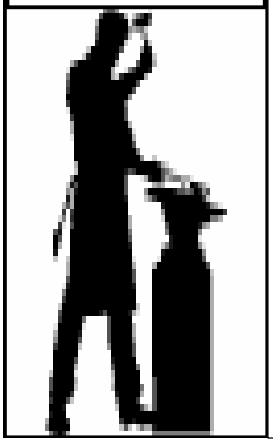
The Upset

" I know of no more encouraging fact than the unquestioned ability of a man to elevate his life by conscious endeavor"

Henry David Thoreau, 1817-1862

Photo by Tommy Ward



MISSISSIPPI FORGE COUNCIL
2005 CONFERENCE
MAY 26, 27, 28

FRIDAY, MAY 27 - SPECIAL CLASS WITH GEORGE DIXON

Design, construction, fitting and wiring of lighting fixtures, both in pierced sheet and heavier forged work. Class limited to 10 participants and starts at 8:30 am at the AG Museum.

FRIDAY EVENING, 6:30 PM. WINE AND CHEESE PARTY

Location, AG Museum Auditorium
Bring your work for display tonight and something for the 'Iron in the Hat'. Presentation and slide show by George will begin at 7:30.

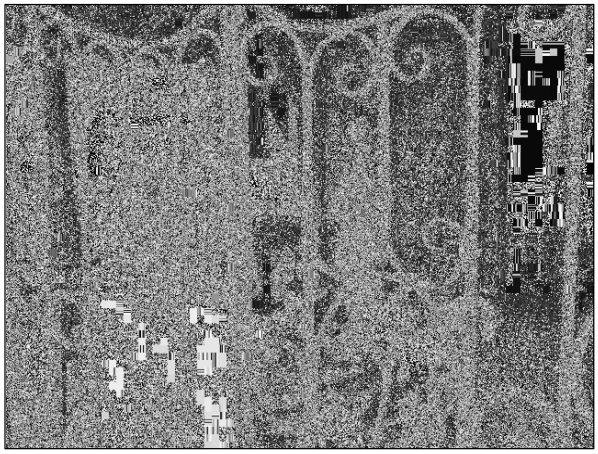
SATURDAY, MAY 28 *- George Dixon will begin his demonstration at 8:30 am. He is currently working with lighting fixtures and in this demonstration George will share his techniques of design, construction, fitting and wiring with us. In George's words, he will be offering a "compendium of forge exercises with the focus on completed pieces that are layered into finished projects."*
He will take us from design to a completed piece ready for delivery.
If we have enough donations we will have another 'Iron in the Hat' at lunch time and dinner will begin at 5:00 pm with the Auction immediately after.

SUNDAY, MAY 29 *- The demonstration will start at 8:30 am and will end around 12:00 pm.*

Registration will start at 8:00 am Saturday, May 28.
Cost is $35.00
Details of the meal are still being worked out as of this printing.

The conference is almost here again and, as usual, we don't have all the details ironed out . We do this every year and yet, somehow, it all works out. This conference should really be a good one. George Dixon has been developing techniques for making lamps. The process includes repousse' work, forging, fitting, layering and wiring. He will take us from the concept to the finished product, ready for delivery. There should be something for everyone here. He will be teaching a class on Friday, May 27 that will include these techniques. The class is limited to ten people so, if you haven't signed up for it yet, call Stacy Stegall to see if there is any space left. You can reach Stacy at the number listed on page 2.

We will have the wine and cheese party Friday night also. This is a great time to display your work, Bring your family and invite your friends. Tables will be available in the Ag Museum Auditorium for your display. This will start at 6:30 pm and George will start his slide presentation at 7:30 and it can last as long as we have questions or want to see slides of his work. In the past this has been a very fun event. It gives our families a time to meet and see why this iron work interests us.



With a little luck, this will reach you in time to remind you our work day at the shop is Saturday, May 14. We need to get the gate mounted and the fence up. This way we can lock up the shop and protect our interests. Bring some hand tools and shovel, post hole digger, portable welder (hand tool?) cutting torch and a handy happy face. It has only been six years since we started the gate, it is time to complete this project.

We have a demonstration trailer available for anyone wanting to give a demonstration at their child's school. It is fully equipped and ready to go. We were not allowed to store the trailer at the Ag Museum so it is at my place in Gluckstadt. Call me and we can make arrangements for you to get it. Demonstrating has always been fun and good for experience. The kids love it and it helps membership.

Auction Items

I hope we will have a lot of good auction items this year. It has been suggested we do more small items. This way we could bring more than one donation and, with a little luck, have enough items for an 'Iron in the Hat' Friday evening, and maybe Saturday also, Think about it.

About the elections

No one has responded with the nomination form. No one has volunteered for any position. With that spirit in mind I am no longer running for the president's position. Bill Pevey has said he will remain in that position if there is no one to pick up the torch. Actually I need to focus more on my business now that new opportunities have been presented. I will continue to edit the newsletter and the web site as long as possible but I would appreciate some help with the web site. Is there anyone out there who wishes to help?

Jim Pigott

LAMA'S BOB XI

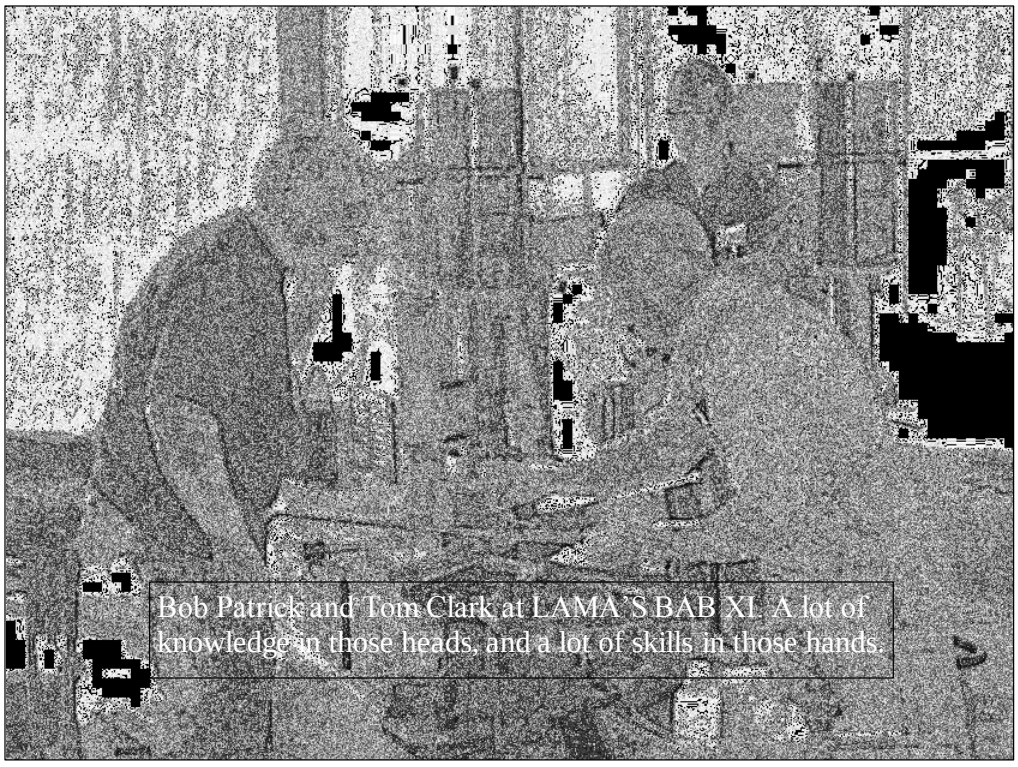
by Tommy Ward

After an agonizing stretch of crummy winter weather, the conference season is finally upon us, and one of the first in the region to fire up this year was LAMA's BOB XI, in March (for the acronymically challenged that's the Louisiana Metalsmith's Association "Banging on the Bayou, Eleven").

BOB's moved from Covington to Lafayette a couple of years ago, and although maybe an hour farther from most Mississippians, it still not a bad drive - all you have to do is head south/west on the I-55/12/10's, and when the roadside vendor signs change from "*Boiled Peanuts*", to "*Hot Crawfish & Boudin*", and the country music station is playing tear jerking songs in French, you know you're getting deep in Cajun country and "The Capital of Acadiana" can't be far.

You can count on a LAMA get-together being fun and BOB XI was no exception, with lots of fellowship, good food, and tailgating.. This year's featured demonstrator was Bob Patrick, and Tom Clark also showed up, so you know the "energy level" was high. In addition to black-smithing, Bob has an extensive background in the industrial metalworking sector, and I found his perspective on techniques and fixtures quite interesting (see the photos and notes for a couple of his simple, but effective devices).

If you haven't done a "BOB", you should consider a ride down next year. The conference is a good one, and the historic Lafayette area is certainly worth an additional day or two's visit.



Bob Patrick and Tom Clark at LAMA'S BAB XI. A lot of knowledge in those heads, and a lot of skills in those hands.

Boy Scout Merit Badge Requirements

The MFC has received a request to help some scout troops earn their Metalwork Badge in the blacksmithing option #4. Are you willing to help in this endeavor? Read this and compare your skills with what is required for this badge. This would be a good thing for our own development. Contact Bill Pevey to volunteer to help.

Note: The outline did not copy correctly from the internet. I chose not to retype this. For any clarification see the web site **www.meritbadge.com Metal work badge**.

Editor

METALWORK

1. Read the safety rules listed in the Metalwork merit badge pamphlet. Describe to your counselor how to be safe while working with metal. Because this merit badge offers four options, show your counselor which additional safety rules apply to the discipline you choose and discuss them with your counselor.2.
2. Do the following:

a. Define the term **native metal**.
b. Define the term **malleable**.
c. Define the term **metallurgy**.
d. Define the term **alloy**.
e. Name two **nonferrous** alloys used by pre-Iron Age metalworkers, and name the metals that are combined to form these alloys.
f. Explain the term **ferrous**, and name three ferrous alloys used by modern metal workers.
g. Describe how to **work-harden** a metal.
h. Describe how to **anneal** a nonferrous and a ferrous metal.

1.

a. Do the following:

b. Put a 45-degree bend in a small piece of 26- or 28-gauge sheet brass or sheet copper. Note the amount of effort that is required to overcome the yield point in this unworked piece of metal.
c. Work-harden another piece of the same sheet brass or sheet copper, and then put a 45-degree bend in it. Note the amount of effort that is required to overcome the yield point.
d. Soften the same bent, work-hardened piece by annealing it, and then try to remove the 45-degree bend. Note the amount of effort that is required to overcome the yield point.
e. Join two small pieces of scrap metal using a hammered rivet. Repeat the process using a pop rivet.
f. Using a flatlock seam, join two pieces of scrap metal together with either lead-free solder or silver solder.

g. Make a temper color index from a flat piece of steel. Using hand tools, make and temper a center punch of medium-carbon or high-carbon steel.
h. Using metal cans, practice using the basic metalworking tools and techniques by making at least two tasteful objects that require cutting, bending, and edging.

a. Do ONE of the following:
b. Visit an experienced sheet metal mechanic, tinsmith, coppersmith, silversmith, jeweler, founder, or a blacksmith at his or her workshop. You may select a skilled hobbyist or a professional. Ask permission to see the tools used and to examine examples of the work made at the shop. Inquire about the level of education required to become an apprentice craftsman.
c. If you have (or your counselor has) access to the Internet, explore metalworking occupations by conducting a Web search. With your counselor's help and guidance, find at least five metalworking-related Web sites. Print a copy of the Web pages and discuss them with your counselor.When conducting your Web search, use keywords such as *metallurgy, metalwork, spinning metal, metal fabrication, steel fabrication, aluminum fabrication, casting metal, pattern making, welding, forge welding, blacksmith, art metal, Artist Blacksmith Association of North America, farrier, brazing, goldsmith, machinist,* or *sheet metal mechanic*.

