



Sofa Sounds

Southern Ohio Forge and Anvil

Newsletter

January 15, 1993

MARK YOUR CALENDAR: Unless otherwise noted all meetings will be held at the Studebaker Frontier Homestead on St. Rt. 202 about four miles north of I-70 and two miles south of the intersection of St. Rt. 571 and 202. Please do not park in the grass or block access to a production area. Donations of items to support the newsletter are always welcome. Finger food and cold drinks provided on a break even, honor donation basis. The forges at the homestead are available before and after the meeting for individual projects. Bring and wear safety glasses. Demonstrations are open to the public and are no charge.

Upcoming Events:

February 6, 1993 -

SOFA MEETING at the Studebaker homestead.
Demonstrator will be **Brian Thompson** making various hooks for hanging plants, fireplace mantle and other uses.

March 6, 1993 -

SOFA MEETING at the Studebaker homestead.
Demonstrator will be **Richard Kern** forging Screwdrivers and Wrenches.

April 3, 1993 -

SOFA MEETING at the Studebaker homestead.
Demonstrator will be **Doug Fink** showing the forging of fancy Candle Holders.

April 24, 25, 1993 -

Blacksmith of Missouri (BAM) second annual Ozark Regional Blacksmith Conference in Potosi, Missouri. See further details inside this newsletter.

May 1, 1993 -

SOFA MEETING at the Studebaker homestead.
Demonstrator will be **Hans Peot** on Proper Damascus billet making.

May 14-15, 1993 -

Sixth Annual Blacksmith's Conference, Madison, Georgia.

President's Note from Ron Thompson:

Welcome to the first newsletter in a long time produced by someone at SOFA other than Ken Scharabok. Ken has done an outstanding job as newsletter editor, conference chairman, and now vice-president of SOFA. He has asked us to find another editor to relieve him of some of his workload and we currently have that position open. If anyone has an interest in helping us out, please contact any member of the board. These are big shoes to fill, since we at SOFA are famous all over the country for our newsletter. So, while we are looking for an editor, a few of us are going to rotate the job around, give Ken a much deserved rest, and get the quality of the newsletter down to something any normal individual could tackle. When it comes to reducing quality, naturally the membership looks to me for leadership. It's a tough job, but somebody has to do it. The way I look at it, if the quality drops low enough, someone will step forward. In the meantime, I'm going to do a couple, Hans Peot is going to do a couple, and Larry Wood will do two. Couple, couple, two. Sounds like a chicken joke. See, what did I tell you, the quality's coming down already. Actually, Ken has some pride, so he has contributed a lot of material and advice to keep the newsletter from being a disaster. He knows a person who needs help when he sees one.

January Meeting Report:

Last month's meeting on January 2, 1993 started the new year off in great fashion. Hangovers had dwindled to a steady throb, and we thought a good blacksmithing demo would counter the football withdrawal symptoms many of our members were experiencing. We had a very good turn-out for Bob Cruikshank's demo. Bob demonstrated making a squirrel cooker and a quilt rack with heart finials. A squirrel cooker is a device used for campers to cook meat over a campfire (almost never squirrels, mostly hot dogs). Bob started with a 8" piece of 5/16" square hot rolled mild steel. Flattened the end for about 2" back, and split it in two. He drew out the splits into tines, pointed on the ends, and made it into a meat fork. Bob then pointed the other end into a rat-tail, bent it about 90 degrees in the post vice, and turned it into a loop. The second piece of the same stock was pointed on one end for driving into the ground and an open loop with a fishtail end was made on the other end. This loop was tilted over about 45 degrees so the meat fork could be positioned in the part stuck in the ground. This arrangement allows for infinite adjustment of the meat fork and makes a very useful tool. Bob related as to how he has sold many of these sets over the years.

Next, Bob took a piece of 5/16" square hot roll stock about 9" long that had been previously flattened back about 1 1/2" down to about 3/16" thick and hacksaw down the middle. He separated the two ends and drew them into a rat-tail. The ends were quickly looped over the horn into a perfect heart and it was obvious Bob had done this many times. The other end was drawn into a rat-tail and made into a loop for holding the bar as shown in the accompanying sketch. A ninety degree bend was made about two inches below the heart and Bob had a heart hook for holding a bar. Now, make another just like it. Then he took a piece of 3/8" round about 40" long, pointed each end into a rat-tail and executed a perfect eye on each end. Bob was shooting for the finished bar to be 32" long. The completed bar rests in the heart hooks and can be used for a blanket rack, towel rack, or used to display quilts.

