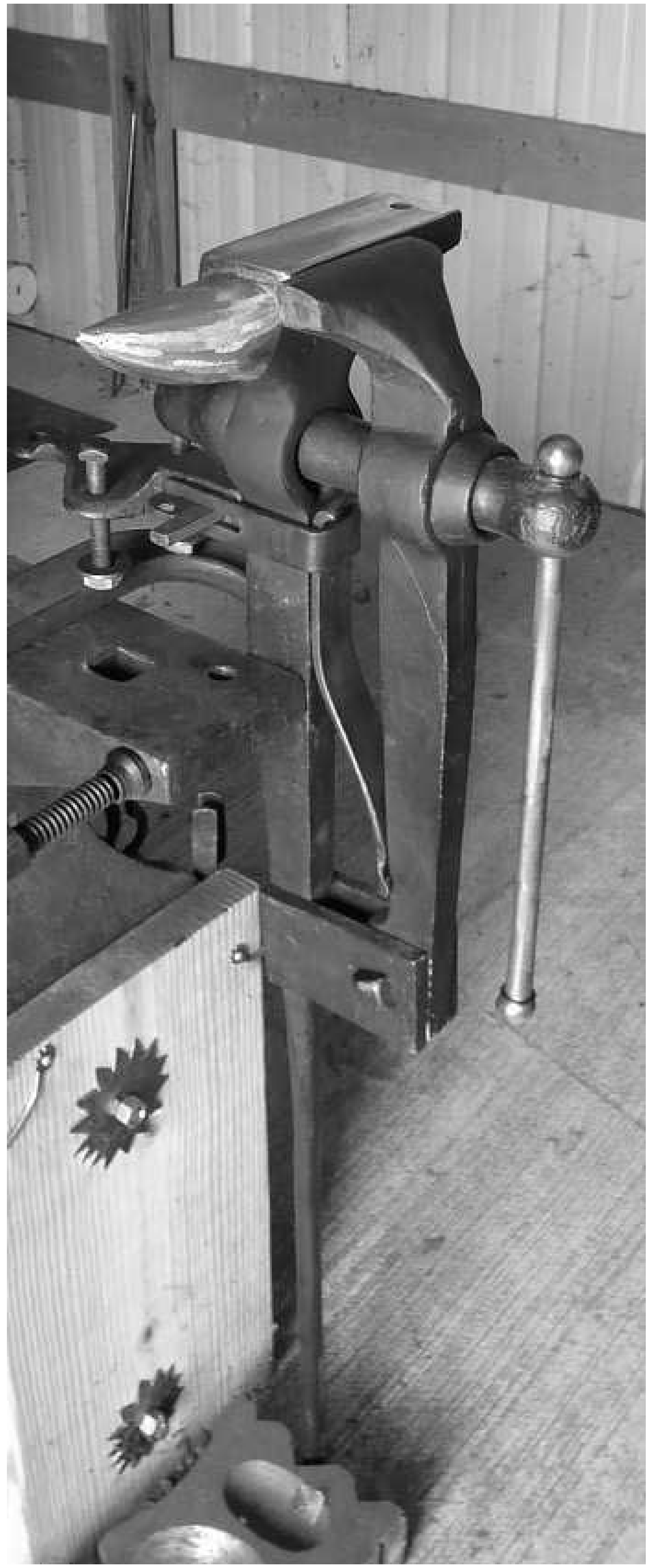
Installation is a snap - simply swing the blade assembly to vertical, slide the end of the table into position with the blade, and tighten the vise jaws against the support crossmember.



Underside view shows the auxiliary table supported by the saw's blade guide plate, with the mounting crossmember held firmly in place by the vise jaws.

Making the Jim Claar Anvil Vise

Michael Wollowski



Jim Claar made this kind of vise when he was asked to make 20 hooks for a pot rack. He wanted to be able to form the hooks under closer scrutiny than allowed by the low height of an anvil. A post vise provides the right height but not enough surface to work the hooks. To solve this problem, Jim modified a post vise by cutting off the rear jaw and welding in its stead a stake anvil. His design seems to be a natural progression of the post vise, extending its use to work where good clamping power enables the use of both hands to form metal. I found his design intriguing and decided to build one myself. On these pages, you will find Construction notes.

To begin, you need a post vise and a small anvil. A post vise with 4 ½" jaws seems to be just about the right size. While I would have liked to use a slightly larger anvil, I settled for a 25 pound anvil that is 11 ½" long and has a 3 7/8" wide face. Both were in pretty good shape. It takes some heart to cut up a perfectly fine tool, however, the end result is a tool that is far superior to each of the individual ones.

Cut off the rear jaws fairly close to the screw hole as seen in figures 2 and 3. This way, you can leave as much of the anvil as possible, giving you more mass. Cut the anvil so that its top aligns with the top of the front jaws. In order to ensure a strong weld, grind a ½" bevel in the front and rear of the anvil as well as the front and rear of the vise. See figures 2 and 3 for details. There is no need to cut a bevel on the heel and throat of the anvil as the bottom of the cut anvil and the top of the cut vise form quite a large cavity.

The welding was done by a local fabrication shop. I gave them the post and anvil and asked them to weld the anvil so that it is square to the post.

This was a mistake.

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As the post is forged and has a taper to it, it is hard to determine a good reference point for squareness. Instead, assemble the front jaws to the back post when dropping off the welding job, giving the welder the intended reference points. It pays to take some time to aligning the anvil to the post when first tack welding them. The more precise you align the anvil with the front jaw, the less grinding you will have to do.

Figure 2: Dry-fit anvil and leg showing the ground bevels

Figure 3: Cavity created by the anvil and vise top.
Figure 4 shows the weld between the anvil and the leg. As you can see, they did a fine job filling in the cavities. Next, clean up the welds and grind the sides of the anvil as well as its top so that it aligns with the front jaw.

Figure 4: Anvil welded to post.
Figure 5 shows that the left side of the jaw does not line up neatly with the side of the anvil, instead there is an overhang. While not intended, I imagine that this may come in handy when attempting to bend a piece over the horn, while holding it tightly in the vise.

Figure 5: Detail showing jaw overhang.
All in all, this was a neat project. I am anticipating years of back-saving use.

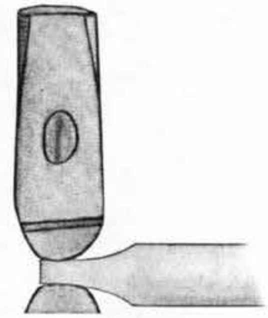
Fabricated Ball Stakes

Ball-end stakes for repousse' can be made using ball bearings and 1/4" x 1 1/2" flat stock. Ball bearings are brittle hard and you will need to anneal them by heating them to yellow in the forge. Un-annealed, the ball can crack on the "ball side" of the weld. To anneal the ball bearings heat a scrap of plate (3/16" or 1/4" thick) and pound a pocket into it. Set the ball bearings to be annealed into the pocket in the plate and place it all in the fire. Raise the heat slowly (to bright yellow), so as not to burn through the plate, and anneal the ball bearings.

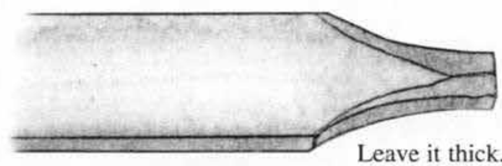
While the ball bearings cool slowly, use a top and bottom swage to forge necks on the ends of as many 4" to 6" pieces of the flat stock as there are ball bearings. Swage the end of each bar down to about 3/8" square. Do not draw-out the thickening of the neck. Instead, leave it thick so it has some strength. Bevel the end of the swaged neck for electric joinery (welding).

When setting up to weld, use whatever thickness of metal that is necessary to shim the centerline of the swaged stake so it is level and even with the centerline of the ball bearing.

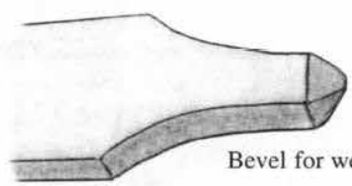
After they are welded it is a good idea to raise a heat (yellow) on the neck, weld and ball end of the stake to relieve any stress imparted by welding. Allow the finished, normalized stakes to cool slowly.



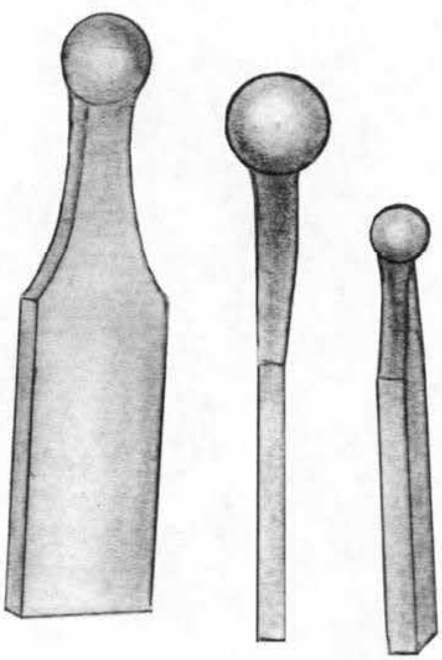
Swage the end.

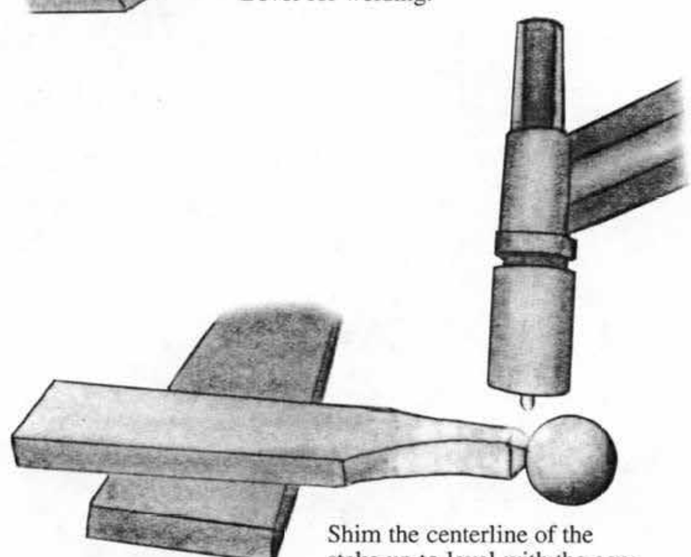


Leave it thick.



Bevel for welding.





Shim the centerline of the stake up to level with the centerline of the ball bearing.

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Just A Horse-Shoe

Anvil's Chorus - Fall 2005

Messing around with a horseshoe makes a great demo for me. (And they have a hard time asking 'what you makin'"). I complete the job in 15 minutes, and don't have to pound my heart out. Also it's hard to mess up

Start taking a heat about 2" at one end – use the horn to put a step to form the muzzle.

You should get the nostril punched and mouth split with this heat. (remember to use a cut plate to spare your anvil).

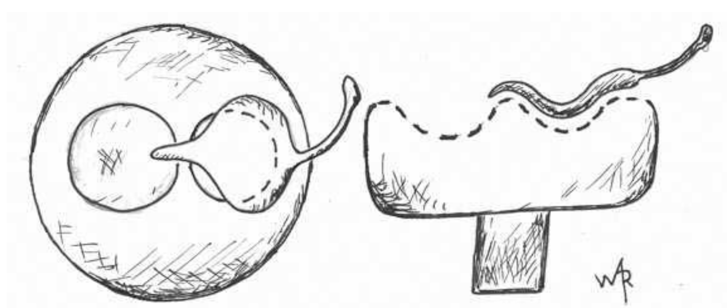
Now the back of head. Cheak first use the flat of the hammer to draw the inside down to make the cheek. Punch the eye and hot cut the ear. Push the ear slightly forward.

When punching eye and nostril make sure that you are close enough to the edge to push out a bump.

Now the mane. Cross peen time. Start at the shoe crease and work outwards to almost a sharp edge

All that remains is putting a hook on the bottom. You will need to straighten the remaining half of the shoe first. I like a "Z" bend. It kinda looks like a hoof and has a smooth hook to not mess up clothes you hang.