After completing the first three requirements, complete at least ONE of the options listed below.

Option 1--Sheet Metal Mechanic/Tinsmith

1. Name and describe the use of the basic sheet metalworking tools.
2. Create a reasonably accurate sketch of two tasteful objects to make from sheet metal. Include each component's dimensions on your sketch.
3. Using patterns provided either by your counselor or made by you, make at least two tasteful objects out of 24- or 26-gauge sheet metal. Use a metal that is appropriate to the object's ultimate purpose.

a. Both objects must be constructed using cutting, bending, edging, and either soldering or brazing.
b. One object also must include at least one riveted component.
c. If you do not make your objects from zinc-plated sheet steel or tin-plated sheet steel, preserve your work from oxidation.

Option 2--Silversmith

1. Name and describe the use of the basic tools used by a silversmith.
2. Create a reasonably accurate hand-drawn sketch of two tasteful objects to make from sheet silver. Include each component's dimensions on your sketch.
3. Using patterns either provided by your counselor or made by you, make at least two tasteful objects using 18- or 20-gauge sheet copper. If you already have prior silversmithing experience, you may substitute sterling silver, nickel silver, or lead-free pewter.

a. At least one object must include a sawed component you have made yourself.
b. At least one object must include a sunken part you have made yourself.
c. Both objects must include a soldered joint.
d. Clean and polish your objects.

Option 3--Founder

1. Name and describe the use of the basic parts of a two-piece mold. Name at least three different types of molds.
2. Create a reasonably accurate sketch of two tasteful objects to cast in metal. Include the height, width and length on the sketch.

3. Do the following:

a. Using a pattern provided by your counselor and another one you have made yourself, make two molds. Position the pouring gate and vents yourself. *Do not use copyrighted materials as patterns.*

b. Make a casting using a mold provided by your counselor *and* make a casting using the mold that you have made. Use lead-free pewter when casting each mold.

c. Remove all evidence of gates, vents, and parting-line flash from your castings.

Option 4--Blacksmith

1. Name and tell the use of the basic tools used by a blacksmith.
2. Make a reasonably accurate sketch of two tasteful objects to hot-forge. Include each component's dimensions on your sketch.
3. Using low-carbon steel at least ¼-inch thick, perform the following exercises:

a. Draw out by forging a taper.

b. Use the horn of the anvil by forging a U-shaped bend.

c. Twist steel by placing a decorative twist in a piece of square steel.

d. Use the edge of the anvil to bend metal by forging an L-shaped bend.

e. Using low-carbon steel at least ¼-inch thick, make at least two tasteful objects that require hot-forging.

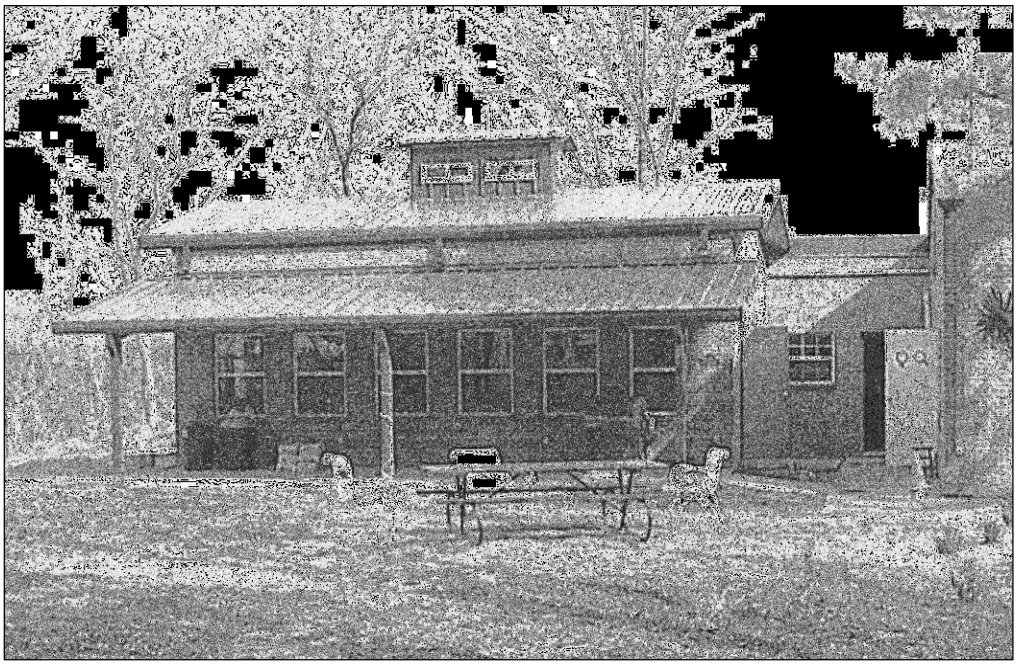
f. Include a decorative twist on one object.

g. Include a hammer-riveted joint in one object.

h. Preserve your work from oxidation.

BSA Advancement ID#: 74

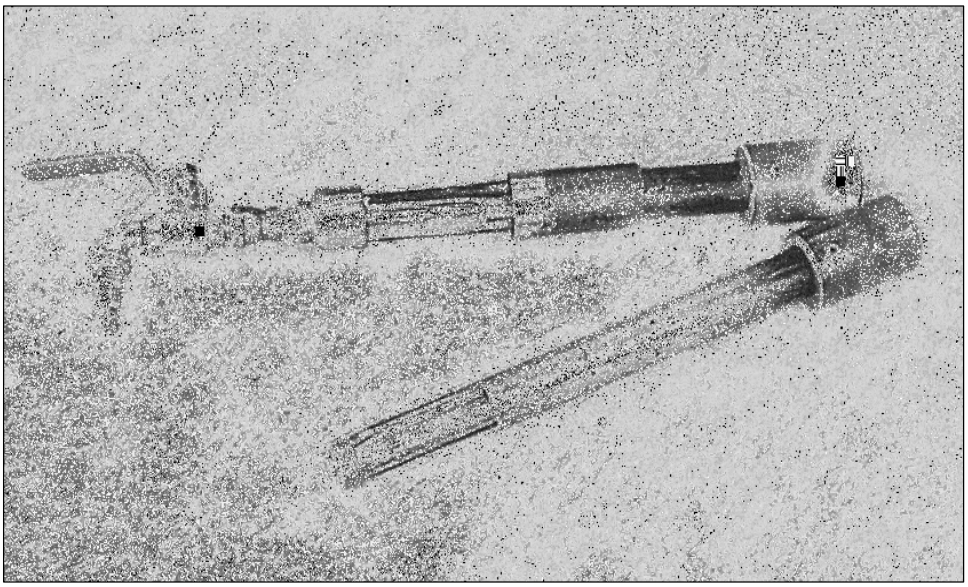
Source: *Boy Scout Requirements,* #33215, revised 2004

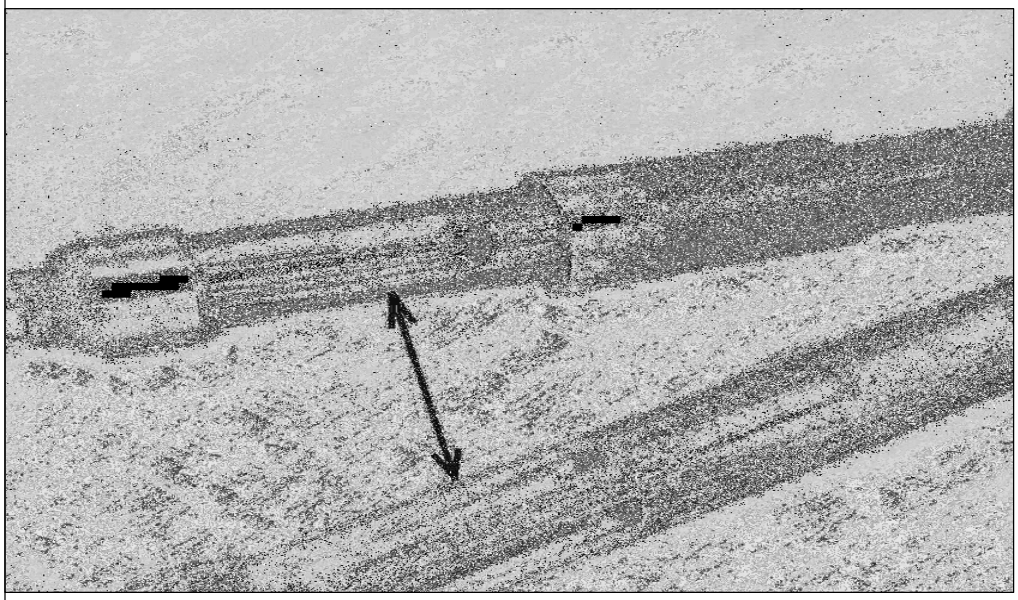


Visitors to The River Bluff Forge Council's "Forging on the River XII", held in Memphis in March, got to tour the recently completed Lawler Foundry on the grounds of the National Ornamental Metal Museum. Museum associates are justifiably proud of the newest addition to their growing facility, made possible by a generous gift from Lawler Machine and Foundry in Birmingham, AL. RBFC's Bob Rogers said that the inaugural class just held in the fine new structure was well received, and that more metal casting classes are planned for the future. - Tommy Ward

Glenn Jarreau's ideas on burners

Here's a couple of photos showing two "super efficient" gas burners LAMA & MFC member Glenn Jarreau recently constructed after reading Michael Porter's book on gas burner design. Made with his usual meticulous craftsmanship, Glenn explained that he had modified Michael's design somewhat by changing the original side air inlets from four smaller slots (bottom of close-up) to three larger ones (top of close-up), and feels that this alteration allows more air flow into the combustion tube due the increased inlet area. Glenn is quite pleased with the performance of these units, and told me that the Porter style burners are far and away the most efficient atmospheric types he's seen. If you're contemplating building a gas forge you would be well advised to read "Gas Burners for Forges, Furnaces, & Kilns" (reviewed in the Sept. 2004 issue of "The Upset").





-Tommy Ward

From: theforge-bounces@mailman.qth.net on behalf of Peter Fels And Phoebe Palmer [artgawk@thegrid.net]
Sent: Saturday, February 05, 2005 8:23 PM
To: Sponsored by ABANA
Subject: [TheForge] Article in "Neurology" Journal,,,sound familiar?

Researchers found that among more than 1,400 welders from Alabama, the prevalence of Parkinson-like symptoms, including tremor, muscle rigidity and slowed movement, was 7 to 10 times higher than the norm for the general population.

The findings, based on a group of mostly male welders between the ages of 40 and 69 years, are published in the journal Neurology.

In an earlier study of 15 career welders, the same investigators found that the men started suffering Parkinson's symptoms at an atypically early age -- at age 46 on average, versus age 63 in a comparison group of non-welders. That led the researchers to speculate that an as yet unknown toxin in welding fumes might speed the onset of Parkinson's disease in people who would likely have developed the disease at an older age.

That study, published in 2001, has since been cited in lawsuits against welding-rod manufacturers. Late in 2003, a jury awarded $1 million to a plaintiff who claimed that years of inhaling toxic welding fumes caused his Parkinson's disease, and thousands of similar lawsuits have since been filed.