The demonstration was a nice job by Bob and the only problem seemed to be his selection of a helper. He asked for an experienced blacksmith with many years of fire control to assist him. Since none of our members volunteered he settled for Ron Van Vickie. The team was outstanding, the fire control expert only burned the end off one piece (talking rather than watching the fire will do it every time). I would have been glad to help but Bob said he wanted to have something to show at the end of the demo besides clinker. It was noticed that when Bob wanted to hot cut and needed help, he asked what happened to Ron Van Vickie. Ron was observed in the back eating pretzels. That's the way a SOFA meeting goes. Thanks Bob!

New Business:

The blacksmith's Association of Missouri (BAM) will be hosting its second annual Ozark Regional Blacksmith Conference in Potosi, Missouri, April 24-25, 1993. The main demonstrators will be Daryl Meier of Carbondale, IL and Doug Wilson of Deer Isle, ME. Other events will include a double anvil shoot, an Auction with Dr. Tim Ryan, Saturday evening contests, tail-gaters(no charge), and the world's second largest bonfire. For more info contact:

Doug Hendrickson
R.R. 1, Box 16D
Lesterville, MO. 63654

One day fee \$ 25, two day \$40, meal ticket \$10. BAM has graciously awarded SOFA one free scholarship. The only conditions for our members are:

1. SOFA member in good standing
2. ABANA member in good standing
3. Willing to give a report for SOFA Sounds upon return.

Any SOFA member interested contact Ron Thompson before February 6, 1993 at 513-492-2259. Selection will be by random drawing or bribes over \$500,000. Winner will be responsible for his/her own transportation and lodging.

Gloves:

SOFA has a supply of Kevlar gloves from Carolina Glove for members (sold only at the meeting) for \$10.00 per pair. These are outstanding value and have become almost indispensable to me. You can pick up a piece of red hot iron from the floor with no problem. Good reason to come to a meeting. I paid \$15.00 for my last pair and thought I was getting a bargain.

Sandia Forge:

Elias J Williams, Jr. would like to know if there is interest in putting on a workshop for construction of the Sandia forge? If any members are interested call Mr. Williams at 419-878-3118. He has the information on doing as the Colorado group and others have done.

An old Indian wrote the pres. "Be careful with the immigration laws you make, we weren't careful enough with ours."

Blacksmith's poem:

I received a note from a good friend I'm sure most of you know wanting to know if a poem he wrote years ago would amuse our membership. I'm sure it will.

Blacksmith Doggerel

**There was a young man named Granville
Who spent all his days at the anvil
The things that he made
Were a hoe and a spade
But he never could make a hand drill**

**My dentist's life is quite thrilling
He's expert at deep-hole drilling
With hammer and tong
A bang and a bong
He pounds away at my filling**

**A man who worked as a farrier
Heard his gal demand that he marry'er
"I'm dishonored, " she said
As she beat on his head
With a bar, now he's much warrier**

**A lady blacksmith quite large in the chest
Cut holes in her shirt to cool off her breast
She drew quite a crowd
Gals shouted out-loud
Now this is our lib at its best**

**Emmert Studebaker
November 1976**

Also from Emmert:

- Coal is available at \$9.00 per hundred pounds
- Please bring bags or your own containers
- If you want coal anytime through the week (Not Sundays), please call ahead. 667-4451 or 667-2441.
- Emmert is not in the coal business. This is an accommodation to SOFA and ABANA members and is not for sale to those who plan to resell it.

Now on to tips and techniques!

We publish these letters to keep our members aware of the National Association of which SOFA is a chapter organization. Through your individual support and our support as one of the leading chapter organizations, ABANA will continue to grow and serve blacksmithing at all levels nationwide.

ABANA

Artist-Blacksmiths' Association of North America



ABANA Chapter Liaison Newsletter
January 1993

P.O. Box 1181, Nashville, Indiana 47448
Executive Secretary, Janelle Gilbert Franklin

Office Hours: 7:30-11:30am & 1:30-4:30pm
Phone: (812) 988-6919

ABANA PRESIDENTS MESSAGE January, 1993

Dear ABANA Chapters,

Last year was a marvelous year for ABANA. We had a super conference at San Luis Obispo, California. Many people across the country helped to put this memorable event together, I couldn't begin to name them all! Many of you donated to the auction, which was a success as well. In fact, ABANA has been growing and doing quite well for some time now. Even as great as the conference was, and as well as we have done recently, there is much more to look forward to.