Tip of the Month:
This is a clever leaf jig, made out of mild steel, invented by Juan Holbrook and demonstrated at this past April NW region statewide meeting. It cups (daps) a forged leaf, rolls out the edges and curls the tip all in one step. It also accommodates two sizes of leaves. It is made by simply sinking two different size ball pein hammers (ball end) into a thick piece of steel and attaching a hardy shank. Very nice, Juan!



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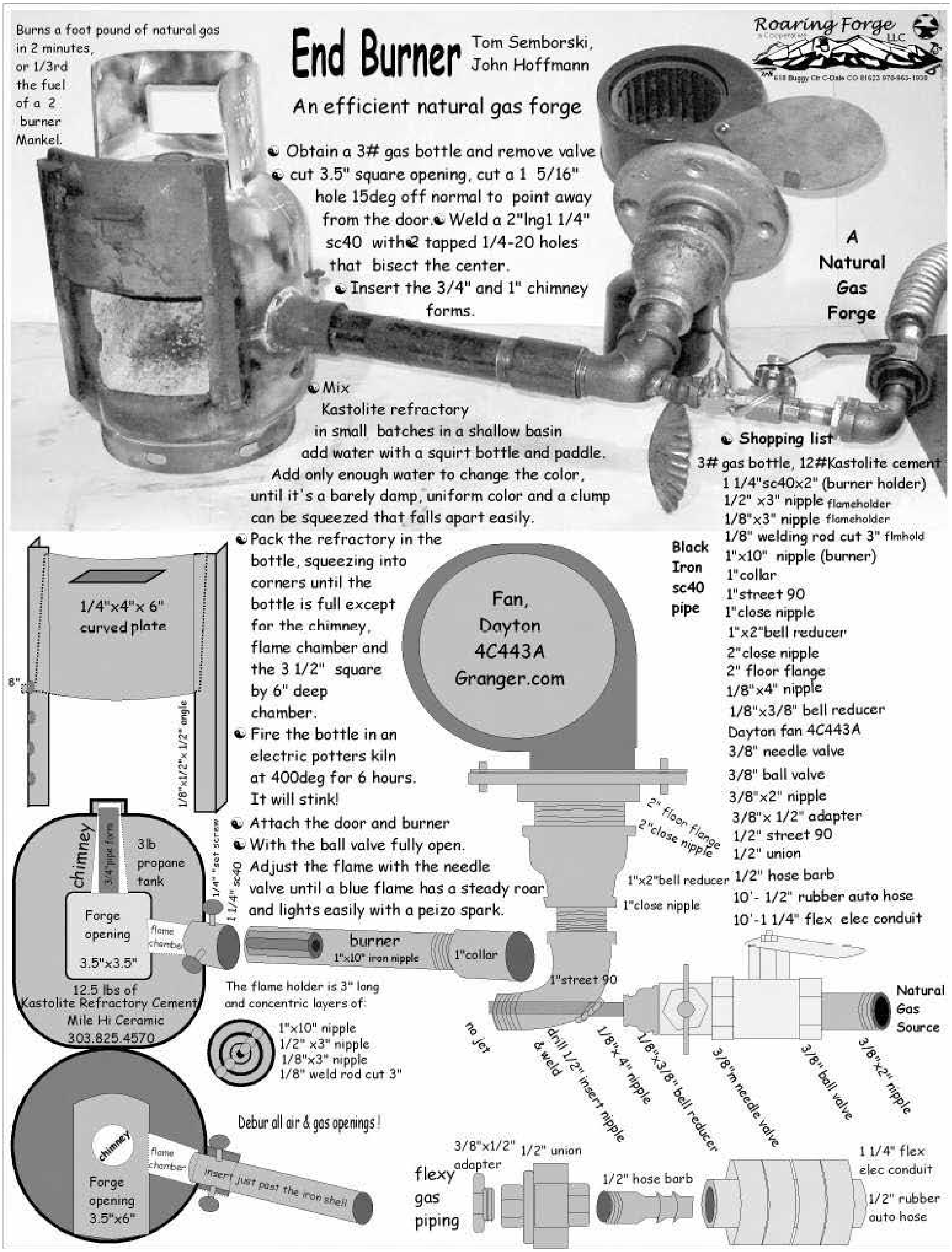
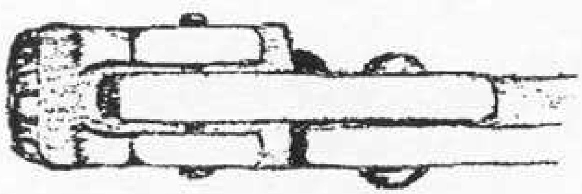


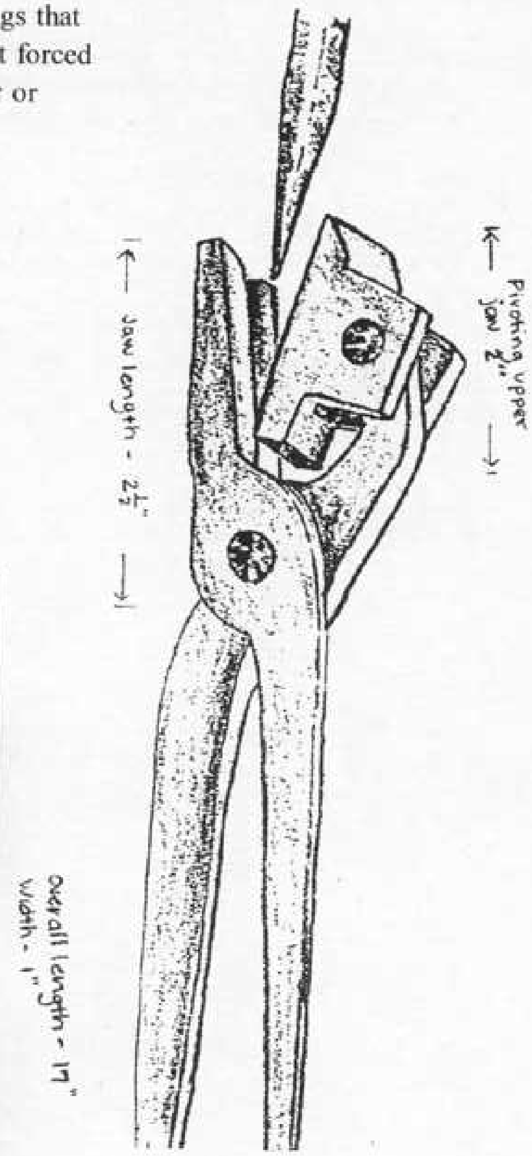
Ray Neubrand's Adjustable Tongs

Reprinted from the Pittsburg Area Artist Blacksmith's newsletter, February 1990
via *The Upsetter*, newsletter of the Michigan Artist Blacksmith's Association, March-April 2006

Ray made these tongs with an upper jaw that pivots enough to the shape of tapered work. The lower jaw has a groove running up the middle. These two features combine to produce a pair of tongs that dependably grip work on the taper itself. This way Ray is not forced to use a pair of tongs that will grip the work above the taper or struggle with a wobbly grasp of the taper.

Top View





The pictures below are of a pair of tongs bought at auction in Iowa! I find them very useful in holding odd, tapered or thin material. -Steven Spoerre

Authors, Holmstrom and Holford describe two more versions of adjustable tongs on page 38-41 in the "Twentieth Century Toolsmith and Steelworker" section of their book *American Blacksmithing*. ISBN 0-517-390485

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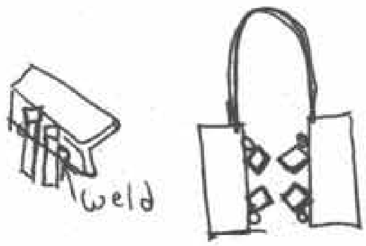
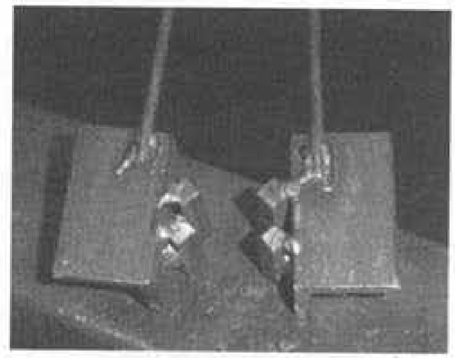
Shop Tip

By Don Nichols

Tool for Holding 1/2" or 5/8" Sq. or Rd.



Finished Tool



4 pcs. 3/8" Sq. 2" Long

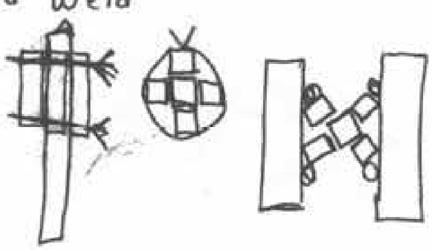
2 pcs. 1 1/2" x 1/4" Angle 3" Long

1 pc. 1/4" Rd 12" Long

Weld 3/8" Sq To Angle on Edge 2 on Each piece of Angle

Weld 1/4" Rd on after Bending in a loop this is to Hold them Together as you put it in Vice

to weld put 4 pcs around 3/8" sq with wire to hold Then Lightly Clamp Angle & sq in vice tie wire Close to Ends And weld



This gives you surfaces on 4 Sides as you Clamp in the vice

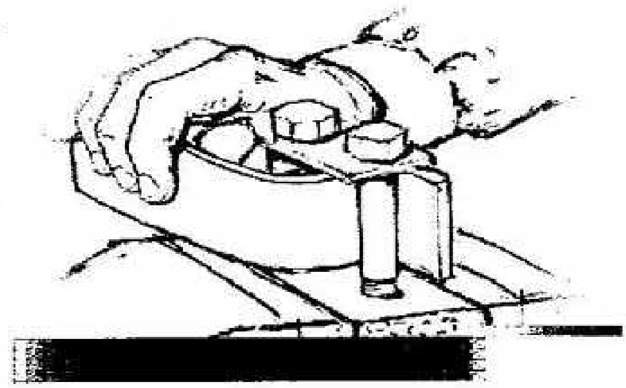
Simple Bending Jig - David W Wilson

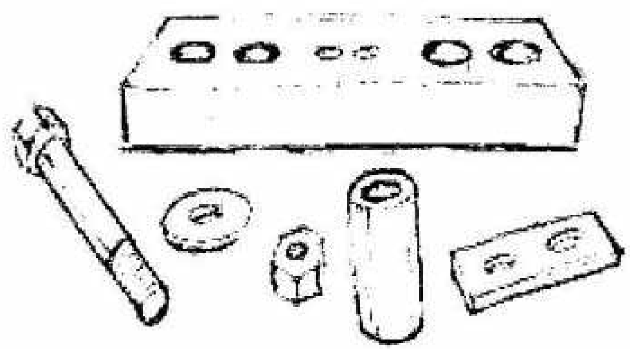
A simple bending jig may be assembled with common materials. The capacity would be determined by the strength of materials and user.

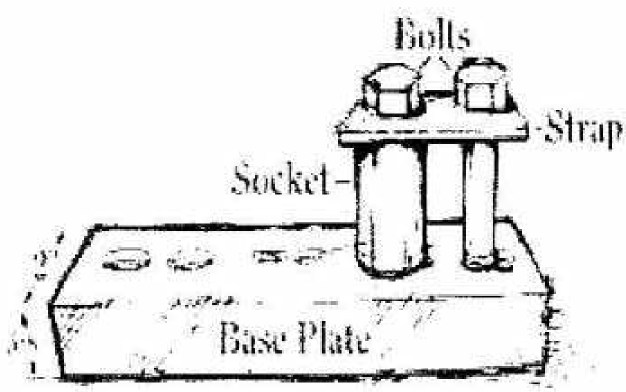
A thick steel plate and large bolts will handle heavier bending. However, a plywood base may be used for lighter bends. The steel plate base is easily assembled if the holes are threaded. But bolts and nuts will also work if held top and bottom through drilled holes in the plate. Various sized sockets from a socket wrench set adjust the radius of the bend. A metal strap may be used to hold the socket in place, and to help keep the bolts from twisting. Smooth bolts and sockets are preferable to threaded rods for the threads will damage the work piece. This type of jig can be held in a vise, or bolted to a work table. A large flat surface around it can help keep the bends flat.