But exactly how common Parkinson's is among welders has been unknown. To find out, Dr. Bruce A. Racette of Washington University School of Medicine in St. Louis and colleagues assessed 1,423 welders, mostly men, who were referred by an attorney for Parkinson's screening. The researchers compared the welders' rates of "definite" and "probable"

Parkinson's disease with those found in a previous study of people living in Copiah County, Mississippi.

Overall, 6 percent to 10 percent of the welders were diagnosed with definite Parkinson's disease, while 13 percent were found to have probable Parkinson's disease. As mentioned, their rates were 7 to 10 times higher than those in the general male population of Copiah County.

"This study is the largest, to date, implicating welding as a risk factor for parkinsonism," Racette told Reuters Health. Other studies, he added, have found no such risk, but it's unclear whether that is related to the smaller size of those study groups.

"We feel that our study is preliminary and requires follow-up with an epidemiology study that incorporates a control group without welding exposure," Racette said.

Parkinson's disease is a progressive neurological condition typically marked by four types of symptoms: tremors, muscle rigidity, slowed movement and problems with balance and coordination. The disease occurs when certain brain cells that produce the movement-regulating chemical dopamine are damaged or destroyed.

No one knows what triggers this brain damage, but scientists believe that a number of factors, genetic and environmental, likely play a role.

On-the-job exposures to certain chemicals, including pesticides and herbicides, have been linked to Parkinson's disease, and overexposure to the mineral manganese can lead to Parkinson's-like symptoms.

The welding process creates fumes that contain manganese, and according to Racette and his colleagues, exposure to the metal "cannot be excluded" as the cause of their patients' symptoms.

There are many potential toxins in welding fumes, Racette noted, though manganese is the one best recognized as being damaging to nerve cells.

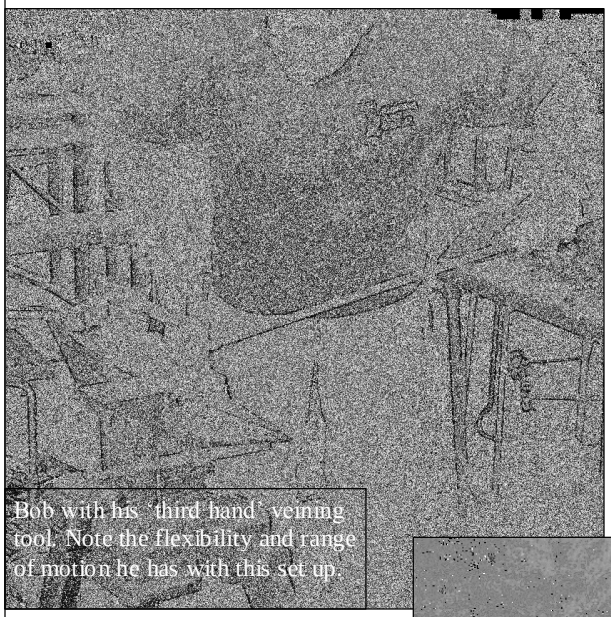
More research, he added, will be needed to clarify exactly what led to the Parkinson's symptoms seen in these welders.

The current study received partial funding from the Welder Health Fund, created by a group of attorneys to support Parkinson's disease screening for welders. None of the study authors has received money related the research, according to a disclosure statement in the report.

SOURCE: Neurology, January 25, 2005.

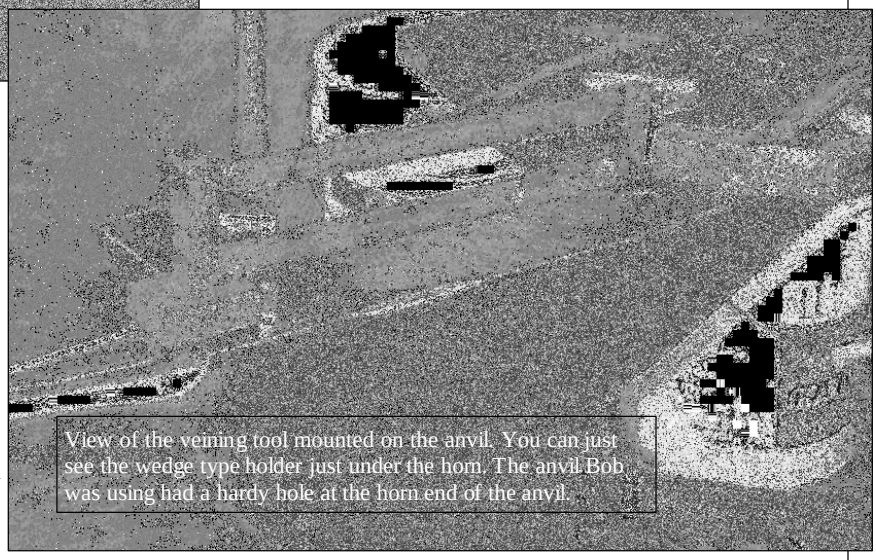
"THIRD HAND" VEINING TOOL

by: Tommy Ward



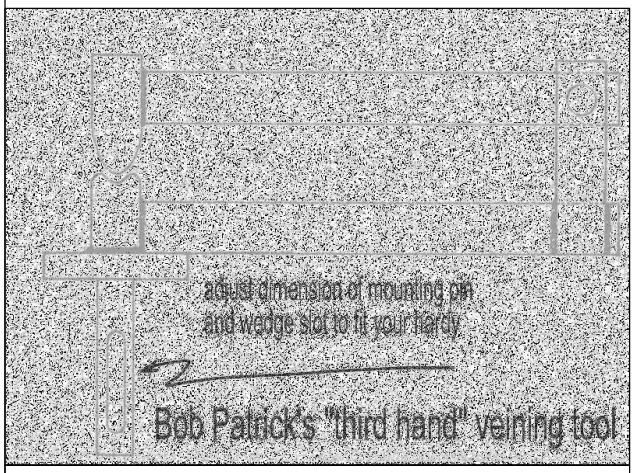
Bob with his 'third hand' veining tool. Note the flexibility and range of motion he has with this set up.

Bob Patrick used this simple veining tool during a demonstration of leaf-making techniques at LAMA's recent conference, and I was struck by the speed and ease with which he could work. Using it, Bob quickly completed deep, detailed features in fairly large leaf sections in just a heat or two. It's really not a new idea; there are a lot of variations around. But most tools, the "Smithing Magician" styles, for instance, are "closed" types that can restrict access to the work in certain situations. Bob's approach, however, features an open "C" throat, hinged on the far end, which allows him to tilt the work as well as move it around through a range of almost 360 degrees. And, depending upon the height of the upper and lower tools, he can reach "in" to deep or dished sections with ease.



View of the veining tool mounted on the anvil. You can just see the wedge type holder just under the horn. The anvil Bob was using had a hardy hole at the horn end of the anvil.

The tool is designed for use in detailing hot work, and is not intended to move large amounts of metal, so tremendous strength is not needed and fabrication should be fairly simple. However, I noted that Bob's version was solidly built, and he particularly emphasized that care should be taken in the design and construction to insure that the upper and lower tools remain in proper alignment.



General layout of an anvil mounted anvil tool.
See text for details.

Configuration of the top and bottom tools is a variable that will be dictated by how fine or aggressive a detail you wish to achieve, however the layout of the working surfaces should follow good tool design practices, i.e., smooth flowing radiuses, relief angles, appropriate clearances, etc. Bob told me that he used a tough quality steel for the tool blocks, but I've forgotten the specific grade (probably one of 5000 series, though). The whole affair is held in place on the anvil using a traditional tapered wedge and slotted tenon arrangement inserted through the hardy hole.

April's Fool

You can fool all the people all the time if the advertising is right and the budget is big enough.

Joseph Levin (1905-1987)

It is better to keep your mouth closed and let people think you are a fool than to open it and remove all doubt.

Mark Twain (1835-1910)

The Constitution gives every American the inalienable right to make a damn fool of himself.

John Ciardi (1916-1986)

Any fool can tell the truth, but it requires a man of sense to know how to lie.

Samuel Butler (1835-1902)

A little government and a little luck are necessary in life, but only a fool trusts either of them.

P. J. O'Rourke (1947-)

Thou clay-brained guts, thou knotty-pated fool, though whoreson, obscene, greasy tallow-catch.

William Shakespeare (1564-1616)

You can fool too many of the people too much of the time.

James Thurber (1894-1961)

There are more fools than there are people.

Heinrich Heine (1797-1856)

http://www.anvilfire.com/iForge/tutor/gccross/index.htm

TRADITIONAL BLACKSMITHING

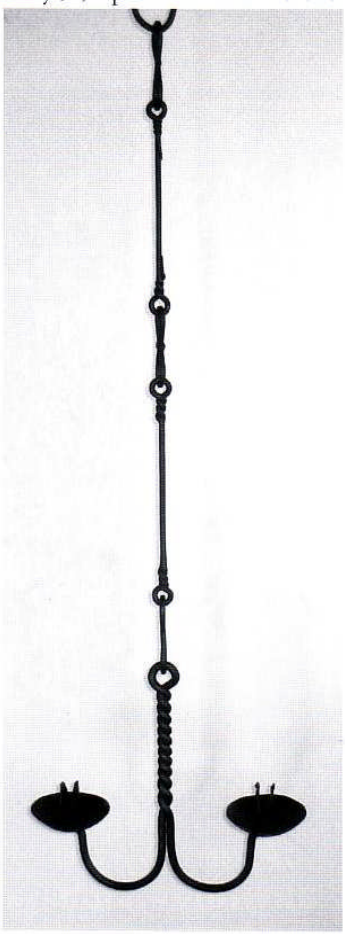
Keep it Simple, Make it Elegant!

A Two-Candle Chandelier
By Jymm Hoffman

Many people know me for doing historical reproductions and I want to make it clear that this chandelier design was given to me by Paul Browning of Sugar Grove, Ohio. I learned how to make it while working at Ohio Village in Columbus, Ohio, in 1981. I am not sure when Paul came up with the design, but I do believe he created it. The only real change that I made is the candle holders. I used to follow his design of a Y shaped, three-leaf candle holder until recently. I have found that two leaves work fine, is much faster to make, and uses less material. This is a great project for novices using a series of basic skills.

Materials:

3/8" Hot Rolled Round, 36" long, 1 piece for chandelier body
1/4" Hot Rolled Round, 8" long, 3 pieces for S hooks
1/4" Hot Rolled Round, 16" long, 2 pieces for chain bars
16 Gauge sheet: 2 disks, 4" diameter for wax catchers
1" by 5", 2 pieces for candle holders



Forge shoulders on each end of the 3/8" x 36" chandelier body rod. Sometimes I punch holes in the flattened area at this time, other times I wait and drill holes after the body is finished.

Bend and upset corners for the wax catchers and candle holders in the vise.

Heat and bend the rod in the middle, leaving enough room for 1/2" round rod to pass through. Heat about 6 to 7 inches of the doubled-over end. Try to get both sides the same temperature; I like a nice bright orange. Grip in the vise so that you hold both legs securely and twist fairly snugly to the 1/2" diameter rod. This will help to make a nice round eye. I like to make the eye line up with both legs. If necessary, I will gently but firmly put the twisted part in the vise to adjust the eye, making certain the center of the eye is in line with the centerline of the body of the chandelier. The body ends up being about 11 inches tall.

Forged shoulders on each end of the 3/8" rod.

Curve one leg over the horn. If you do not want to make a jig, get one leg to the size you want (mine are about a 4" diameter, making about an 8-inch spread), trace it on the face of the anvil with soapstone, and make the other one match. You can also mark your horn to help get it close. After this I move onto the decorative chain.