1993 marks our 20th year! ABANA is on solid financial ground. Because of our secure fiscal situation, I am pleased to announce an additional service to the membership. We will soon be publishing a newsletter in between issues of the *Anvil's Ring*, mailed to the entire membership at no extra cost. The ABANA Board is working on the details now, and we hope to see the first of these newsletters out in a couple of months. There are two illustrators available that are being considered for the drawings. I've seen their work -- nice! Former ABANA Board member Jim Ryan will be the editor. What a great way to kick off our 20th anniversary!

We are also be adding several other new membership services, so look for them listed in the winter issue of the *Anvil's Ring* (to be out in January), across from the order form page in the back.

Have you ever made a "New Years Resolution?" How about making a commitment right now to raise your safety awareness this year? I'll give you an example: How many times have you been working in the shop, and needed to use the grinder for "just a second?" Isn't it tempting to just grab the grinder and use it whether you have safety glasses on or not? In many cases, you might think about the glasses for just a moment before you use the grinder anyway. Please, make the commitment to provide the protection to yourself, no matter how short the task is; whether it is wearing the eye or ear protection, breathing protection, wearing cotton or leather, or whatever is appropriate protection for the occasion. You can make it second nature. Your friends and family will love you for it, and you can set an example for those to follow which may save their lives someday.

We have much to look forward to. May 1993 bring you everything your heart desires!

Happy New Year,


Clayton Carr
ABANA President

NEW CHAPTER: The Blacksmith Organization of Arkansas (BOA) recently held their first meeting on December 12, 1992 in Mountain Home, Arkansas. As they prepare to become an ABANA Chapter let's give them some support by sending them Chapter Newsletters. Send your newsletter copy to John Loeffler (Editor), HC 61 Box 44, Calico Rock, AR 72519.

SAVE THE CULTURE CENTER: The Florida Artist Blacksmith Association (FABA) has started a campaign to save the Stephen Foster State Culture Center which has been slated for closure. FABA has put a lot of effort into developing a blacksmith shop at the Center and feels its closing will eliminate a valuable blacksmith resource for the state. They are asking their members to call or write their state senators and representatives to try and reverse the closing. This is a commendable effort and we wish them the best of luck.

METALfab '93: The National Ornamental and Miscellaneous Metals Association (NOMMA) is planning its 1993 Convention to be held in Lexington KY, March 2-6. Events of interest to the blacksmithing community are the Top Job Jamboree, Educational Programs (23), and the Exposition with 70 exhibitors. For a convention information packet call 404-363-4009.

SAFETY: With the start of a new year I want to remind everyone to keep safety foremost in your minds whenever you are working in the shop. Take that extra few minutes to make needed repairs on equipment. It is my hope that the coming year does not give us horror stories about someone getting hurt because they didn't think about safety first.

BLACKSMITHING KUDOS: The new issue of *Knives Illustrated* has a photo of Hugh Bartrug's "St. Michael's Sword". Hugh is a member of the Pittsburgh Area Blacksmith Association (PABA) and ABANA. He recently captured the "W.F. Moran Award". The July issue of *Fine Homebuilding* has an article by Tom Joyce (ABANA member) on Architectural Ironwork. Tom is an accomplished blacksmith living in New Mexico.

NEWSLETTER THEME: The Illinois Valley Blacksmith Association (IVBA) has a novel concept for their newsletter. They have a theme for each issue. Designs, drawings, and/or photos of hearts, flowers, and leaves are requested for the Feb-March issue. What a neat way to get members involved in their organization and to participate in the production of the newsletter.

DID YOU KNOW?: The 1911 Boy Scout Handbook states that to receive a blacksmith merit badge you had to; 1) upset and weld a 1" bar, 2) make a horseshoe, 3) know how to tire a wheel, use a sledge hammer, forge a shoe correctly, rough shoe a horse, and 4) be able to temper iron and steel. How many of us today could get that badge?