The distance for the work piece between the bolts and/or socket should be snug to keep it from slipping. Several holes drilled into the base at various distances facilitate making numerous radius bends.

"S" type bends are easily bent with this jig. A long rod will help give leverage for several S's. They may be bent by: 1. Inserting the end of the rod and bending the top part of the "S" 2. Work this bend back through the jig reversed, then bend the bottom of the "S". Cut hook from section of rod, repeat. Scrolls are also easily bent by gradually working the work piece around a bolt or socket. For repeated work, it's best to match it to a master shape.







This page was created by David W. Wilson

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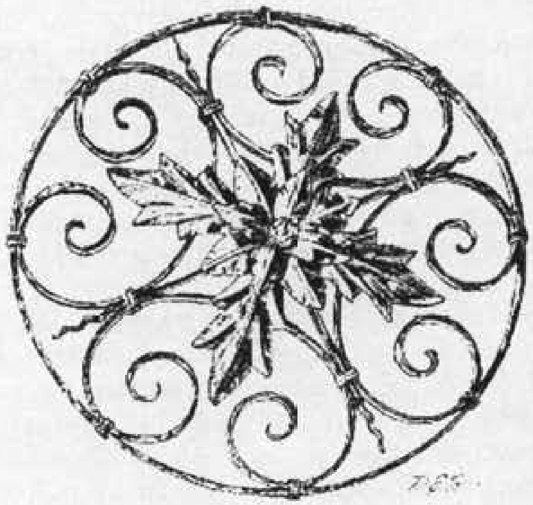
New Jersey Blacksmiths Newsletter



Forging for a Living

the methods and tools of

Ray Spiller

article and illustrations by
Dave Smucker

Part I

Ray Spiller was one of the featured demonstrators last fall at the Alabama Forge Council's Tannehill Conference. In this two-part article, I will cover some of the methods and tools that Ray showed during his two demonstration sessions.

Ray Spiller lives and works in the Nashville, TN area and, as I say in the title of this article, does "Forging for a Living". During his demonstrations, Ray shared not only his approach to blacksmithing, his methods and tools but also how he approaches the business side. In this article, we will include aspects from all of these areas.

Being in Business. Early in his career Ray, like many other blacksmiths, worked the "craft fair" circuit but then moved on to doing mostly architectural ironwork. In making this move, he is primarily a sub-contractor to major Architectural and Structural Iron Work Contractors in the Nashville area. Ray said that he has about 4 structural steel folks that he regularly works with and sells to "wholesale". These firms take Ray's work, add their mark up to it, and include it with other work they are providing for a given job. Generally, these firms do the sales side, customer interface and installation work. In other words, Ray doesn't spend any time or money on marketing or sales nor have to estimate his time for the installation.

This "wholesale work" accounts for between 2/3 and 3/4 of Ray's work. The remaining part is direct retail work that comes from customers that may already have some of Ray's pieces in their ironwork or are referred to Ray because the major Architectural and Structural Iron Work Contractors don't want to deal with the small size or type of work. Again, this means that Ray doesn't spend much time on marketing or sales for this type of referral work.

At this point, you may have the same basic question that I had – why would the Architectural and Structural Iron Work Contractors go to Ray for work if they are already doing that type of work in their own shops? Well, it turns out that, for the most part it is because Ray does the type of specialized architectural work that they really don't like to do or don't really know how to do well. Leading this list is scroll work and work with specialized architectural elements such as the one shown on the cover and lead to this article. Ray also does many of the "curved" stairways in the Nashville area.

Even with all of this, Ray has to be very competitive on his work or it will go elsewhere. After all, the contractors are bidding on these jobs and the contractors are not going to give Ray the work because they like him – but because he can deliver good work at a cost-effective price that allows them to get the overall successful bid on the job. To do this cost-effective quality work Ray has developed his own personal methods and tools.z

Working Safe. Safety is critical to all of us but if you work by yourself and make a living with the work of your hands, safety is all-important. If you injure yourself and can't work the work isn't done and you aren't paid. Ray's comments on safety include that he wears ear-plugs, safety glasses and almost always wears gloves. Ray uses exclusively a propane forge for heating his metal and has found gloves important for his work. In many cases he works many multiple pieces at one time and the gloves let him handle stock that may be hotter overall than many of us are used too.

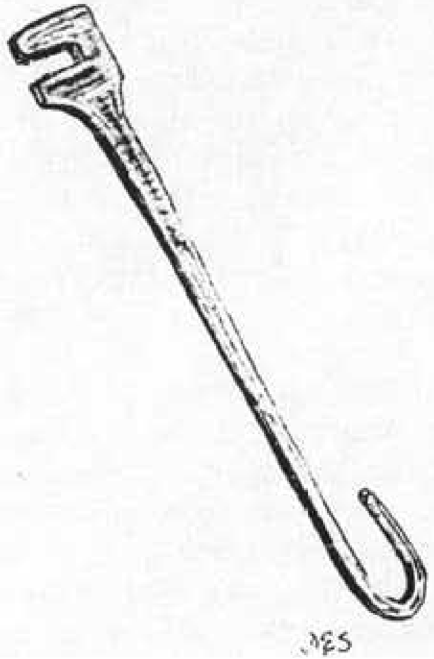
For safety glasses, he likes to use didymium lenses that allow him to look at the forge and hot metal all day long without eyestrain. They also provide the protection of safety glasses.

Ray is right handed – and likes to have the anvil horn pointed to the right, when facing the anvil. This allows him to work with the hardie hole to the left and any hardie tools out of his way. Still I did not see him ever leave a hot cut in the hardie – where he might run into it.

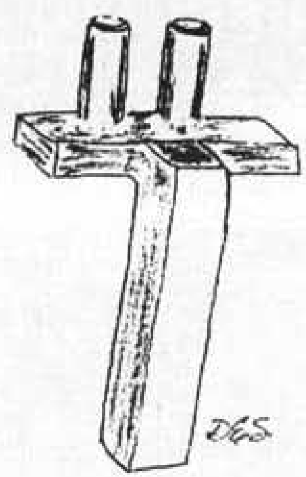
Making Scrolls. Ok let's look at Ray's methods for making scrolls – many scrolls.

To start you have to have a "plan". In other words, you need to have a master scroll you are going to work from or you need to generate a full size drawing you can use to be your master scroll.

Scrolls, of course, can be made 100 percent by forming on the anvil with a hammer. Alternatively, they can be started on the anvil and finished with bending forks. However, if you are going to make very many scrolls and you want them all to be of the same size, then there is great aid in making a scroll jig. If you have never made any scrolls – then I suggest that you first do some basic practice work to get a feel for the process and then make a scrolling jig.



To make scrolls in almost any form you will need to make several bending forks. It is also extremely helpful to have a stationary fork that you can either use in your hardie hole or hold in the vise. Ray has a number of forks – made from leaf springs like the one shown. To make these you can anneal the spring stock, then saw out the fork slot followed by carefully rounding the slot edges with files and emery cloth. Ray notes that it is very important that the faces of the slot be parallel. If not you will have great problems bending with the fork and make corkscrews rather than scrolls. Draw out the remaining portion and form a return loop as part of the handle. Ray likes to use a set of forks with one loop pointed up as shown and one loop pointed down. This allows you to pass the handles of the forks by each other as you work.

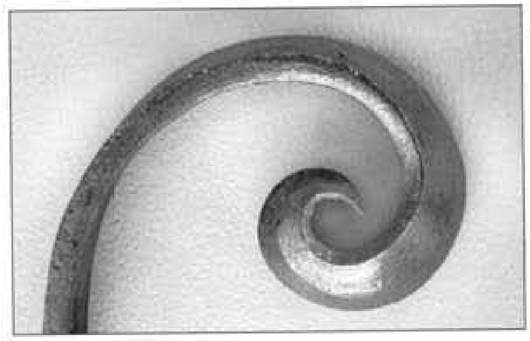


Here is Ray's version of a fixed fork for mounting in your hardie hole or vise. It has two round pins welded to a flat bar and the hardie tang (stem) welded on the side of the bar. A good material to make the pins from is the unthreaded portion of a grade 5 or grade 8 bolts. This is a higher strength and tougher steel than using just mild steel for your pins. Work to keep those pins parallel so that you don't have the corkscrew problem with this tool too.

Ray does an interesting thing with many of his hardie tools. He welds the tang or stem on the side of his tool base rather than on the bottom. This does two things – it means you don't have to grind the weld to have it sit flat on the anvil and it also means that for a lot of tools you don't have the problem of them falling through the gap when used in the vise.

The Beveled Scroll

by Mark Aspery, Springville, California



This scroll is the sister to the blown over beveled leaf scroll. The techniques are very similar.

To start, draw a slightly round taper of at least 2" on the end of the bar. Bring the end down to a sharp point, **Steps 1A through 1C.**

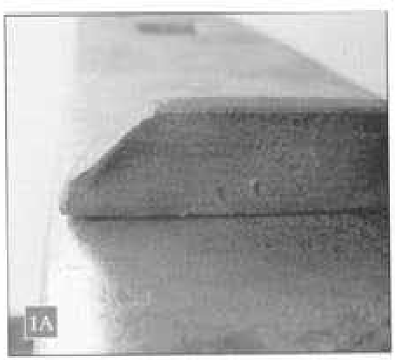
The next step will dictate the shape and size of the finished scroll. Turning the bar on edge, turn a scroll on the end of the bar. I like to start a bit back from the end.

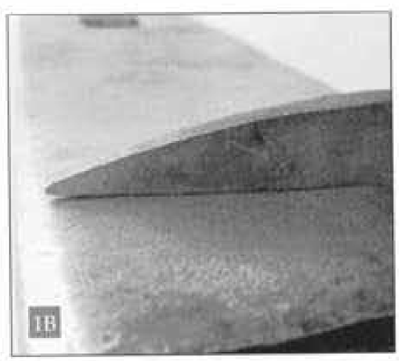
Bend as much as you can from the top and then place the bar underneath the bick and bend the majority of what is left. I like the scroll to make about one complete turn through 360°, **Steps 2A through 2C.** The result of working on the bick is shown in **Step 2D.**

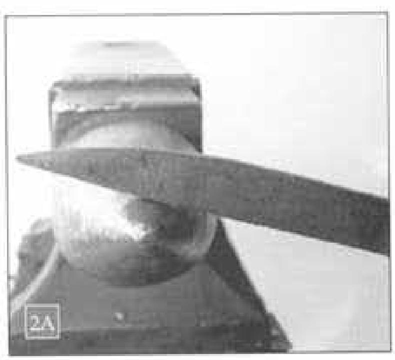
Getting to the very end of the scroll can be difficult. In order to get to the end, you will have to knock the end out of alignment. Take **Step 2E** and finish scrolling, using your hand hammer on the face of the anvil.

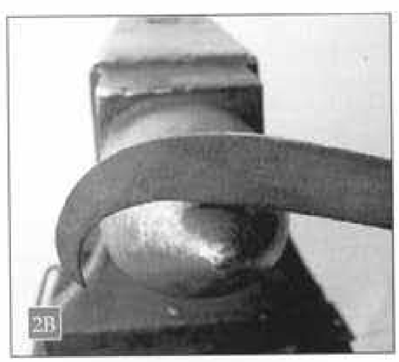
Once the scroll is formed, edgeways on the bar, decide whether this will be a left or right-handed scroll. This type of scroll has a front and a back, making it one-sided visually. When you lay it on the anvil face to be beveled, if the bar scrolls to the right, it will produce a right-facing scroll, and of course vice versa, **Step 2F.**

At this stage bevel the edges. The inside edge will receive most attention visually and so requires a little more effort than the outside edge.