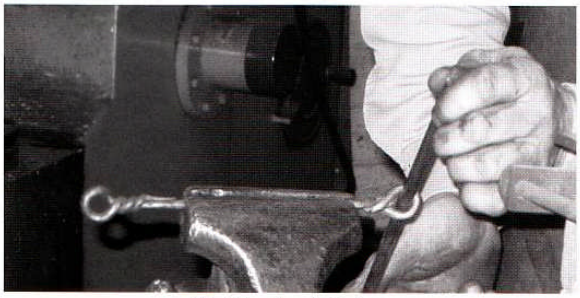
Matching the two curves with the aid of a soapstone.

The decorative chain is 3 "S" hooks with two bars that have twisted eyes on each end to connect the hooks. The hooks are made from the 1/4" round, 8 inches long, and closed. When making them, leave hooks open enough to assemble, let air cool and you can close them cold on the final assembly. Each hook ends up being around 3-1/2" tall.

The twisted bars in the chain are made from 1/4" round steel 16 inches long. Do not make as fine a point on the ends as when making S hooks because too fine a point twists up unevenly around the eye. I use a 3/8" round rod for these twists, again twisting snugly to the 3/8" rod helps form a nice eye. I then gen-

A completed chandelier body.

tly but firmly hold the twist in the vise to adjust the eye, normally by carefully hitting with my hammer, to bring the center of the eye in line with the center of the 1/4" rod. The twisted bars end up being about 9 1/2" long.



Twisting the chain bars.

For the wax catchers, I drill or punch the rivet holes first, or sometimes after forming the cup. In this case, it is for a 3/16" rivet. (I have cut nails for rivets, but they are a little harder than commercial rivets). I heat them up and toss them into a swedge block and form the cup, letting these pieces air cool.

When making the candle holders I rough cut the leaf shape, not even attempting to cut the round section of the base with the shears. I use a sharp (relatively new), 10-inch 1/2-round file to remove the material to form the round base and thin the area for the leaf to fold up. Once all of the burs are removed, I heated the leaves and put veins in them with a chipping hammer. An alternative to this would be to cold-chisel veins from the backside into lead.

The chain bar with S-hooks attached.

While hot, I curl the tip and give the leaf some round shape either in the step of a London pattern anvil, or in a half-round swage. Next, is to fold over a 3/4" round bar held vertically in the vise, again allowing these to air cool.

One of the chandelier's S-hooks.

Once all the "pieces parts" are made and cool enough to handle, I start assembling with the chandelier body and candle holders. With the 3/4" round bar vertically in the vise and long enough to be on the screw, I rivet the candle holder, wax cups and body together. If you put a little dimple in the top of the 3/4" bar, it will help hold and line up the rivet. Once the candle holders are on the chandelier, I assemble the chain. The last in assembly is the chain to the chandelier. Total length of the assembled chandelier and chain is about 38-1/2 inches.

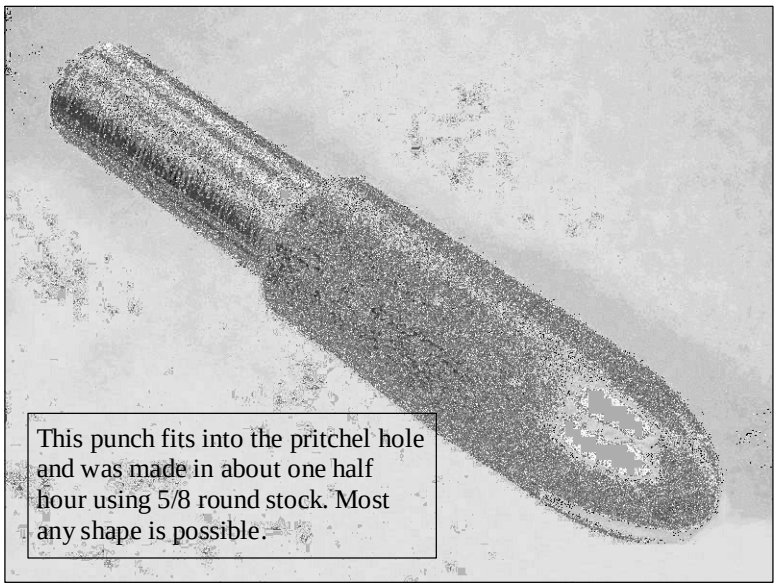
Depending on what I have on hand, as well as time and customer's preferences, I either wax, oil, or clear coat the final product. An alternative is to use tung oil on the chandelier, which gives a nice satin finish.

Many thanks to the Hammers Blow and the authors/artists responsible for this article and the one on forge welding later in this issue. It is with their willingness to share that I am able to bring such good information to the MFC members. Help support those who share with us by becoming members to the associations. See the application for ABANA, as a member you will receive The Anvils Ring and The Hammers Blow.
As a member of The Artist-Blacksmith Association you will receive the Artist-Blacksmith Quarterly.
By supporting them you are supporting Blacksmithing . Editor

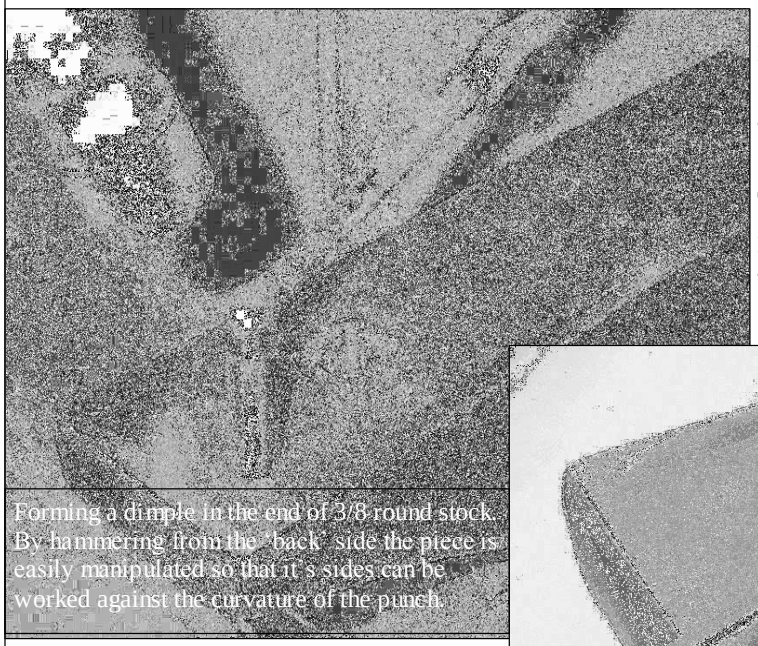
STATIONARY PUNCHES

by: Tommy Ward

Here's another "third hand" idea I saw Bob Patrick use - simple punch type tools held in position by the anvil's pritchel hole. Why not eliminate the frustration of juggling a punch, hammer, and odd-sized work piece by making up a few of these stationary punches that allow you to hammer from "behind" the piece; controlling the work in one hand and hammering with the other. An added benefit, particularly on thin sections, is that the work remains hotter longer when not in direct contact with the cold mass of the anvil.

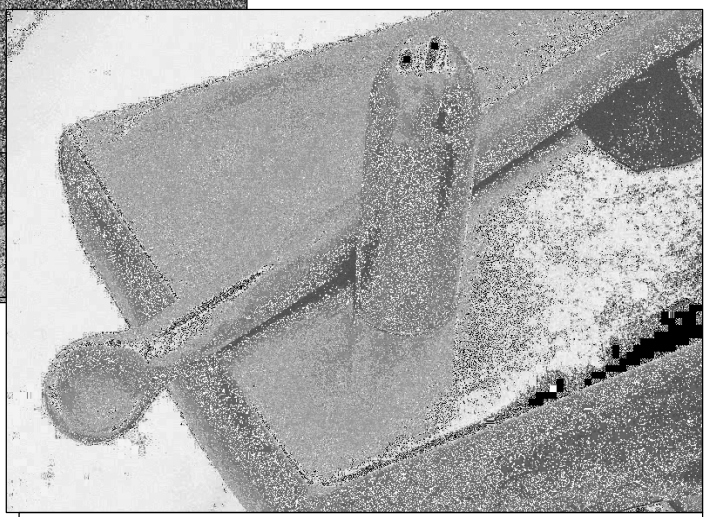


This punch fits into the pritchel hole and was made in about one half hour using 5/8 round stock. Most any shape is possible.



Forming a dimple in the end of 3/8 round stock. By hammering from the 'back' side the piece is easily manipulated so that it's sides can be worked against the curvature of the punch.

These things are simple to construct, making them attractive for "one time" projects. Most pritchel holes seem to be in the neighborhood of around 1/2", so any stock that's slightly larger can be used. No limit on the design; most any configuration of hand punch that you would use for repousse' or detailing could work. Metallurgy, refinement of design, degree of finish, etc., will be your choice based on application.



The deep dimple on the end of a rod makes a nice recessed screw hole for mounting brackets, sconces, and the like, or by drawing out a bit of taper and developing a bend at the taper, an attractive foot can be fashioned for pieces with legs.

From: The ABANA Forums [forums@abana.org]

My first shop had a dirt floor that was always dusty. Hard to sweep up the chunks of clinker and chips of waste metal that fell on it - sweeping always raised clouds of dust.
Because my half-barrel quench tub leaked each time I refilled it I had a mud hole. (The top part of the staves had to re-swell to stop the barrel from leaking.)

To fix the dusty / muddy mess I wet the dirt down with a garden hose to make it good and muddy. I then poured two inches of pea gravel onto mud, covering every square inch of the floor. I used a gardener's tamp to drive the gravel into the mud. I didn't stop wetting down the floor and tamping the gravel until I had the last of the gravel embedded with no loose pieces. When the mud dried I had a level floor that was no longer dusty. Easy to sweep, too._____

CONTROLLED HAND FORGING

Forge Welding

By Dan Nauman
Illustrations by Tom Latané
Photos by Dan Nauman

Lesson Number 10– Forge Welding

Definition:

Fusing two or more bars together by bringing them to a high heat in a forge, and applying pressure to the area being fused by hammer blows.

Lesson: Upsetting, scarfing (see Definitions, right), and forge welding the ends of two bars of equal size together to make one bar.

Intent: The smith will learn the technique of welding two bars of equal size together, accurately maintaining the original stock size and shape after welding.

Materials: Two 15" bars of 1/2" square mild steel.

Tools needed: Basic tools include standard cross peen hammer and anvil. Flux (see Definitions, right), either borax or EZ Weld. Calipers and a square can be used to evaluate your work.

Method:

Forge welding is used in several circumstances: to produce a smooth transition of adjoining elements; to secure several elements into a bundle (i.e., leaves, grapes, acorns, basket twist); to join a bundle to another element; to close the ends of a single bar shaped in a ring, oval, or rectangular shape (as in a frame); to join mild steel to high carbon steel (as in an ax bit); or to laminate several bars together to form a billet (as in Damascus laminate).

A forge-welded sample from Cyril Colnik

Definitions:

1.) **Scarf** (scarfing): Preparation or preparing a portion, often the end of a bar for welding, by tapering to a thin edge which can be blended into the mating material.

2.) **Flux**: The product applied to the areas to be fused to reduce oxidation, and lower the melting temperature of the scale. (Examples: borax, EZ weld, etc.)

3.) **Clinker**: The hard, gritty, often glassy mass that congeals in the bottom of the firepit.

4.) **Coke**: Soft coal that has had the bulk of its impurities burned out. Coke's appearance is puffy. As good-quality soft coal burns, it expands and congeals to the neighboring coal nugget, forming a larger mass. Almost entirely carbon in its makeup.