IN-HOME HAMMER-IN: Several chapters have begun to video their hammer-ins so that members unable to attend can still keep up with what is going on. With the distance some members must travel or prior commitments keeping them from attending, this seems to be an appreciated benefit.

GOOD LUCK IN '93: I hope everyone had a great holiday and there was a power hammer in each of your stockings on Christmas morning! Hopefully everyone made a New Year's resolution to spend more time in the shop and expand their blacksmithing skills.

THANKS: ABANA members in your chapter appreciate the reproduction of the monthly chapter mailing information in your chapter newsletter. Please continue to keep the avenues of communication open for those who are interested. If your chapter has information that you would like to share within our chapter mailing network, just submit your info to the ABANA Office and it will go out in the next monthly mailing.

Please keep sending your newsletters to the Chapter Liaison Committee so we can keep abreast of your events and programs.

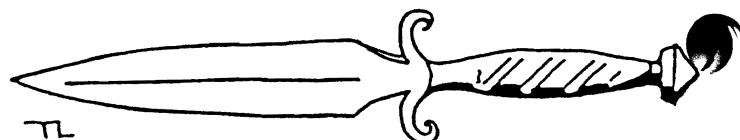
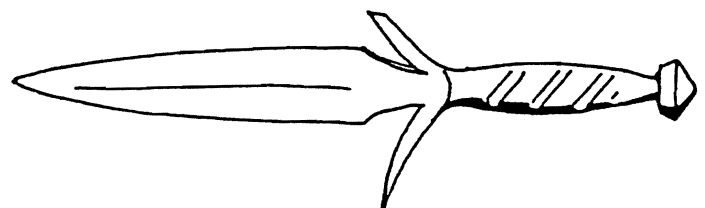
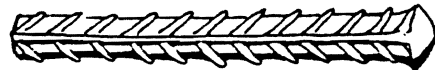
Ron Porter, Chapter Liaison Committee Chairman
RR 1 Box 64, Bunker Hill, Indiana 46914.

Letter Opener

by Tom Lotone

The drawing enclosed shows the steps I used making a letter opener from reinforcement rod from the Berlin Wall. Lots of smiths bought pieces at the past two Metalsmith Madnesses thanks to donations by Doug Johnson. The project can be done from any rebar or round rod. Round rod will not have the nice decoration on the handle.

1. Upset end slightly
2. Fuller around and below upset
3. Draw down to fullered depth (do not reduce to less than $1/2$ the original diameter).
4. Dress ball or knob on end over anvil edge.
5. Fuller to define handle allowing slightly more than $1/2$ bar length for blade.
6. Draw down to fuller depth on handle side taking care to preserve a portion of ridges at center of handle.
7. Point blade drawing squarely
8. Flatten blade in plane with continuous ridge on each side of bar (see fig. 1) Spread with cross or straight pein for greatest width.
9. Chisel away a portion each side of blade for guards. Draw guards to points
10. Scroll Guards. Dress with file.



MORE THAN YOU EVER WANTED TO KNOW ABOUT BORAX

Borax is a comparative newcomer to the blacksmithing scene. For practical purposes the world's supply is found in California. Therefore, before about 1870 borax was not available to the blacksmith, and probably not really needed because of the difference in welding characteristics of wrought iron and more modern mild steel.

Borax is mined as a mineral named tincal in the Mohave Desert, and is also prepared from the evaporation and purification of brines from Searles Lake. A third major source is the mineral rasorite found in large quantities near Kramer, California. Up until about 1930 it was produced from colemanite mined in Death Valley. Chemically it is sodium tetraborate ($\text{Na}_2 \text{O} \cdot 2\text{B}_2 \text{O}_3 \cdot 10\text{H}_2 \text{O}$). The theoretical composition is --

Sodium oxide	16.25%
Boric acid	36.51%
Water of crystallization	47.24%

It begins to melt in its own water of crystallization at 141.41 degrees Fahrenheit, and is soluble in water, acids, glycol, glycerol, and other solvents. When it is heated it foams vigorously as it loses the 47% of the water contained in the crystal form. It eventually smooths out to form a clear glass at a red heat. It is somewhat of a paradox because, while it is loosing its water it is chemically alkaline, but when it turns to a glass it acts as an acid. Molten borax dissolves many metallic oxides or salts to form boron glasses, some of which have characteristic colors. It is used for the removal of oxide slags in metallurgy and in welding or soldering. As a potter I use it as an important flux in glaze formulations.