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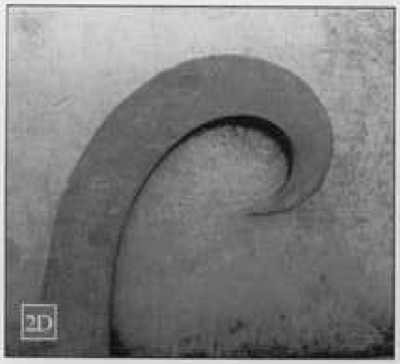
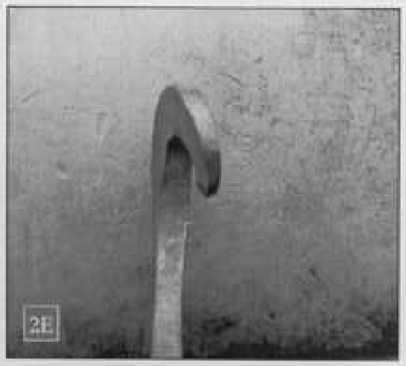
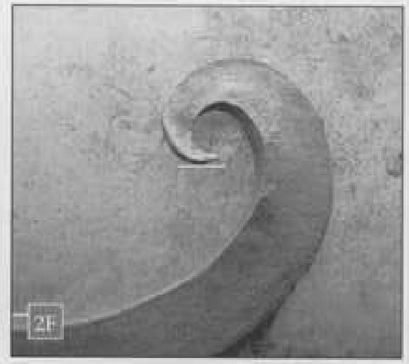






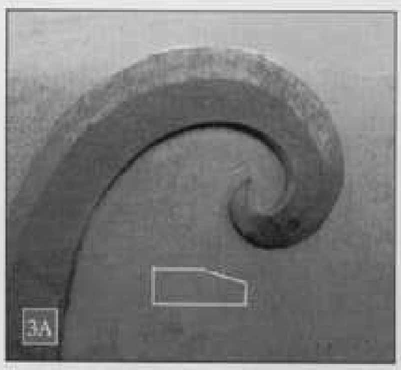
When you bevel the inside edge, the scroll will open; when you bevel the outside edge, it will close the scroll, making it tighter.

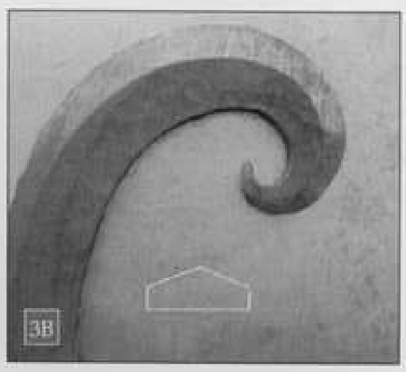
I like to have the chamfers meet in the middle of the bar for the first couple of inches, **Steps 3A and 3B.**

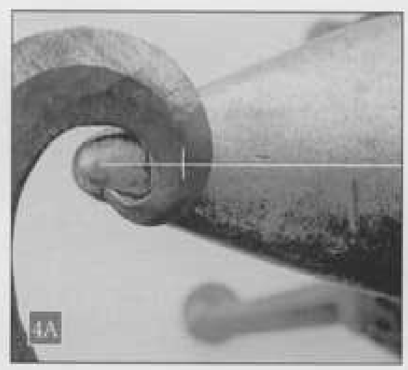
After the chamfers are complete, the scroll must now be turned 90° to the parent bar.

And now to the scrolling part: in order to better understand how to turn this type of scroll, get a piece of cardboard (a breakfast cereal box will do nicely) and draw the outline of your forged scroll on the cardboard. Cut out the cardboard scroll with scissors.

Holding the cardboard in one hand between the thumb and forefinger, start at the end and make a bend 90° to the centerline of the scroll. Feed about ¼" out and do the same thing. Continue along the entire scroll. You should find that the scroll end has made a slow 90° turn and is now resting in line with the rest of the scroll. That knowledge helps you when you go to the anvil. You could turn these scrolls off the side of the face of the anvil if you didn't need some clearance for the turning end. As such, we turn these scrolls on the end of the bick as it allows us the clearance that we need for turning the scroll, **Steps 4A through 4D.** ♣

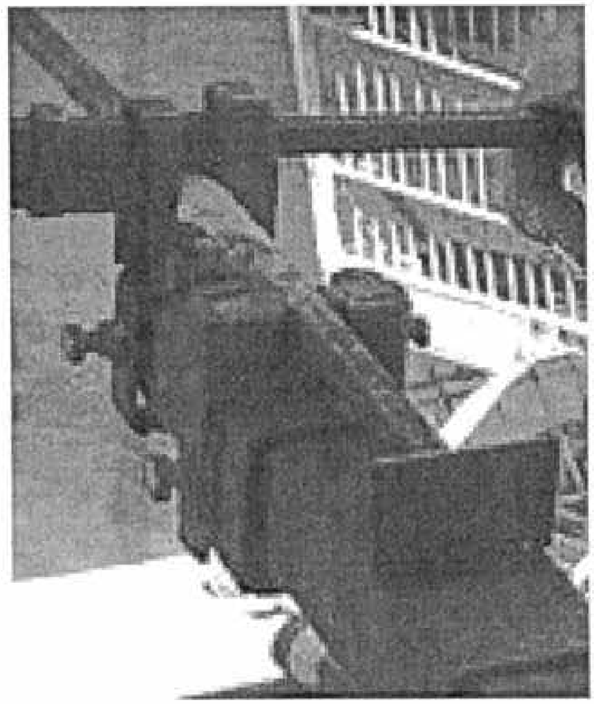






DONNY COVALT'S TWISTING JIG

By: Marty Lyon



A railing project requiring many pickets with identical twists inspired Donny Covalt to design this twisting jig. This jig makes it simple to accurately position a twisted section, or sections, within a piece of stock.

Figure 1 shows the five parts of the jig. Donny built his from scrap. There is nothing critical about the materials used or the dimensions. I will give you the dimensions of the materials he used but you can use what is convenient for you. The rail is a 3' piece of 2" thin-walled square tubing. The tool rest, support holder, and stop are built upon 2.5" thin-walled square tubing and these three pieces can slide along the rail. Each of these three parts is tapped for a 7/16" bolt so they can be secured to the rail once positioned.

The tool rest has a flat piece of sheet material welded to the 2.5" tubing. A cutout in the sheet material is sized so that the largest piece of stock to be used with the jig will pass through. The stop is very similar to the tool rest except it has no cutout.

The stock support is the only critical piece. Donny's are made from 5/8" by 1 1/4" steel. The width of the notch, on top, corresponds to one dimension of the stock. A separate stock support is required for each different stock size. I would suggest you make a minimum of three (1/4", 3/8", and 1/2" notch width). This top notch should be cut accurately so that the stock will fit into, but will not twist in, the notch. The depth of the notch should be at least as great as the width, but is not as critical. Note, there is a second notch; this one is in the side of the stock support. This notch receives the end of a 1/4" bolt from the support holder that secures the stock support to the support holder.

The support holder is made up of several parts welded to the 2.5" tubing. These parts form a channel for the stock support. It also must be threaded for the 1/4" and 7/16" bolts.

Figure 2 show the jig in use with a modified monkey wrench twisting tool. Position the tool rest at the end of the rail. Position the support holder so that the length of the twist is established by the space between the left end (according to Figure 2) of the stock support and the left side of the tool rest. The distance between the left end of the stock support and the left side of the stop sets the length of the untwisted section. It is important that the jaws of the twisting tool maintain contact with the tool rest. You can use this jig to make multiple twisted sections in the same piece of stock.

There are still two things you have to do to get a successful twist: heat the metal properly and count those turns of the twisting tool.

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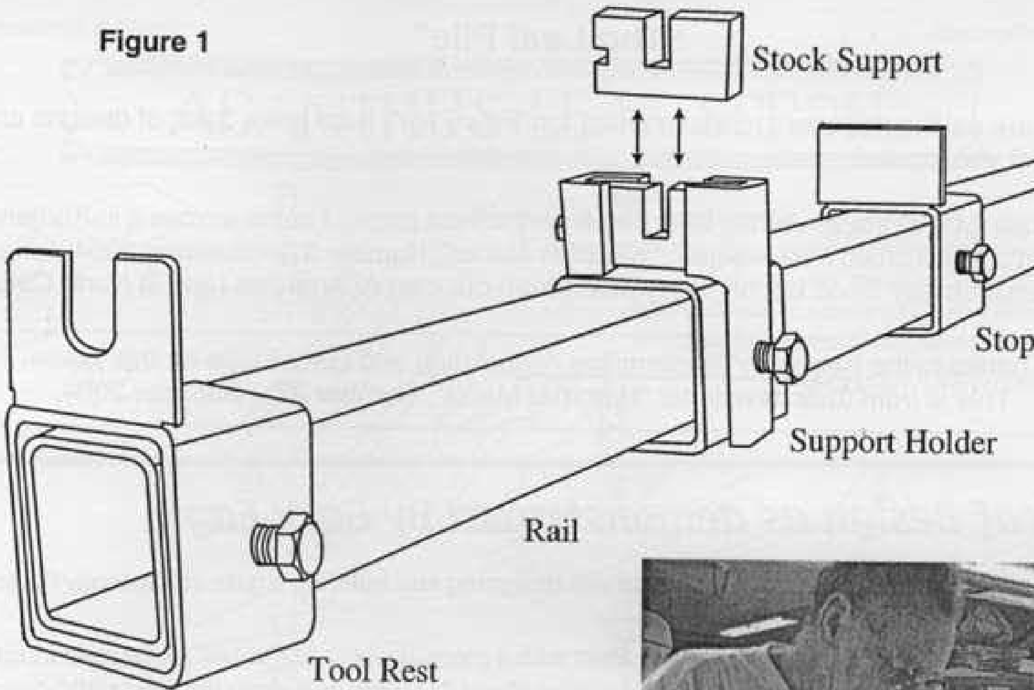
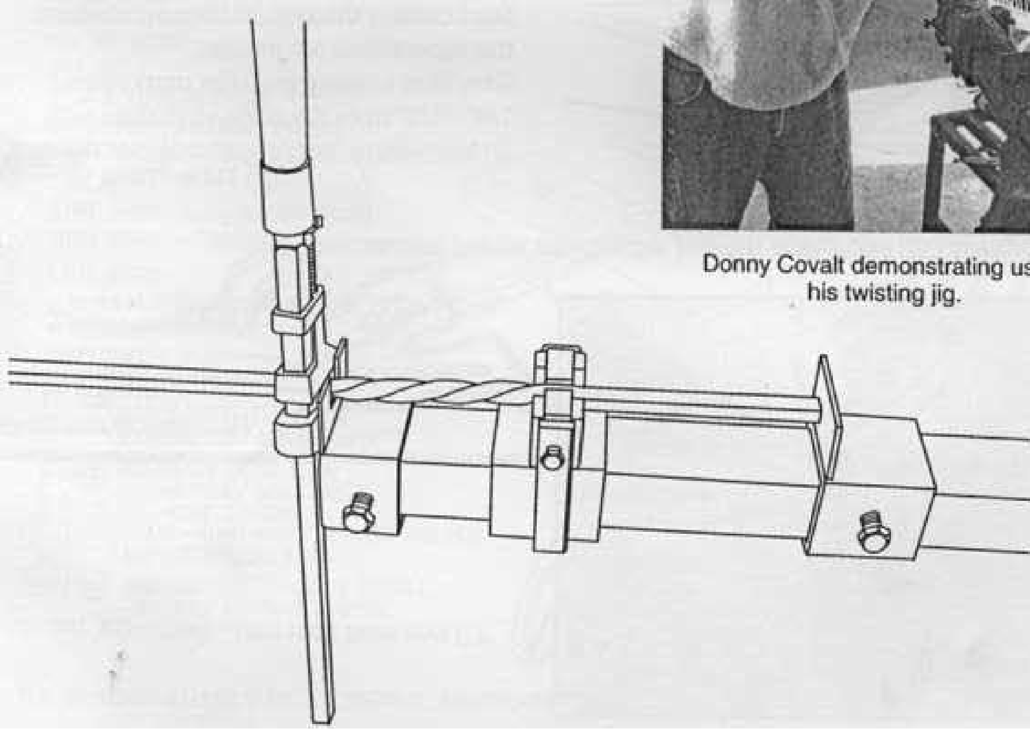
Figure 1



Donny Covalt demonstrating using his twisting jig.