Note: Just as there are different approaches to other aspects of forging, the same is true for forge welding. It cannot be said that any one way is best, as there are many experienced smiths who produce consistently sound welds in a different manner than explained here. Different scarf forms, different fluxes, and several other aspects of forge welding can be learned and utilized. To introduce these differences in this lesson would prove confusing to the student. Thus, this lesson will concentrate on the method taught to me in the 1970s. Differences aside, the fundamentals usually prove to be similar or identical.

In all cases, a high heat is needed at the point of fusion to successfully weld the bars together. The color of the bars should be yellow to yellow/white when removed from the fire. The only exception to this would be when welding high carbon steel to mild steel. A lower heat of orange/yellow should be the highest heat applied so as not to burn the carbon out of the carbon steel.

The gray scale that forms on a bar when heated is the enemy of the forge weld. The bars will not fuse properly when scale is

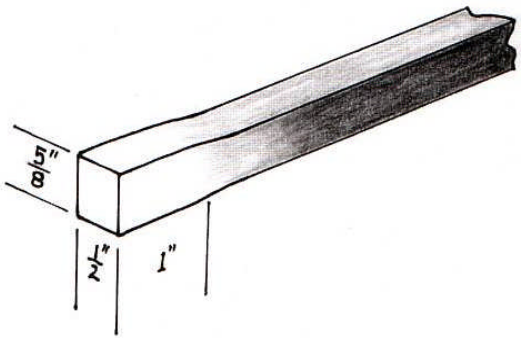


Figure 1: Upset end preparation

CONTROLLED HAND FORGING

present. Scale forms on the outside of the bar in the presence of oxygen. Flux forms a barrier around the areas to be fused, protecting it from oxidation. It is applied to the bars at an orange heat. Flux is not glue, or a bonding agent, rather it lowers the melting temperature of this scale, and prevents more scale from forming while heating in the fire. Some smiths theorize that to some degree flux also raises the burning temperature of the metal.

Another important aspect of welding is to be absolutely sure you have a "clean," domed fire. A clean fire is free of a clinker in the firepit, and has no fresh coal burning in the center of the fire. A good welding fire also has an abundance of coke domed and banked in the firepit. Should the fire "hollow out" while heating the bars, only coke should be added to the fire to replenish the fuel. Fresh coal cools the fire, and also introduces impurities naturally found in coal. These impurities are largely burned out as the coal becomes coke.

When taking a welding heat, a good deep fire with the bar in the center of the fire under a good two or so inches of coke will reduce (but not eliminate) the amount of scale which forms on the bar during heating.

Step One–Preparing the scarf:

Taking a short high (yellow) heat on the last 1" of the bar. Then upset about 1" of the end of the bar so that the bar measures at least 9/16" square. (See previous lesson Number 7) Next, forge one dimension back to 1/2", producing a cross section measuring 1/2" x 5/8".

Step Two:

Take another yellow heat on the end of the bar, again on the last 1" of the bar, place the end of the bar (with the 5/8" sides vertical) squarely on the anvil's face with the end of the bar 1/4" from

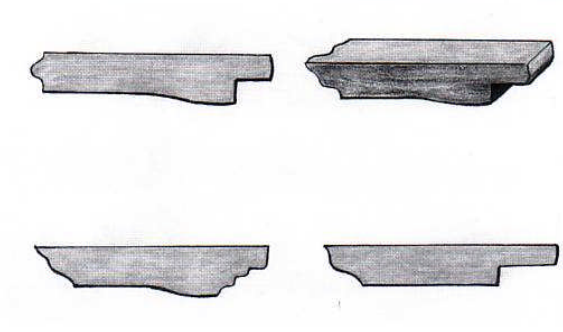


Figure 3: Above, correct. Below, incorrect. Left– initial shoulder backed off anvil too soon. Right– no upset remains for scarf to be laid upon during weld.

the inside edge of the anvil. The edge of the anvil should be somewhat sharp for this step. Hitting straight down with the hammer's face halfway above the anvil face and halfway beyond the anvil face (Figure 2, photo), reduce the cross section to about 1/2 the thickness of the material, in this case to 5/16".

Tip: In order to create a clean shoulder in this operation, put a slight downward pressure on the bar so the bar stays where you put it. Then after the first or second blow add a slight forward pressure to keep the bar from "stepping" off the anvil.

Step Three:

The forging dynamics of the material will cause the area of the bar on top of the anvil to slightly spread wider than desired. In the same heat from step two, turn the bar 90 degrees, and forge this area back down to 1/2" in thickness.

Step Four:

Take another yellow heat on the last inch of the bar. Place the

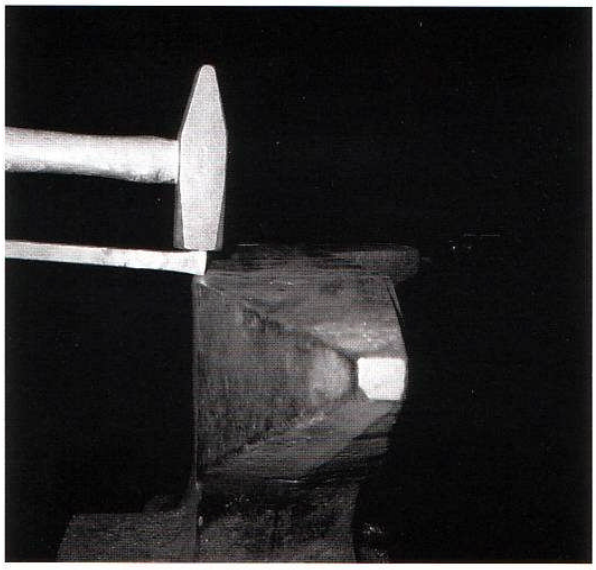


Figure 2: A half-face blow.

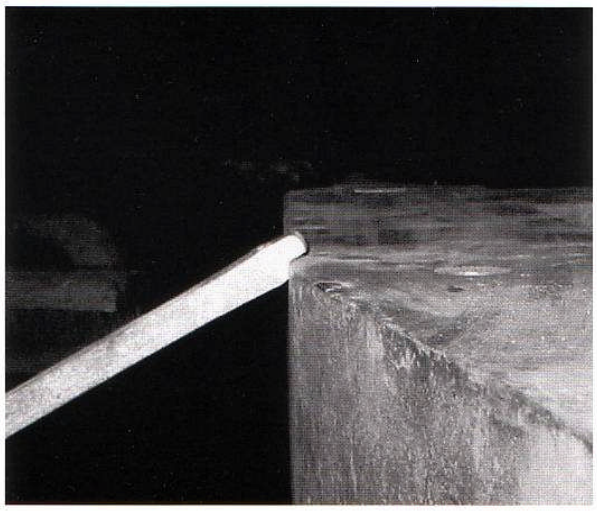


Figure 4

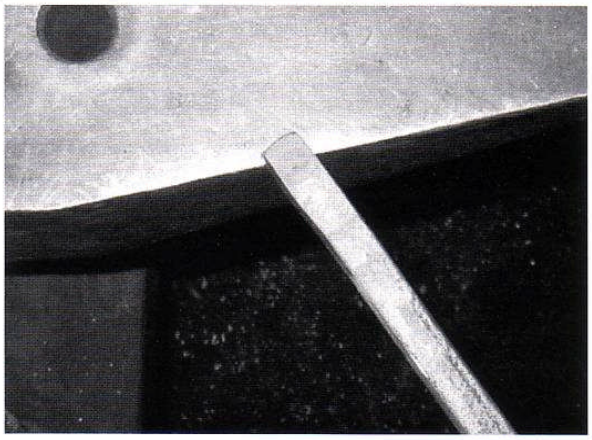


Figure 5

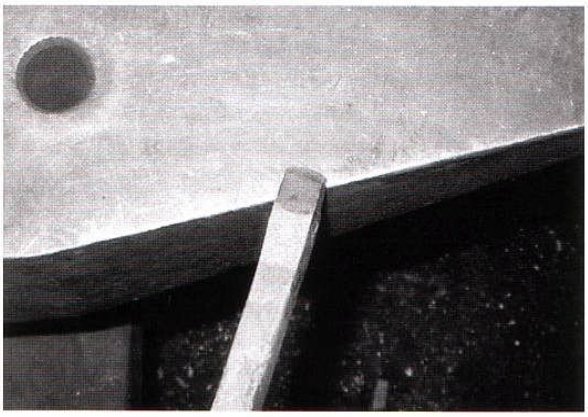


Figure 6

shoulder produced on a sharp edge of the anvil, pressing the shoulder squarely against the side of the anvil. The hand the bar is holding should be lowered slightly so the face of the scarf is off the anvil face. (Figure 4, photo). Move the hand holding the bar to the left of square, and take a blow. Moving the bar back and forth at a 90-degree angle (right to left), and using each step produced by the previous blow to brace against the side of the anvil, slowly step the bar off the anvil. (Figure 5, photo). In this same process, the profile of the bar should be drawn out to a flat point. (Figure 6, photo). If done correctly, the face of the scarf should have steps as shown in Figure 7. When the scarf is drawn out, forge a slight curve at the end of the scarf. You should be able to do all of step four in one heat.

Notes on scarves:

The reason for the curve at the end of the scarf is simple. The anvil acts as a heat sink when hot metal is applied to it. If the end of the scarf is not off the anvil when welding, it might cool too rapidly, and the weld will not be properly fused in this area. The curve keeps the thin edge of the scarf off the anvil before the first blow, retaining the heat longer to produce a sound weld.

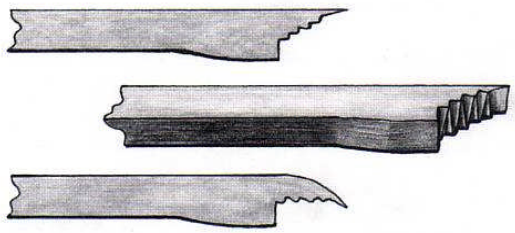


Figure 7: Top– shouldered and stepped scarf. Bottom– Curved tip. Shoulder prevents scarf from overlapping beyond upset area when scarves are quickly placed together.

The thin tapered edge of the scarf is formed to produce a smooth weld joint. A scarf with a thick edge will produce a weld with a very visible seam (Drawing, figure 8).

Step Five:

Repeat steps one through four on the second bar.

Step Six: Fluxing the scarves.

SAFETY! - Some fluxes may emit noxious fumes when heated. Make sure your forge and building are vented properly.

Reduce the air blast in the fire if you have an electric blower. If you are manually applying the air blast, reduce the force of the blast to more of a whisper. This will reduce the chances of burning the scarves while fluxing by reducing the available oxygen in the fire.

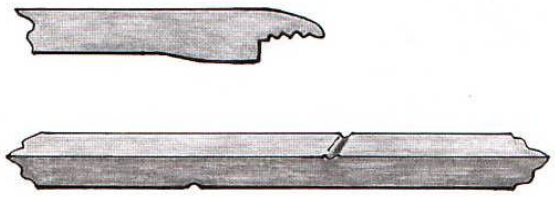


Figure 8: Blunt scarf makes seam difficult to blend.

Making sure you have a clean and deep fire, place the scarves into the center of the fire, face up. If the bars are not covered with coke, cover them. When the bars reach a bright orange, with the bars remaining in the fire, take your fire rake make a hole in the fire over the scarves so flux may be sprinkled on the face of the scarves. With a small spoon with a long handle (so you do not burn your hand), apply enough flux to cover the scarf, as well as beyond the scarf where the other scarf will join. (Figure 9, drawing). Cover the bars once again with coke. When you are finished fluxing the scarves, position them so they are facing down in the fire.