Figure 2



BELT GRINDER DESIGN & CONSTRUCTION

By Otto Bluntzer-
Genesee Forge

THIS ARTICLE With a keen interest in designing, building and making things work and at the request of several members of the Genesee Forge, this article describing an approach to building a "Belt Grinder," comes about. Some of you are aware that my primary interest is that of "Bladesmithing" not to lessen the rewards derived from forging articles as fashioned by our current and Ancestral Smiths. On October 15th 2001 I began a very beneficial class at the **American Bladesmith School** in Washington, Arkansas called, "Intro to Bladesmithing". At this two week class I had repeatedly made use of **"Bader Grinders"** and became very comfortable with how they functioned. Prior to this I had converted a **"Craftsman"** belt grinder by adding a third pulley to allow for "Slack Belt Grinding". This third wheel had a rubber boot to allow a smoother grind. The modification proved useful, but the overall machine had serious limitations. Soon thereafter an opportunity to visit **"Centaur Forge"** in Burlington, Wisconsin resulted in the purchase of an **"Ickler Grinder"**. This machine has only a cushioned contact wheel driven by a 1/2 HP AC motor and an idler wheel which also serves as the belt tracking mechanism. A good machine, it too needed a heavier motor.

RATIONALE Several reasons for constructing my own grinder were: (1) The need to make use of many grinding techniques, (2) Cost, and (3) The need to select different sizes of contact wheels. In order to execute this project it would be necessary to have what might represent more than average shop tools. It should also be mentioned that many articles and several books written by Wayne Goddard provided ideas of importance in the initial design phase.

PREPARATION Over a period of many months, sketches, drawings and a number of CADD designs made me feel comfortable that the necessary information was in place. A collection of metal stock earmarked for the different assemblies then proceeded. Along the way I had come into possession of a metal lathe & mill which made possible the construction of pulleys and other parts.

SPECIFICATIONS The Grinder must make use of: 2" X 72" belts, A 110V. DC Motor rated at 1.5 HP minimum, A belt speed, SFM (Surface Feet per Minute capable of reaching a maximum of 3,500 SFM, Speed to be adjusted by either a touch pad or potentiometer, Contact wheels to be easily and rapidly changed, and finally it was determined that parts of the machine were assembled in a manner allowing for removal and modification if that became necessary.

MATERIALS ON HAND Cost of all materials purchased were under $50.00 due to availability of parts which came from a commercial grade Treadmill. The Baldor 1.5 HP DC Motor, the motor rectifier and control panel, and most of metal stock came from the same treadmill. All ball bearing assemblies came from similar machines. Basically the only cost was that of aluminum stock purchased from surplus and for a 5/8" high quality drill bit needed to bore holes in the pulleys. A small amount of bar stock was purchased.

WHERE TO BEGIN As sketches were being made it was realized that the project could not be completed if the necessary materials or tools to shape these materials were not in hand. An inventory of materials collected, the quantity and size of materials was made. Page 12 begins with the materials list. On page 12 is a list of tools used.

MATERIALS LIST

Item	Size/Ouanfity/Amount
(1) Base Plate	1/4" T X 12" W X 19" L (has a 2" lip at 90 degree angle on one end)
(2) Upright Support	Shaped with Plasma Cutter from a 1/8" X 18" X 14-1/2" Plate.
(3) Drive Pulley on Motor	Aluminum billet, 5-1/4" D X 3" W. (5/8" bored for motor shaft)
(4) Idler or Tracking Pulley	Aluminum billet, 4/1/2" D X 3" W. (5/8" bored for 6" L idler shaft)
(5) Idler Shaft	5/8" D X 6" L (Mild steel OK if ball bearings are used)
(6) Mounting Brackets	For Contact Wheel Arms - 1" X 1" Angle Iron. 3 Foot needed
(7) Contact Wheel Arms	1" X 1" Square Stock - 8 Foot required (needed for other parts also)
(8) Contact Wheels	
(A) 8" D X 2" W	Made of a Rubber Wheel taken from industrial size Cart.
(B) 3/4" D X 2-1/2"	Made from a Steel Tube, incorporates two small ball bearing assemblies)
(C) 2-1/4" X 2" W	Made of two Rubber Rollers with Bearings mounted side by side on shaft
(D) 14" X 2" W	Same as in item "D" (Neither of these last two wheels are easily balanced)
(E) Flat Platen	(Not yet built as the Ickler grinder is used in place of until completion)
(9) Belt Tensioner Lever	1/4" X 3/4" Stock, 18" L (Forged to shape as will be shown)
(10) 15", Additional Stock	Same as above 1/4" X 3/4" (Used for tracking mechanism & brace)
(11) 1.5 HP. DC Motor	Baldor - Commercial application use
(12) Controller Assembly	Includes rectifier and digital touch panel (Taking from Trotter Tread Mill)
(13) Ball Bearings	Matched Pairs for Contact Wheels (Size determined by application)
(14) Valve Spring	From B & S or Tecumseh 3-1/2 HP to 6 HP (for tracking mechanism)
(15) Bolts & Nuts	2- Head Bolts from B & S or Tecumseh engine for locking mechanisms)
(16) Bolts & Nuts	Generous Assortment of 1/4 X 20. (Used for assembling parts)
(17) Round Rod	1/4" X 6" L for making three, T - handles for item above.
(18) 3/8" X 1-1/2" X 6"	Stock to be drilled, tapped and welded to Contact Arm Brackets

TOOLS USED

(1) Metal Lathe	Extensively used for turning and boring Idler and Drive wheels.
(2) Metal Band Saw	Extensively used for cutting stock to desired length.
(3) MIG Welder	Used for welding up brackets and small parts as needed
(4) Bench Drill Press	Used for drilling holes prior to assembly of frame.
(5) Hand Drill	Used for drilling holes after basic metal frame is completed.
(6) Bench Grinder	Used periodically for bringing parts to rough tolerance.
(7) Belt Grinder	Frequently used for creating smooth operating surfaces.
(8) Angle Grinder	Used to touch up edges of frame and parts assembled to frame.
(9) Forge, Anvil etc.	Used to shape handle used for installation & removal of belts.
(10) Bench Vise	Useful when draw filing.
(11) Tap & Die Set	Used at locations indicated on drawings.
(12) Dial Calipers	Frequently used for general as well as lathe work.
(13) General Tools	Commonly used for basic metal work.

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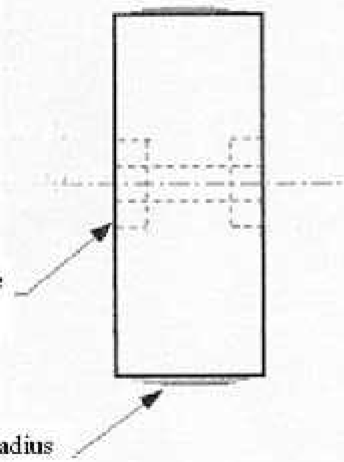
(4) IDLER or TRACKING PULLEY

This pulley can be the same diameter and width as the drive pulley described in step # 3. Ball bearing assemblies are included for free rotation on a fixed shaft. The face of the "Idler Pulley" must have a slight crown such as a typical balloontire, but not as pronounced. The crown is 1/6", although 1/8" might be better

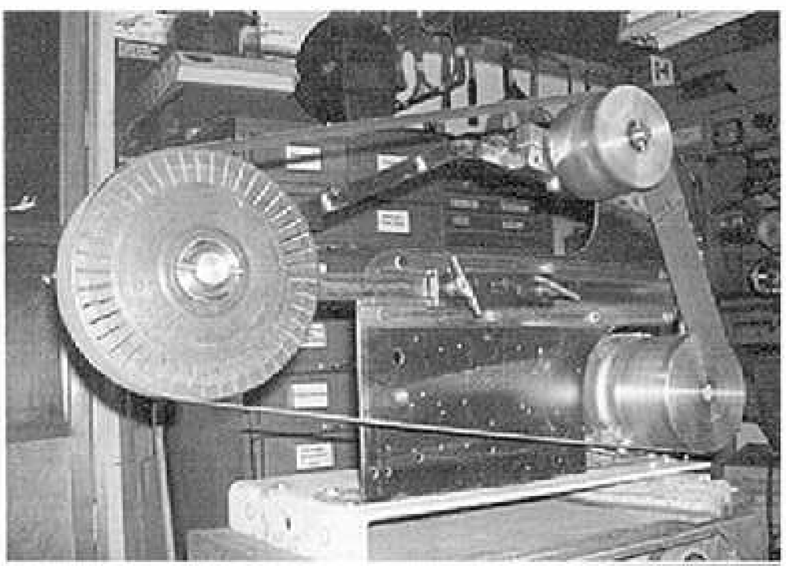


(5) IDLER SHAFT

This shaft was chosen to be 5/8" D X 5" long. It will be secured at one end of a 6" length of 1" square stock.

(6) CONTACT WHEELS

At present there are four contact wheels in use. An 8" wheel with a 2" width is most often used. This wheel was taken from a typical industrial cart. New recesses were turned into the rubber wheel to retrofit the original. The wheel face was trued on a lathe.
Next, a 3/4" diameter wheel is used for finishing radii less than a couple inches. This is made of a metal tube with bearings inserted. Because of its size, no provision was made for a rubber boot over the metal surface. A rubber sleeve to fit over this contact wheel is anticipated.
Then a 2-1/4" D wheel is used for curves larger than 2".. This wheel has a rubber boot.
Finally there is a 14" D wheel. Because of its size it is difficult to balance. It is generally used for creating "Hollow Grinds" on knife blades. The surface is made of a plastic composite. It should have a rubber boot on it. Later drawings will show mounting details of the above "Contact Wheels". (The 8" "Contact Wheel" is pictured at lower right)
Not yet made is a "Platen Grinding Attachment". The Ickler Grinder currently in use has a good platen grinding arrangement. The 1/2 HP motor it driving that grinder is grossly inadequate.



(7) MOUNTING BRACKETS

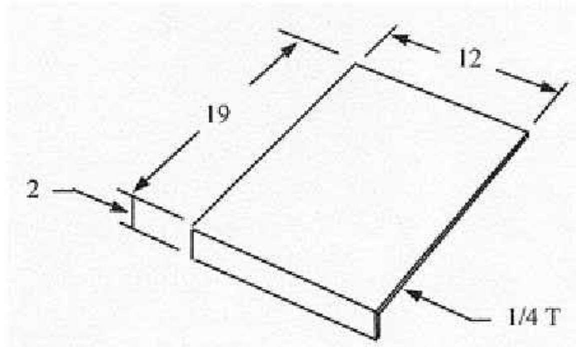
Two pieces of angle iron, 1 X 1 X 18" are bolted to the "Upright Support" to allow insertion and removal of the "Contact Wheel Arms". These arms are made of 1" X 1" Square Stock. The brackets may be welded, however, bolts allow for adjustment should that become necessary.