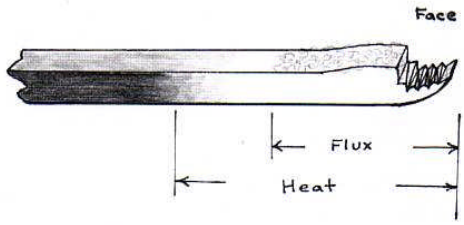


Figure 9: Fluxed face heated from below.

Notes:

One of the biggest mistakes beginners make in welding is not applying the flux back far enough on the bar where the bars will be fused.

Some smiths prefer to flux all sides of the scarves, while others simply apply flux to the scarf faces. The theory behind fluxing all sides of the bar is to insure that all surfaces are free from scale, as well as to increase the burning temperature of the bar. The bar can and will burn if allowed to get to a full sparkling white heat, at which point the flux will also burn off. The bars likely will not weld at this high temperature. Also, the molecular structure of the material will break down, creating a weaker joint, and often an unsightly weld.

If you choose to flux all sides of the scarves, turn the bar 90 degrees only after you are certain the flux has adhered to the scarf surface. You will know when this happens, as the flux will be the same color as the bar. If one bar gets hotter than the other, move it to the side of the fire where the fire is cooler, or reduce the air blast further.

Fluxing the scarves in the fire keeps them hot, and reduces the amount of scale formed, therefore shortening the time it takes to produce the weld. Removing the bars from the fire to flux the scarves is not necessarily wrong, as many smiths prefer this procedure, and do so successfully. Sometimes, fluxing in the fire is virtually impossible (i.e., welding a wagon wheel tire.) In these cases, removing the bar from the fire is necessary.

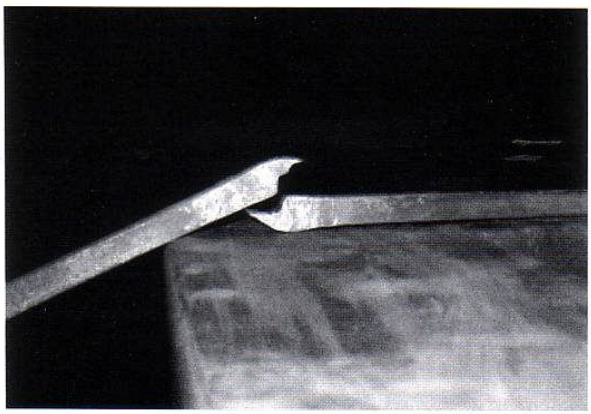
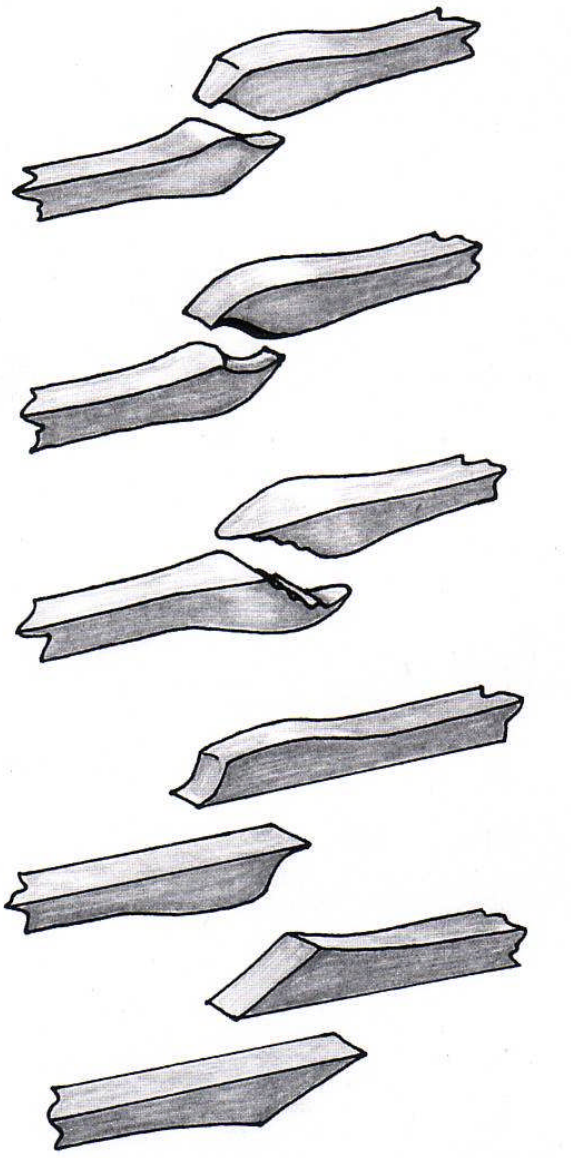


Figure 10



Some other forms of bar end scarfs. The 90° shoulder on the scarf described in the text will aid in quick alignment of bars to be welded, preventing overlap beyond upset material.

Always keep coke on top of the bars when not in the act of fluxing.

Tip: Rub soapstone or chalk on the face side of the bar to indicate direction of the scarf face when pulling the bars from the fire.

Step Seven: Welding the bars

Have your hammer at the anvil in a position to grab it quickly. The scarves are at a welding heat when they are at a yellow-white appearance in color (often referred to as a "welding heat"). Make sure the scarves are heated well beyond the shoulder where the

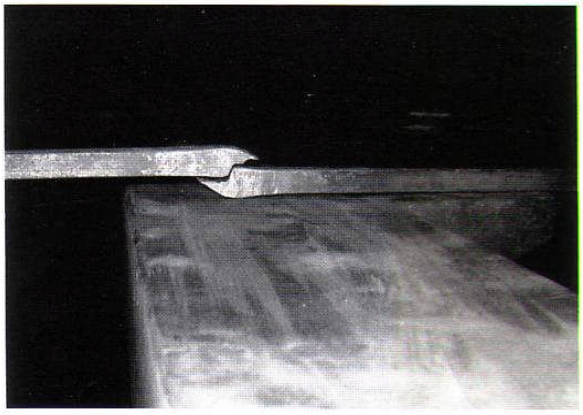


Figure 11

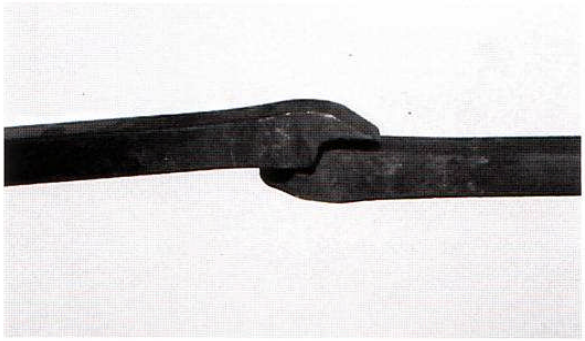


Figure 12

mating bar will join. Some smiths wait to see just a few sparks coming from the fire, indicating the piece is just starting to burn. This is not necessary, and can lead to burning the tips off of the scarves.

Tip: If you are not sure if the pieces are at a welding heat, gently touch the pieces together in the fire. If they want to stick, almost like a magnet, they are probably ready to weld. With experience, this touching in the fire will not be necessary.

SAFETY: When welding, molten sparks fly from the bars which can burn others, as well as you. Alert others in the area when performing a weld, and make sure other items in the shop that are flammable are protected from the sparks. Some smiths wear a protective leather apron when welding to prevent their clothes from burning. You and anyone else present should be wearing eye protection with side shields at all times. After welding, be aware of the possibility of fire caused from stray sparks in the surrounding area, i.e., shop rags, charcoal, dry wood, etc. These items and others ignite easily from molten metal and flux spattered from the forge-welding process.

Bring the pieces out of the fire, rotating one piece 180 degrees so that the scarf is facing up. Place the bar with the face up on the center of the face of the anvil, coming in from the far side of the anvil. (This bar should be in your hammer hand.) Place the other bar on the near edge of the anvil, with the scarf off the

Figure 13: Bars for practice weld– no alignment of scarves.

face, pointing up at about a 45-degree angle. (Figure 10, photo). In a hinging fashion, lower the scarf down onto the opposing scarf, keeping contact with the edge of the anvil to control the accuracy of the placement of the scarf (Figure 11, photo) and press down on the opposing scarf. The heels of the scarves should be placed together as shown. (Figure 12, photo). Press down hard enough so you can release the bar in your hammer hand.

Release the bar in your hammer hand, grab the hammer, and strike firmly in the center of the joint. Forge the entire joint rapidly with six or seven blows. Make sure you forge the thin tip of the scarf as it will cool rapidly. Next, flip the now-welded bar 180 degrees to forge the opposite side. Hit six or seven blows on the entire joint and then turn the bar 90 degrees and repeat five or six more blows on the joint. Flip the bar 180 degrees and hit the joint once again five or six blows. Repeat as necessary, never forging colder than a medium orange heat.

Note: Dark spots on the joint indicate cooling of the material and will not weld there. This may be caused by too low a heat, or inadequate fluxing. These areas must be fluxed again, returned to a welding heat, and forged to fuse the joint.

While welding, keep in mind that you do not want to forge the cross section of the joint down beyond the parent stock size. Also, be careful not to forge beyond the joint as this will also reduce the cross section of the bar beyond the parent stock size.

With a properly executed weld there will not be any "dark spots" or evidence of a scarf. If there is evidence that the weld is not complete, flux the open seams of the joint, and take another welding heat. Remove the bar from the fire, and forge down carefully, so as not to greatly reduce the cross section of the bar beyond the parent stock size.

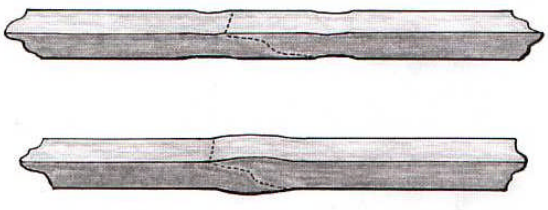


Figure 14: Top– thin areas due to loss of material from burning, too little upset, or over-hammering, must be upset. Bottom– remaining bulge must be drawn down to dimension.

Note: Timing is important. If you take too much time getting the pieces from the fire to the anvil, you may lose too much heat to weld the bars together. To increase your proficiency, you may want to take a few "practice runs" by removing the bars while cold from the firepit, positioning them on the anvil as described in step seven. Do this until you are comfortable with the procedure. You will then be able to release the bar from your hammer hand and grasp the hammer without the bar falling to the ground.

Tips:

-Some fluxes, such as EZ Weld brand, are very aggressive and may adhere to the metal after the weld has been completed. To remove it, take another welding heat, remove the bar from the fire, and scrub vigorously with a stiff wire brush. Flux is harder than a file, so do not try to file the flux off, as it can ruin your file.

-A lighter hammer of 1 1/2 to 2 pounds may work better than a larger hammer. With a lighter hammer, the hammer can be swung faster and more accurately. Also, the chance of forging down beyond parent stock size is reduced with a smaller hammer, as you will not have the heavier force of the larger hammer.

-You may want to first practice a more simple weld to get used to the properties of forge welding. The faggot weld is a simple, crude weld which has no end preparation (no scarves.) Try bending a 3/16" x 3/4" piece in half and weld the last 3/4" of the end of the bars together. (Figure 13, drawing). Be extra careful when performing this type of weld, because the larger surface area causes more molten flux and sparks to fly from the joint.

Step Eight: Refining the weld (If necessary)

If the cross section of the joint is still larger than the parent stock size, place the bar back in the fire and bring the joint to a welding heat. Remove the bar from the fire, and carefully forge the joint back down to the parent stock size.

Potential problems and solutions:

If the weld is properly executed, the joint is invisible, the bar has no bulges or "necked-in" spots, and has sharp 90-degree corners. (Figure 14, see drawing of bulge and necked-in spots). To refine the bulge, proceed as described in step eight.

If the bar is necked in, it will be more difficult to fix. The portion of the bar where it is necked in is taken to a welding heat, and then upset (refer to Lesson Seven, *Hammer's Blow*, volume 12, #1, Winter 2004) back to the parent stock size. A poorly executed weld will begin to come apart or fail entirely in the upsetting process.

If a parallelogram was formed at the joint, first upset the joint, then take another heat and forge down the acute angles slightly. (As explained in Lesson One, *Hammer's Blow*, volume 11, #1, Winter 2003.) Then carefully reduce to the parent stock size.

Targets:

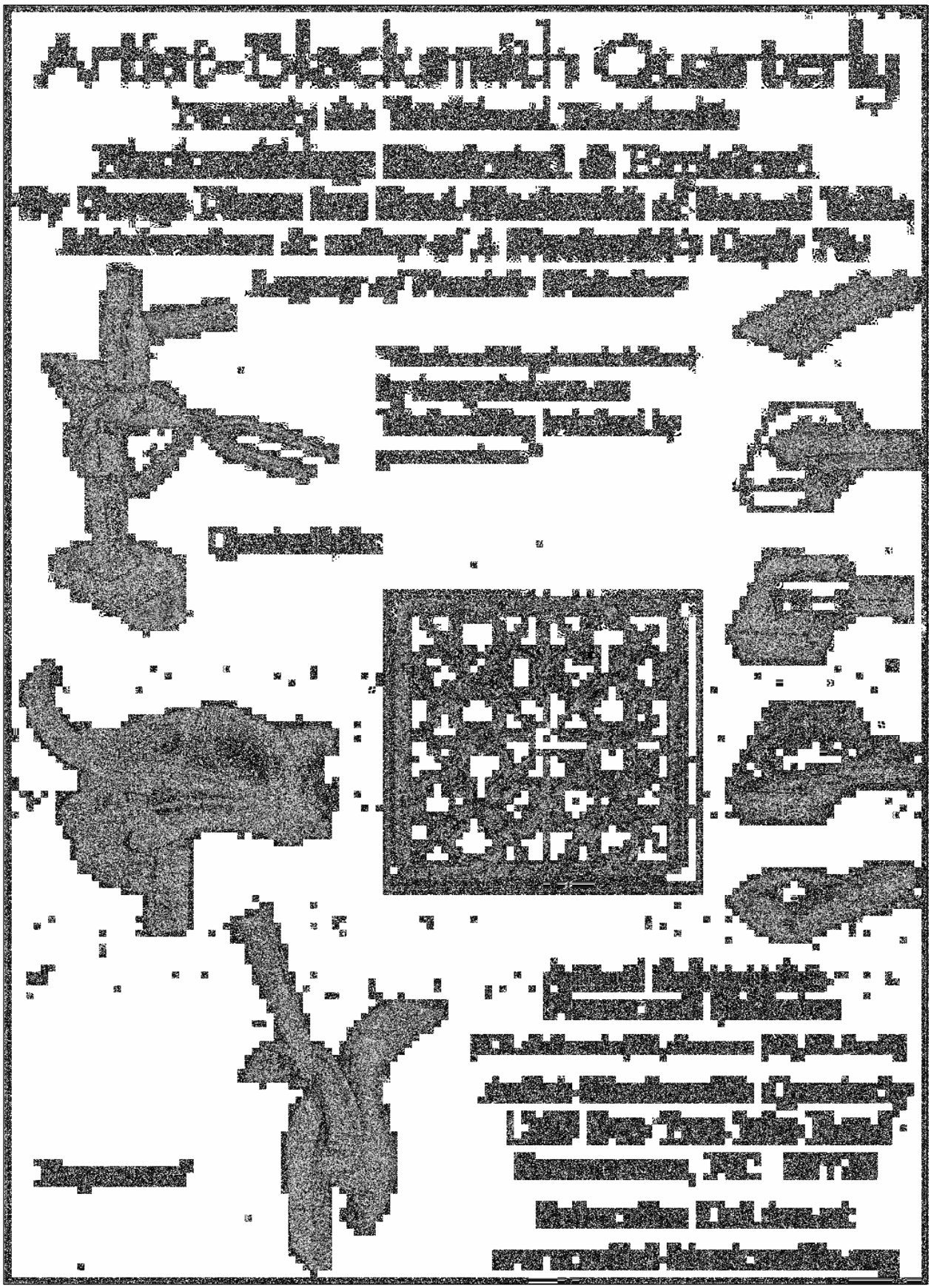
-The scarf is produced in one heat.

-The weld is completed in one to two heats, and the joint returned to the parent stock size.

-The joint is to be square in section with sharp corners, no necked-in areas, and no bulges. You can check your accuracy with a pair of calipers. Check for squareness with a steel square.

-The welded bar is to be straight, have no twist, be free of flux residue and the bar should have no visual evidence of a seam.

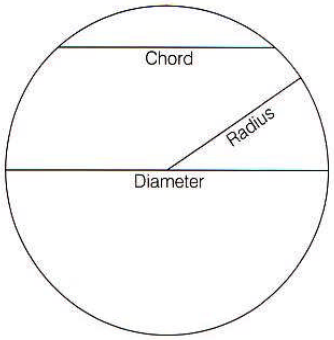
More examples of forge welding from Cyril Colnik

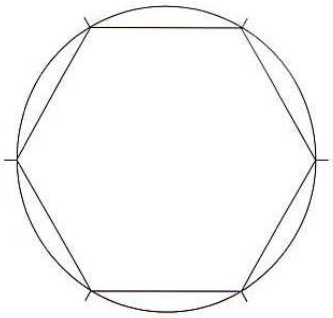


Dividing Circles

by Paul Quyle, Murphys, California

A few years ago I was visiting the shop of my wonderful friend, Morgan Keaton. As always he was busy, this time laying out bolt holes for a circular plate that was to be bolted onto some machine. It was a circular plate with eight bolt holes uniformly spaced on the circumference of a scribed circle.





I would have spent far too much time trying to do this by trial and mostly error with dividers, walking them around the circle, changing size until I got what I wanted.

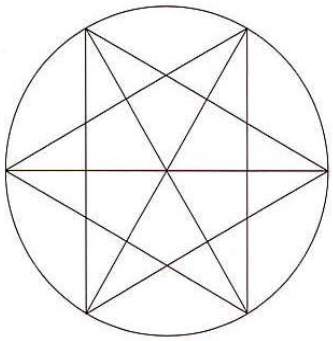
Not Morgan, he pulled out a little chart from his tool box, made one small calculation, set his dividers and in the first try, he had perfect divisions. He told me it was an old method used by machinists for many years and that a circle of any size could be divided into any number of divisions based on its diameter expressed as a unit of one. His little chart was labeled *Chordal Values (see next page)*. I have no idea where it came from; he had cut it out of some publication. I copied it and have made use of it many times; it is a real labor saver.

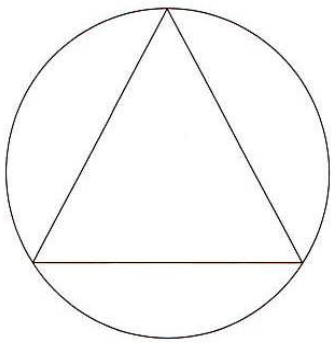
The math involved in arriving at these values is way beyond anything I want to worry about. I did go so far as to dig out my old high school text to review circles and nomenclature. To understand how to use the chart, some explanation of circles is necessary. So let's start by looking at a circle drawn with a compass.

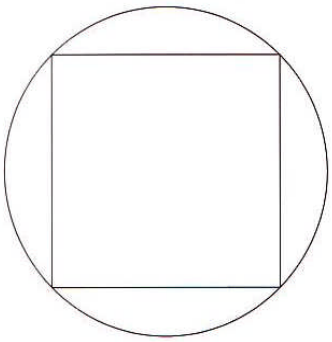
A chord is a straight line that has its end points on the circumference of the circle. A chord, therefore, has a limited length. The longest chord that can be drawn is a diameter. We all remember from elementary school that if we use a compass to draw a circle, the radius can be used to step off the circumference into six equal parts. Draw lines or chords between these points and you have a nice hexagon.

But now try to divide that circumference into, let's say, 17 parts. Life becomes very much more difficult. That is where this little table of *Chordal Values* becomes of so much value. Simply look up the number of divisions you want, read across to find a decimal number and multiply the diameter by this number. For example, we want to put 17 bolts around the circumference of a 13" diameter circle. Simply look at the chart for the number of spaces wanted, read across to the decimal number .1838. Multiply the diameter of 13 by the value .1838, which equals 2.3894. Set your dividers to exactly 2.3894" and start stepping off the circumference of the circle. You should come out with exactly 17 divisions.

Discrepancies will be from inaccurately setting the dividers. This chart only goes up to 32 holes; if you want more, you are on your own! These values allow you to form many different shapes; for example, other shapes such as triangles, octagons or stars are all easy to do.







Chordal Values

Divisions	Length of Cord	Divisions	Length of Cord	Divisions	Length of Cord
3	.8660	13	.2393	23	.1362
4	.7071	14	.2225	24	.1305
5	.5878	15	.2079	25	.1253
6	.5000	16	.1951	26	.1205
7	.4339	17	.1838	27	.1161
8	.3827	18	.1736	28	.1120
9	.3420	19	.1646	29	.1081
10	.3090	20	.1564	30	.1045
11	.2817	21	.1490	31	.1012
12	.2588	22	.1423	32	.0980

ABANA

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President's Letter

March, 2005

Well, the weather is warming, and renewed interest springs forth for many of us to explore a new skill or idea in our pursuit of excellence in the art of blacksmithing.

The craft school brochures and workshop opportunities seem a little brighter as you read them. You get to thinking of a visit to other shops to gain new ideas or of working with a 'master' in a technique you want to learn more of. Reading published articles and opportunities to attend demonstrations occupy more of your attention?

GREAT! One of ABANA's goals is to foster that enthusiasm!

After a patient and a diligent effort of a dedicated group of members, the "ABANA EDUCATIONAL ENDOWMENT TRUST" is becoming a formal reality, even as this goes to press. Combining the old "National Endowment Trust", the "ABANA Scholarship Account" and a contribution of general funds into the new educational trust will provide initial funding. Income from the TRUST will provide annual scholarship and grant funds for the committee to award to members. In your committee's words:

"First, I'd like to explain the purpose of the scholarship program as I see it. As is the case with

(Continued from page 24)

all of ABANA's activities, our mission through the awarding of scholarships is to promote the craft of blacksmithing. This happens in at least three possible ways: first, a member who receives a scholarship gets financial assistance as they pursue some aspect of blacksmithing. This most often comes in the form of taking a class or workshop, but it might extend to assistance needed to travel in order to study or document a rare technique, or a style of work unique to a specific geographic area, or a specific time period. That is the easy part, and generally, it primarily benefits an individual member. Secondly, and more to the benefit of the general membership, [it is your money we award] each scholarship recipient incurs a debt to ABANA. How a scholarship recipient repays that debt to the membership depends on the individual project, amount of support, level of skill, and location of the recipient. All scholarship recipients are expected to share what they have learned with the membership, whether through articles, tips or techniques in the Hammer's Blow or The Anvil's Ring, or through demonstrations or presentations to an affiliate of ABANA. Some recipients also may be expected to publish in affiliate newsletters, outside publications, give public demonstrations, exhibit work to the public, and promote ABANA in their travels.