(8) CONTACT WHEEL ARM LOCK

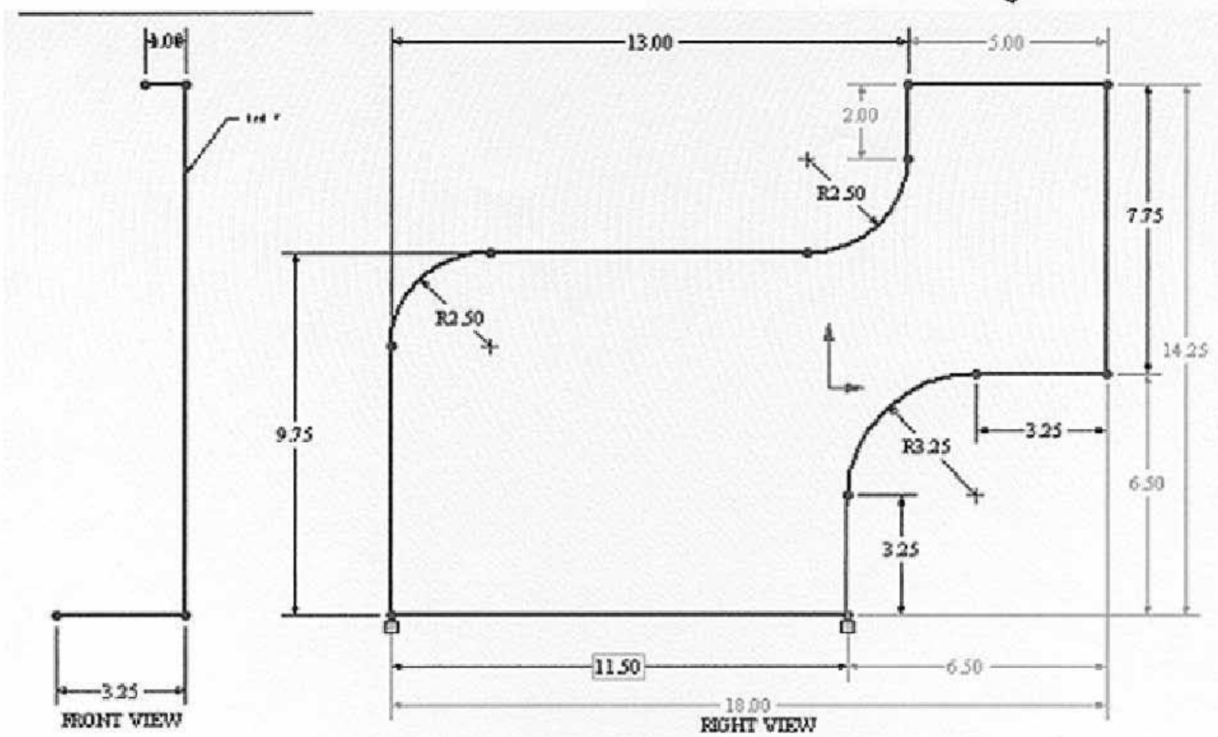
This is made of a 1/4" thick plate measuring 1-1/2" X 6", welded to the two "Mounting Brackets". As shown at right, there are two bolts used to secure the "Contact Arm". Bolts used are taken from a B&S small engine. Rods measuring 2-1/2" long X 1/4" D are welded to the heads of the bolts to serve as handles. The bolts were cut off to a length of one inch. "Really pleased with how well this mechanism functions!"

ASSEMBLY SEQUENCE & ILLUSTRATIONS
(1) BASE PLATE

NOTE: All dimensions given are in inches unless otherwise noted.
As per most parts, the exact dimension of the Base Plate is only incidental! It's what I had in stock!



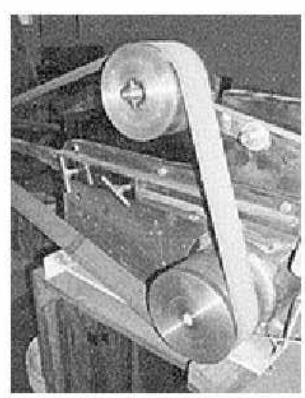
(2) UPRIGHT SUPPORT



This "Upright Support" is made from 1/8" plate. By itself, it is much too weak to support the idler and contact wheels. It is recommended that a thicker plate be used. The scrap from which this plate is made has a 3-1/4" bend at the bottom which extends as shown in the front view. This was used to bolt the "Upright Support" to the base. There was also a right angle, 1" bend at the top.

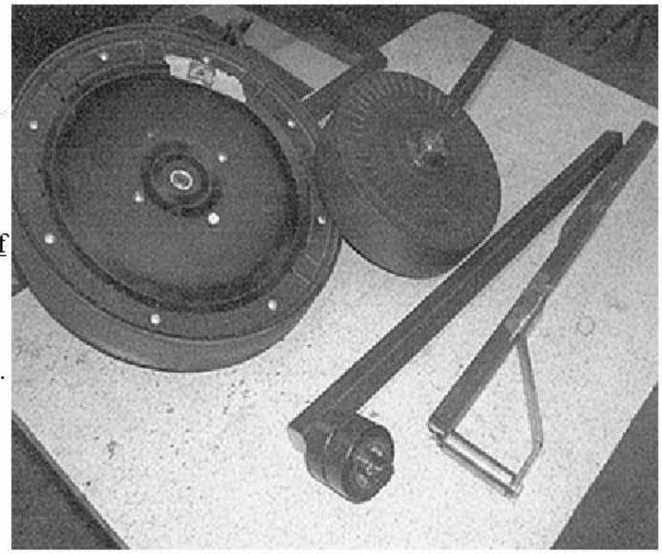
(3) MOTOR MOUNTING

The motor is bolted to the rear of the "Base Plate". The motor shaft is located at the focus point of the 3.25" radius of the "Upright Support as shown in # 2 above. The drive wheel will extend over the edge of the " Base Plate".



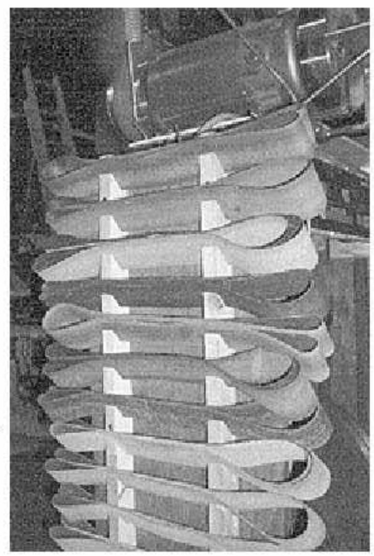
(4) DRIVE PULLEY (Lower right corner of picture)

Make the "Drive Pulley" approximately 6" D X 3" wide. The maximum RPM of the motor along with the diameter of this drive pulley determines the maximum SFM of the belt. This arrangement produced 3,400 SFM. The motor shaft is 5/8" D. The pulley was turned on a shaft for precision balance. A keyway was cut into the pulley to match the keyway on the motor shaft.



(12) CONTACT WHEEL CONSTRUCTION

Four "Contact Wheels" were described earlier. At the lower right is the smallest, a 3/4" X 2-1/2" wide wheel. Note the angled bracket on that is included to provide rigidity. All four wheels have mounting arms as earlier described, made of 1" X 1" stock. It should be noted that a high quality set of bearings which are designed for high RPMs should be used for the very small contact wheels. Their RPM is very high even at moderate motor speeds. Pressures applied to these smaller wheels are much less than the larger contact wheels. It should be noted that the axel shafts for these rollers must maintain true right angles referenced to the mounting arms to avoid belt tracking problems.



(13) SANDING BELT and CONTACT WHEEL STORAGE

A slotted rack was built to store the 2" X 72" belts. At the rear of the stand. The stand is open on both left and right sides allowing for mounting of the "Rectifier Circuit" and "Control Panel". Racks for storage of the four contact wheels are included.

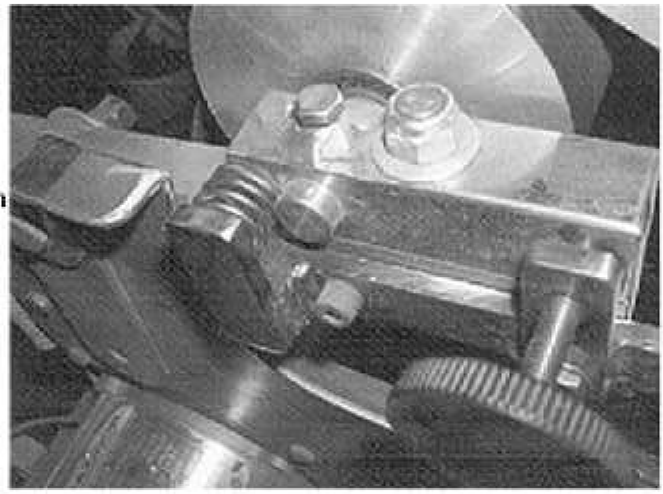
(14) ADDITIONAL COMMENTS

(A) The "Upright Support" should be made of heavier plate than what is used here. Note that a reinforcement bar has been added from the top of the "Upright Plate", angling down to a point behind the motor where it is attached to the "Base Plate". The 14" Contact Wheel may require additional bracing as the wheel has some vibration at medium RPM. A gusset plate may be welded to the "Upright Support" at the front to provide additional rigidity.

(B) The addition of a "Disc Grinder" attachment was included as the Baldor Motor came with a heavy flywheel which was precision balanced. By gluing on a sanding disc and constructing an adjustable table, the need for a seperate disc sander no longer exists.

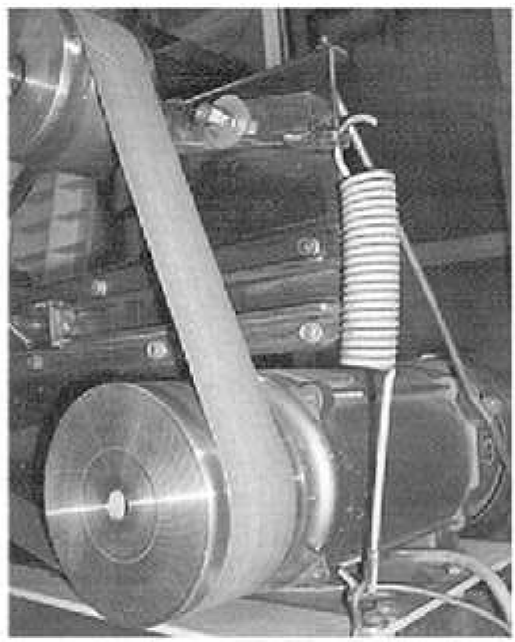
(C) DC Motor controllers are now available which are not nearly expensive as those in the past. A "Variac" along with a "Full Wave Rectifier" (high current rating) with the use of a couple of spike protection capacitors will also provide an excellent means of DC motor speed control.

(D) A considerable quantity of articles and illustrations are on file relating to belt sanders. For further information: hezzy@eznet.net



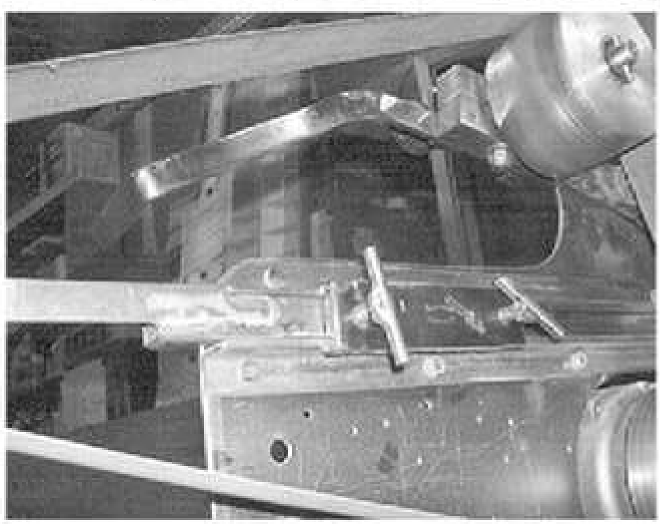
(9) <u>IDLER WHEEL TRACKING MECHANISM</u>

The "Idler Wheel" or "Tracking Wheel" is adjustable. Its position can be slightly rotated on an horizontal plane which causes the belt to ride properly on the contact wheel. The large thumb screw seen in the picture to the right is rotated in order to properly position the "Idler Wheel". To the left of the mechanism is a Briggs & Stratton valve spring which counteracts the pressure of the large thumb screw. The "Idler Wheel Shaft" appears immediately



(10) <u>SPRING TENSIONER FOR BELT</u>

Pictured at right is the spring which applies pressure to the sanding belt. <u>With this arrangement there is no tendency for anything to fly off or away from the winder in the event that a belt breaks</u>. Belt tension is adjusted by how much of the "Contact Arm" is allowed to extend from the "Contact Arm Guides". The "Drive Wheel" is at the bottom of this picture. Mounted behind the drive wheel (not visible in any view) is a speed sensor which causes the DC motor to maintain the RPM to which the control panel has been adjusted. The smaller of the two wires at the lower right corner of this view is the cable which returns to the control circuitry providing the necessary feedback. Consider this feature the same as "Cruise Control" on an automobile. <u>Under heaviest of loads I have not been able to slow the motor. This is true from the lowest RPM to full 3,400 SFM.</u>



(11) <u>TENSIONER ARM</u>

In order to remove or install belts on the grinder, the "Tensioner Arm" is depressed. Then the belt may be easily slipped on or off. This arm is attached to and pivoted at the "Upper Support" at the rear. In order to prevent the belt from wandering off the contact wheel, as heavy pressure is applied, the entire mechanism should be stoutly designed. This picture also shows a view of the two "Contact Arm Guides" along with the "Arm Locking Mecha nism". Bolts are used to secure the angle iron guides to the "Upright".

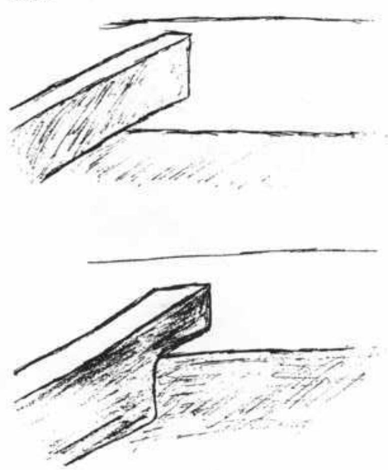
Dragon Head Key Chain Fob

By Bill Clemens

Stock - 1/4 x 1

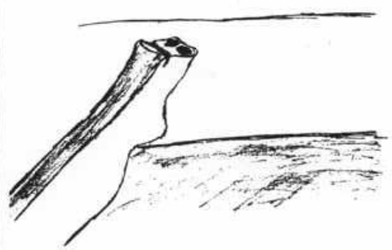
Tools - Center Punch
Straight Chisel
Curved Chisel
Small needle nose pliers or scrolling tongs
1/4 Inch Hole Punch

Begin with approximately 1/2 inch of the bar or the hammer and form the nose with half face blows. Upset the end slightly to square up the nose.

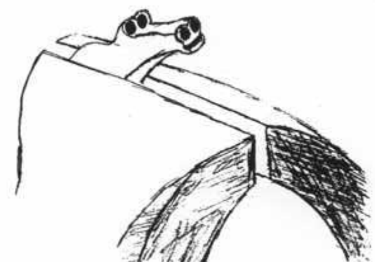


With the bar in the vise, use the center punch to form the nostrils and the chisel to form the mouth.

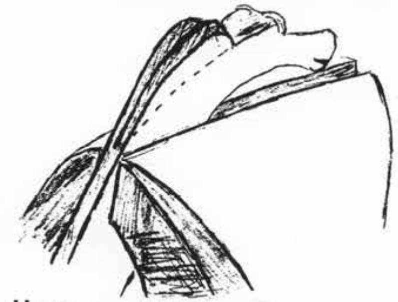
Next form the eye ridge on the anvil with half face blows



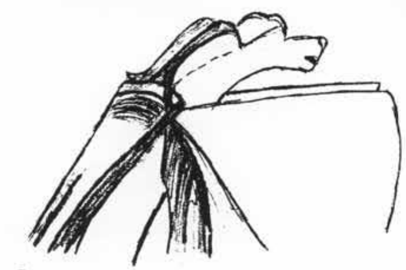
Add the eyes with a chisel. An eye tool can be used to add detail if desired.



Divide the ears using the straight chisel, deepest near the eyes and tapering back towards the tips approximately 1 inch back.

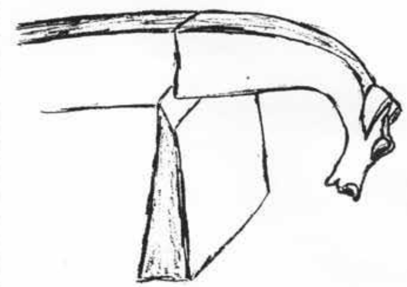


Use the curved chisel(curve down) to separate the ears from the neck.



Curve the ears forward and down with pliers or small scrolling tongs. Make sure the sharp cut edge is turned in against the neck.

Cut the dragon from the stock approximately 2 inches behind the ears.



Finish forging the neck, rounding the end and punching a hole for the key ring. Curve the head down over the horn, using bending forks or with scrolling tongs.

Clean the Dragon, being careful to remove any sharp edges and apply a coat of wax. Add Key Ring.

Gas Forge Burner Construction & Comparisons

Steve Bloom

It's getting time for me to repair/retrofit some of my shop gas forges, so I've been doing a bit of research. There are a number of designs out there and many claims about efficiency with precious little comparative data. I've listened to folks expound on the "obvious" superiority of blown forges since the gas pressure is far less than venturi systems - ignoring the fact that gas consumption is both a function of pressure and orifice size. Since I'm a fan of venturi systems (no dependency on continued electricity to maintain a safe burn), I decided to play with a couple of standard designs. The idea is to run them side-by-side in the same forge while doing the same work and while monitoring actual fuel consumption.

The burner types are all venturi (or atmospheric) burners. The first is based on the burner design used in the Sandia forges (Fig.1). There is a bell that connects to a narrower delivery pipe and the gas is injected from a delivery tube running perpendicular to the overall burner. The second type is a "T" burner (often referred to as a "T-Rex" burner). It is composed of a pipe T fitting with the delivery pipe as the stem of the "T" (Fig.2) and with the gas delivery tube inserted through the top of the "T" and centered over the delivery pipe. The third design is the sidearm design (Fig.3) with a gas delivery tube equivalent to the "T" unit but with a single lateral air opening.

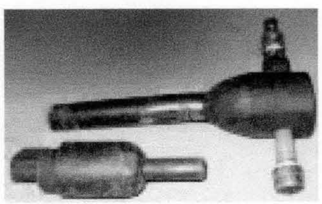


Figure 1: A "Bell" burner

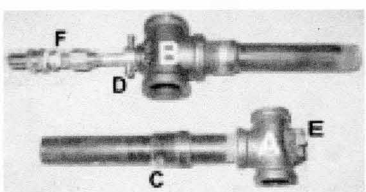


Figure 2: A "T" burner

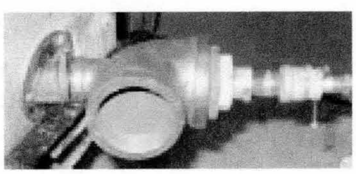


Figure 3: A Sidearm burner

Before launching into the actual comparison, I'm going to indulge myself with a blow-by-blow account of the fabrication of the units. The Bell-type can be made using pipe-reduction fittings, but that's no fun if you're a smith.

I've equipped my 50lb Little Giant power hammer with a lower die block with two "ears" (Fig.4). The ears are simply 1" square blocks of steel welded to the sides of the die with 5/8" holes drilled down their centers. There is a 3/8" threaded hole in the outer surface for a lock bolt (not needed) and a 1/2" hole at the base for scale removal (*really* needed). In the best of all worlds, the ears would be positioned outboard of the bottom of the die cavity but, for now, those 1/2" holes will have to do. The swage is shown in Fig.5. Note that the left post is fixed while the right post can slip back and forth -- makes getting the unit mounted a lot easier. Fig.6 shows the unit in operation. Block the end of the pipe with a wet rag (otherwise, it's a chimney), heat the pipe to yellow, slip it (ok - force it) into the swage and start hammering while rotating the pipe. This is, of course, precisely the same operation for making candle sockets when applied to smaller pipe. When you've got a neck forged (and thus two bells), cool the pipe. Saw off the neck close to the bottom of the bells and saw off the bell that is still part of the pipe. Repeat for as many pairs of burners you want. I have made burners out of 1.65 and 2" pipe (ID measurement) welded to 3/4" pipe (more on why one might be better than the other later in this article). Fig. 7 shows the result - a bell.

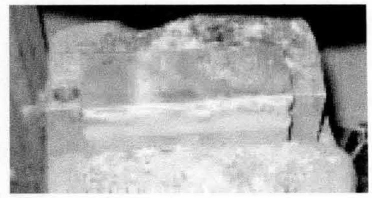


Figure 4: Lower die with hardy holes

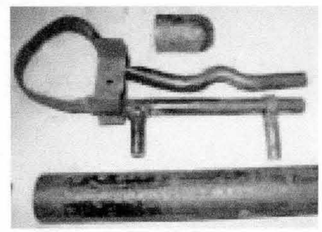


Figure 5: "Bell" former swage

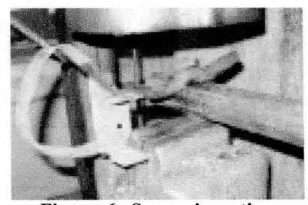


Figure 6: Swage in action

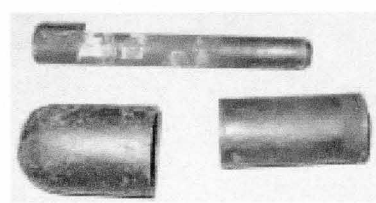


Figure 7: "Bell" in progress

The next step is to drill a large hole (~3/4") centered in the bell - not an easy task unless you make a quick tool - a chunk of round stock that will sleeve into the bell that has been drilled to accommodate 3/4" round stock (a lathe or a friend with

Fig. 8: Center drill

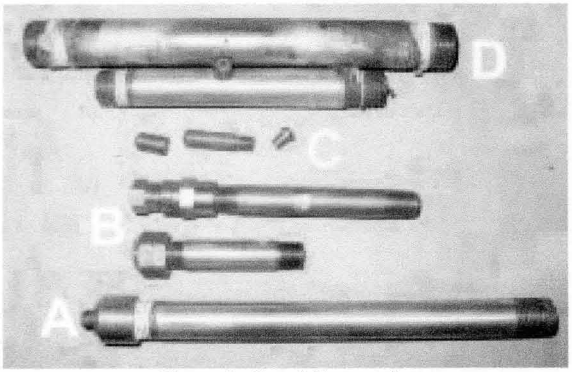


Figure 9: Gas delivery tubes

a lathe helps here)(Fig.8). I usually smooth out the lip of the hole in the bell by beveling with a 7/8" bit.

Insert a piece of 3/4" round stock to produce what is shown in the lower left of Fig.1. The rod acts as an alignment device for the 3/4" pipe forming the business end of the burner. Slip an appropriate length of pipe over the rod, butt it against the bottom of the bell and weld it around the entire junction of the two pieces. I've made burners with lengths of 3/4" pipe as little as 4" and as long as 8" and have put a 45 degree bend in some - and all worked fine.

To finish the basic design, drill a hole slightly larger than the gas delivery pipe at right angles to the long axis of the burner somewhere in the bell (more on that later). A 1/4" pipe nipple (2nd from the top in Fig.9) requires a hole a bit larger than 1/2". A mechanism needs to be added to lock the gas pipe in place. For a 1/4 pipe, a 1/2 x 13 hex nut drilled out to slip over the pipe, drilled and taped for a set screw on one of the flats, and welded to the bell makes a decent lock mechanism.

The "T" design is simple - start with a "T" and weld a block of steel opposite the stem opening or use an "X" fitting with a plug (Fig.2), screw in a section of pipe as the stem, chuck the assembly up in a lathe (you *do* have a lathe, no?), and drill a close tolerance hole for the gas delivery pipe. For a 1/4" pipe, I drilled a 1/2" hole and bored it out to a couple thousands over the pipe diameter. Drill and tap a set screw at right angles to the gas pipe to make a lock mechanism. The sidearm burner is essentially the same with the exception of the major pipe fitting (Fig.3) which ought to have the smooth sweep to the "stem" opening.