The third way that ABANA members can benefit from the scholarships we award is by attending a workshop or demonstration supported by an ABANA scholarship. Many scholarship recipients give demonstrations, and we offer a scholarship to affiliates in order to help them offset the costs of bringing in visiting smiths from outside their area. In any case, get to those demonstrations when you can. It is one way for many members to benefit from a single scholarship."

Initial funding of the educational trust was explained above. The trust will continue to add to its principle with income from "Iron-In-The-Hat" proceeds.

It is also set up to receive tax deductible donations to its principle [the more it grows, the more income derived to invest in educational pursuits!!]. The trustees, Dorothy Stiegler, Bill Callaway, Doug Learn, "chief promoter" Will Hightower or the Central Office will be glad to furnish additional information.

NUFF SAID!

Scholarship applications and deadlines are available on-line at: http://abana.org/resources/education/index.shtml, or through the Central Office.

The committee chair is Chris Winterstein, board member, alumni of the Metal Museum program, instructor and demonstrator, coordinator of the iron and wood studios at the Penland School of Crafts, gallery exhibitor, and operates a shop accepting private commission work. [He and his committee have the background to give your application the full consideration it deserves!!]

Tips on Applying for an ABANA Scholarship:

- First, read the instructions! In order to apply for a scholarship, you must have been a member in good standing for at least six months (one full year for applications requesting over $1000.)
- Only completed applications will be considered.
- ABANA does not award funds for college tuition assistance.
- It is expected that in undertaking a course of study, an applicant have an instructor or program in mind. We do not grant funding to provide "time for developing work."
- An affiliate, rather than an individual, must apply for funding to support a workshop or demonstration.
- The more you want, the more we want! It is our job to insure the best value to the membership through the awarding of scholarships. A thorough, well-prepared application including documentation of costs and financial needs, and outlining benefits to the individual as well as the general membership is expected. The level of detail should match the level of support requested. That is, if you want $1500, we expect more than if you are asking for $200. Finally, due to limited funding, your chances are better of getting a smaller amount of money than a larger one. It is just a fact."

Whether you seek scholarship funding, have a chance to attend a demonstration or read an article from a recipient, or become a contributor to the Educational Trust, I hope the fire of smithing continues to burn a little brighter in your mind.

Don Kemper
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dkemper@abana.org

A Blacksmith's Craft

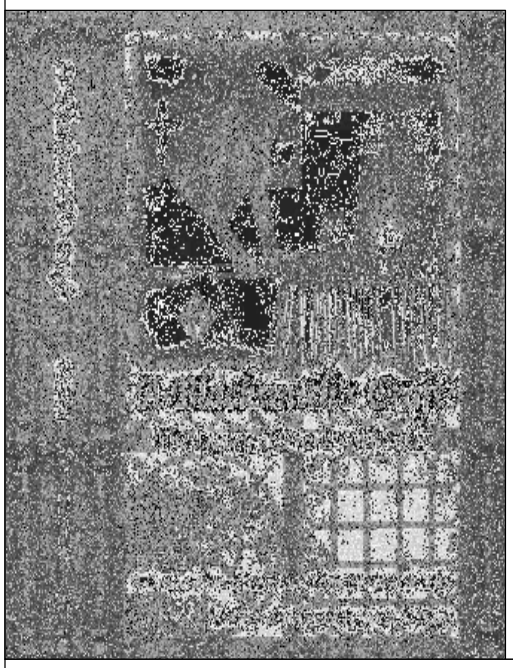
The Legacy of Francis Whitaker

By George Dixon

There are over 750 illustrations in this 128 page book by George Dixon. The chapters were approved by Francis Whitaker 8 months before his passing.

Editor's Note

I think this is one of the best blacksmithing books ever printed. You will not regret having this information available. I am already looking forward to Volume 2



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Tip From Benny Crevitt's Shop

from the Mississippi Forge Council Newsletter

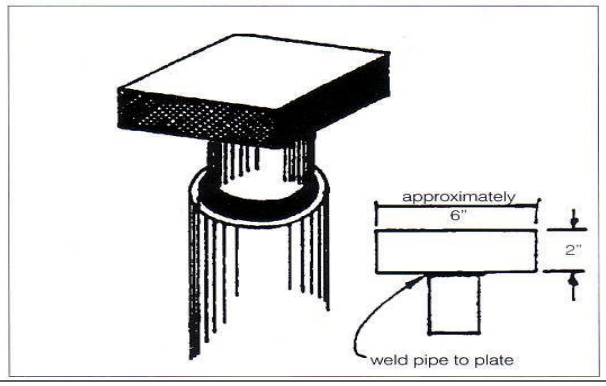
When working with small pieces, the closer you can stay to the fire, the more iron you can move and the fewer steps you have to take.

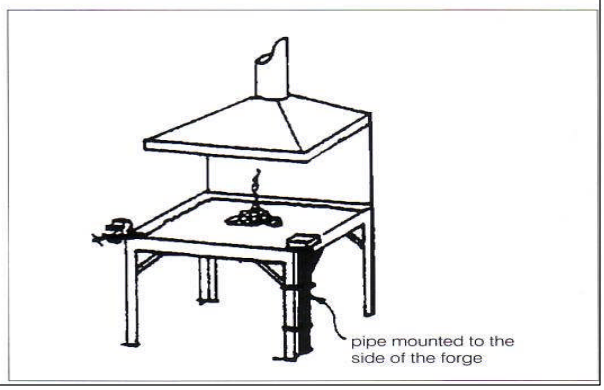
The 2" thick plate metal is heated in the fire and dropped into a pipe mounted to the side of the forge.

Use the 2" plate for a *preheated anvil* to keep thin pieces from losing heat while forge welding.

Benny says, "You can stand in one place and not have to move back and forth. When you're making a hundred repetitive items (e.g. scrolls, twists, etc.), every step saved adds up."

A small vise is mounted on the side of the forge for quick twist of small pieces. ♣





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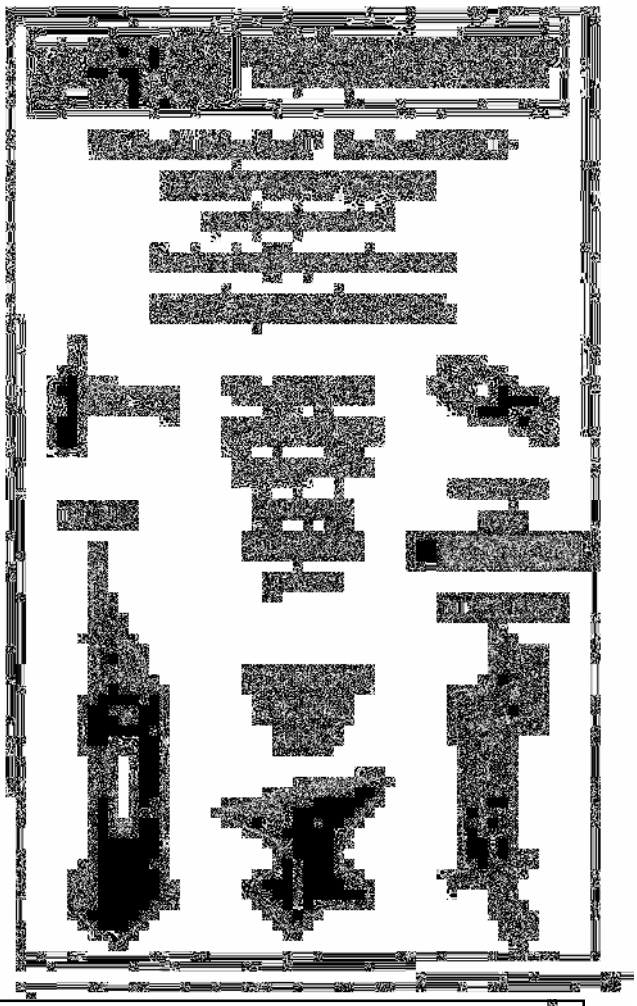

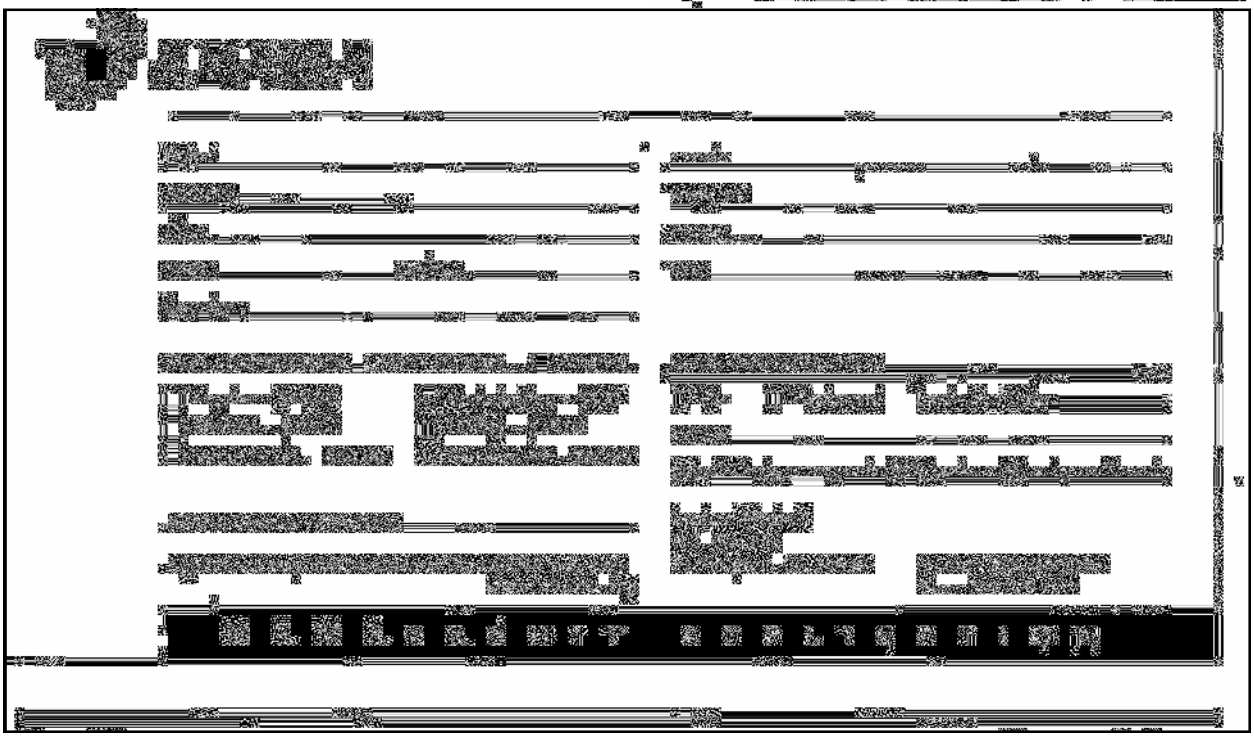

Mississippi Forge Council Membership

Date ————————————————-

Name -————————————————

Spouse ————————————————-

Address ————————————————

City ————————————————

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Make check for $25.00 payable to MFC and send to:
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PO Box 320744
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MFC is an affiliate of the Artist-Blacksmith Association of North America (ABANA) Dues are $25.00 per year and include subscription to The Upset.

Disclosure
Blacksmithing is inherently a dangerous occupation. You are responsible for using eye, ear and respiratory protection and safe work methods. The Mississippi Forge Council, it's Officers, demonstrators, writers, editors and members specifically disclaim responsibility for any damages, injuries or destruction of property as a result of the use of any information published in the Newsletter, demonstrated at conferences or at meetings. Every effort is made to insure the accuracy and safety of information provided, but the use of any material is solely at the user's own risk.

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