A series of gas delivery tubes are shown in Fig.9. For the bell burner, you'll need an orifice somewhere around 0.040" diameter (#60 drill). Cap one end of the pipe, slip it through burner and mark the pipe midway across the bell. You can then: (1) drill a 0.040 or 0.035" hole in the pipe (a collet drill chuck helps here) (top pipe labeled "D"); (2) drill and tap a hole to accept a MIG tip (lower pipe labeled "D"), or (C) drill a 0.150" hole, press fit a TIG tip and drill it. Miller tips are 1/4x28, Lincoln tips are 12x24 and all are ~1/4" soft copper, so it's easy to cut them in half, rethread to 1/4x20 or 1/4x28 (Fig.9 C), and deburr the orifice. For a "T" burner, you can use a 1/8" pipe with a connection fitting and a plug (top pipe, Fig.9 B) or a cap (lower pipe, Fig.9 B) or use a 1/4" pipe (Fig.9 A) - here using a cap and a shortened MIG tip. In all these cases, the orifice has to be located at the center of the cap or plug, so it's back to the lathe again.

The other end of the system is the connection to the gas

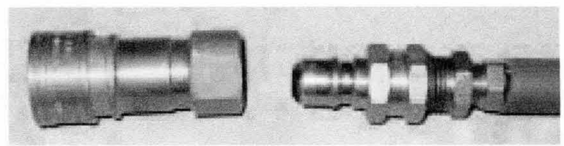


Figure 10: Propane quick connects

supply. Your friendly propane/AC retailer (in my case, Tempaco) stocks gas quick connects (Fig.10) which work just like the ones on your compressed air lines. The costs are not too bad and they make the plumbing a lot easier. They typically are 3/8" NPT so a bushing or two may be needed to hook to the gas delivery pipe. If you don't already have one (or two or three), get an adjustable LP regulator with gauge (ran about $25 last one I bought).

The "T" burner design does not have (nor needs) adjustment

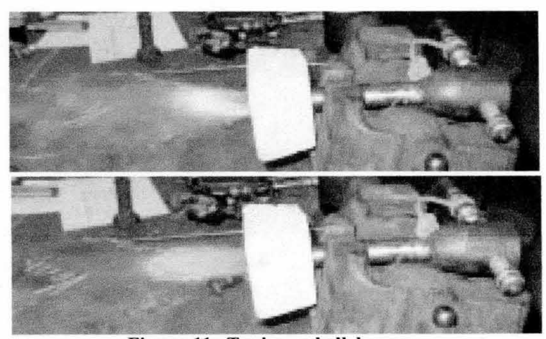


Figure 11: Tuning a bell burner

while the bell burners need tuning. Secure the burner and slip a scrap of fire brick over the end of the burner. The tip ought to be an inch or so inside the brick. Position the orifice in the center of the bell and pointing down the delivery tube. Light off the burner and observe the flame and listen to the burner. If there is a lot of yellow and sputtering (top, Fig.11), you loosen the set screw and move the gas pipe back and forth and rotate it until the flame is blue and the sound resembles a little jet engine (lower, Fig.11). There will be a sweet spot and it's pretty obvious when you find it. When satisfied, lock down the set screw.

The next step is mounting the burner in a forge. In the past, I've welded plates (or big washers) on the burner tip far enough back that when the plate is welded to the forge or bolted to it, the burner tip is recessed in the refractory brick

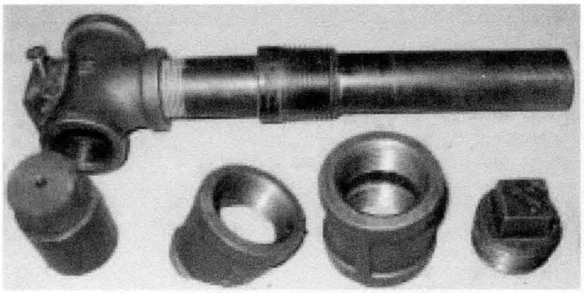


Figure 12: Burner mounting hardware

approximately 0.75 to 1.0 inches. This makes pulling a burner difficult and thus makes running a two burner forge on a single burner a pain (since you **do not** want to leave a non-burning burner on a forge to act as a chimney!). My ever so clever solution is shown in Fig. 12 & 13. Get a pipe connector that slips over the burner delivery pipe. Saw it at an angle (to allow the burner to enter the forge at that angle so as to produce a swirl effect) and weld it to the forge. A slug of round stock with a centered hole (lower left, Fig.12) lets you drill a pilot hole in the refractory. A pass with a slightly undersized spade bit completes the hole. When the second burner is pulled, just screw in a pipe cap. Voila, problem solved.

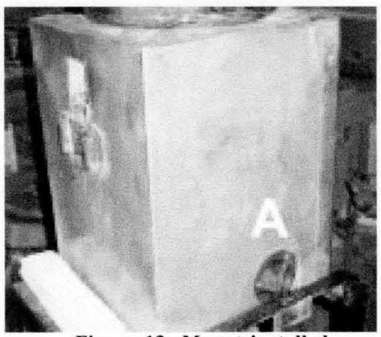


Figure 13: Mount installed

Now to the experiment. The apparatus (Fig 14) consisted of a vertical gas forge (A), a large pot (B), a variety of burners (C) and a digital pyrometer (D). The scheme was to first bring the forge to operating temperature. Four liters of water were placed in the pot and the temperature is recorded). The 20lb propane bottle is weighed and connected to the burner. The burner is lit, the time noted, and the temperature is monitored. When the water temp hits 200 F, the system is shut down and the propane bottle reweighed. As long as the amount of water is constant and the start and end temperatures are consistent from run to run, then the same amount of work is being done in the same forge, hence the gas consumption (the difference in weights) is a reasonable measure of burner efficiency.

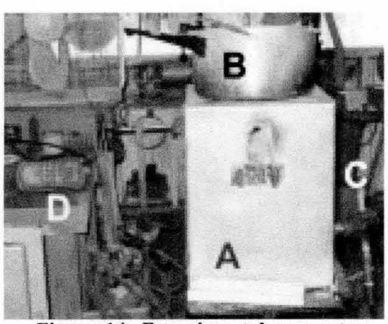


Figure 14: Experimental apparatus

The variations tested were:

(A) burner designs (Bell vs “T” vs sidearm);

(B) area (in^2)of maximum opening: Bell at 2.0 & 3.55 (1.5 vs 2” pipe); “T” at 1.57 & 2.11 (3/4” vs 1” fitting)

(C) orifice size (0.040 & 0.035) and

(D) location of the orifice relative to the junction of the bell (or “T”) to the delivery pipe (Fig.15). Due to the scale used, the precision of weighing was 0.5 ounces.

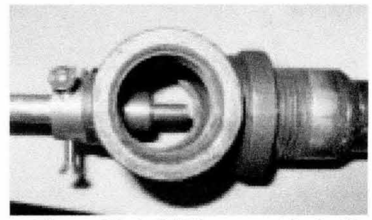


Figure 15: A “T” burner with tip 1” from junction

Burner Type	Orifice Diameter (in)	Orifice Distance (in)	Gas Used (rel)	Time to 200F (rel)
Bell-large	0.035	2"	1	1.18
Bell-small	0.035	1"	1.14	1.42
T-small	0.045	1"	1.43	1
T-small	0.035	1"	1.43	1.14
T-small	0.035	0"	1.43	1.29
T-large	0.035	0"	1.43	1.14
Bell-large	0.035	1"	1.43	1.34
Bell-large	0.035	1"	1.43	1.28
T-large	0.035	1"	1.71	1.48
Sidearm	0.035	2"	2.14	1.28

Table 1: Experimental results

The results are given in Table 1, where gas used and time were placed on a relative scale. The least gas used was 0.22 lbs (1st row) and the fastest time was 322 sec. (row 3). As you might expect, orifice size controls speed to termination but for the same amount of work, does not affect gas used (compare row 3 and row 4). If you run a forge for a long time, a smaller orifice is indicated. The best gas consumption was acheived by a large bell burner with the orifice 2” from the junction but note that a small bell with a 1” separation was essentially the same (0.5 oz more - right at the limit of the measurement error). At 20 psi, the smaller burner stopped working correctly while the larger one continued burning, so an argument can be made for a larger bell if you’re pushing the pressure envelope. Moving the orifice closer to the junction for the bell burner (rows 7 & 8) gave consistent but poorer results. The sidearm burner (as configured here) was definitely the tail-end charlie as was the large “T”.

Given the limited amount of replicability and the lack of precision in the gas consumption, the take-home message is that there does not appear to be a head-and-shoulders better burner in the group. Make what is easy to make, A bell allows ease of adding choke plates and/or blower input, so that’s the way I’m going with the mount idea shown here.

101 Ways to Die in your Shop

By Dominick Andrisani

Let's face it. Blacksmithing is dangerous. There are a gazillion ways to get hurt, or worst to die, in every shop. I thought it would be enlightening to list a few of them as a friendly safety reminder.

1. You can die from tetanus. Tetanus is a bacterium that adversely affects skeletal muscles. In recent years, approximately 11% of reported tetanus cases have been fatal. The highest mortality rates are in unvaccinated people and people over 60 years of age. Tetanus is often associated with rust, especially rusty nails, but this concept is somewhat misleading. Objects that accumulate rust are often found outdoors, or in places that harbor anaerobic bacteria (like the tetanus

bacterium), but the rust itself does not cause tetanus. The rough surface of rusty metal merely provides a prime habitat for tetanus bacteria to reside, and the nail affords a means to puncture skin and deliver bacteria into the wound. Tetanus can be prevented by vaccination and the CDC recommends that adults receive a booster vaccine every ten years. Standard care practice in many places is to give the booster to any patient with a puncture wound who is uncertain of when he or she was last vaccinated, or if he or she has had fewer than three lifetime doses of the vaccine. The booster may not prevent a potentially fatal case of tetanus from the current wound, however, as it can take up to two weeks for tetanus antibodies to form. For those of you who think you are hardier than a horse, I want to remind you that Traveler, General Robert E. Lee's favorite horse, stepped on a nail and died of tetanus. (Reference: Wikipedia)

2. You can die from the fumes if your heat galvanized metal in your forge. Just ask blacksmith Jim "Paw-Paw" Wilson. Oh, he died that way! (Ref: http:// www.anvilfire.com/iForge/tutor/safety3/ ndex.htm)

3. You can die if you lay your acetylene tank on it side for some hours and then pick it back up and use it. When free state (liquid) acetylene exits your torch it explodes in a way that turns your tank into in improvised explosive device (IED). The next thing you don't know is that your body is in small pieces in the collapsed remains of what used to be your shop. 4. You can die if you run your oxy-acetylene torch with the acetylene regulator pressure greater then 15 p.s.i. You and the tank can explode with near simultaneity as free state acetylene violently decomposes! (Ref: www.baesg.org/acetylene.htm) 5. "Injuries resulting from the use of angle grinders are numerous. The most common sites injured are the head and face. The high-speed disc of angle grinders does not respect anatomical boundaries or structures and thus the injuries produced can be disfiguring, permanently

disabling or even fatal. However, aesthetically pleasing results can be achieved with thorough debridement, resection of wound edges and careful layered functional closure after reduction and fixation of facial bone injuries." I don't think you want to go there! It sounds painful and costly. Be careful! Always wear appropriate eye and face protection (Ref: www.head-face-med.com/ ntent/4/1/1)

6. You can get burned. While this might not seem obvious, it's best not to wear gloves when blacksmithing. If you pick up hot metal with a gloved hand, the chances are that you will be burned worse

than if you grabbed the hot metal barehanded. After you burn your fingers on hot metal, stick your hand in the slack tub and keep it there for a few minutes. This procedure won't cure a thing. It just gives you time to think about what you just did! If your burns are bad, apply some SSD (Silver sulfadiazine, a sulfa drug) to prevent and treat infection. It kills a wide variety of bacteria including ones that live in slack tubs. See your doctor or pharmacist and keep some SSD around. 7. When using otating machinery like a drill press or some other spinning tool, your hands, face, and body

can be pulled into the machine and become mangled. Remove your gloves, loose clothing, and long hair before you start the machine.