Ordinary 20 Mule Team Borax, or any other brand, is 99.5% pure. Before processing it contains some clay and some silica along with a variety of soluble salts. It is a cheap material which is produced in enormous

quantities. Almost every blacksmith now prefers borax in some form as a welding flux. Most commercial welding compounds are based upon borax with a whole string of fancy additions. There is a question if the additions really improve anything.

Anhydrous or fused borax is a commercially prepared form of borax. It has been melted to remove all of the water of crystallization from the molecule. It now melts at a much higher temperature (1367.6 degrees F). Because there is no water to boil off, it does not move or blow off the iron. It melts into a smoother coating, and will leave fewer bare spots. It is available from the major ceramic supply houses and from all of the suppliers of laboratory chemicals. It is a question in my mind if it is even worth worrying about. It must be kept tightly sealed because it will reabsorb moisture from the air. It is more expensive to buy, even though 53 lbs. of the anhydrous form are equal to 100 lbs. of regular borax. In view of the fact that one or two pounds of plain borax will last most of us for years, who cares? It is not difficult to apply plain borax so the puffing up or blowing off is no problem. Just watch it melt and cover any bare spots. On a large industrial scale anhydrous borax is cost effective, there is a saving in fuel costs, but unless you are using tons of the material in a furnace with strong drafts and continuous production there is no reason to consider it.

I know that usually most blacksmiths only use borax as a welding flux; however, it is a real help in protecting your metal during other heat treating processes. I like to cover tools that I am hardening with borax to prevent scale formation. Occasionally you may have to wire brush some of the glass off after the tool is quenched, but that is a lot better than having scale form.

(This article was written by Paul Quayle of Murphys, CA, it is from the Newsletter of the California Blacksmiths' Association)

CLINKER-FREE FORGE
Willard Smith

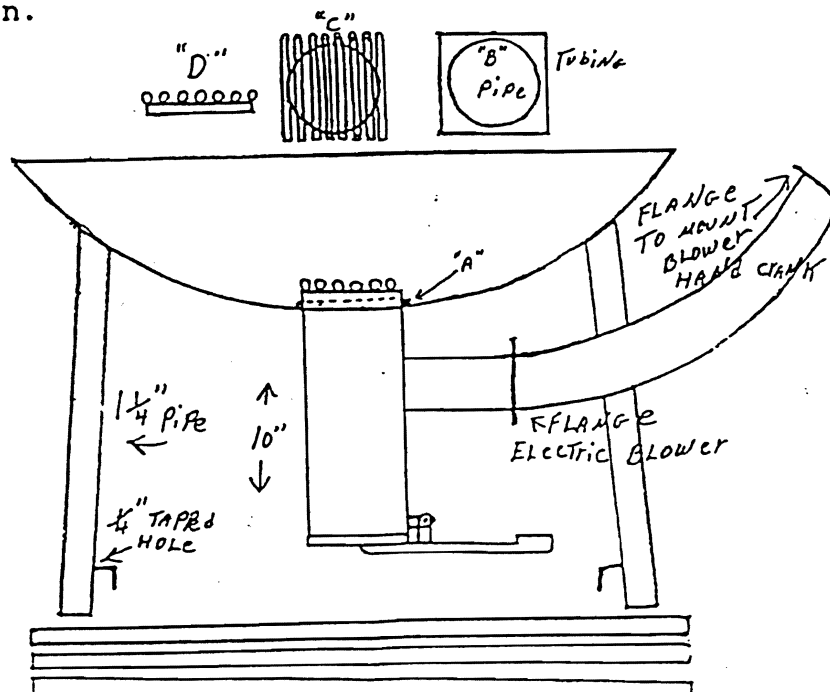
This is probably the most enjoyable forge you have worked on. It is a portable forge that can do big jobs, yet is easy to handle by yourself and is compact for hauling. It is made from the head of a water tank. Do not use one with galvanizing on it. This particular one is made from a 2' diameter tank.

There are two things that make this work so well. The first is the air chamber that goes into the bottom of the forge. It should stick up 1" from the weld inside at "A." Use square tubing; it's easy to fit and work with. Do not use tubing smaller than 3" x 3." The wall thickness I used is 1/8."

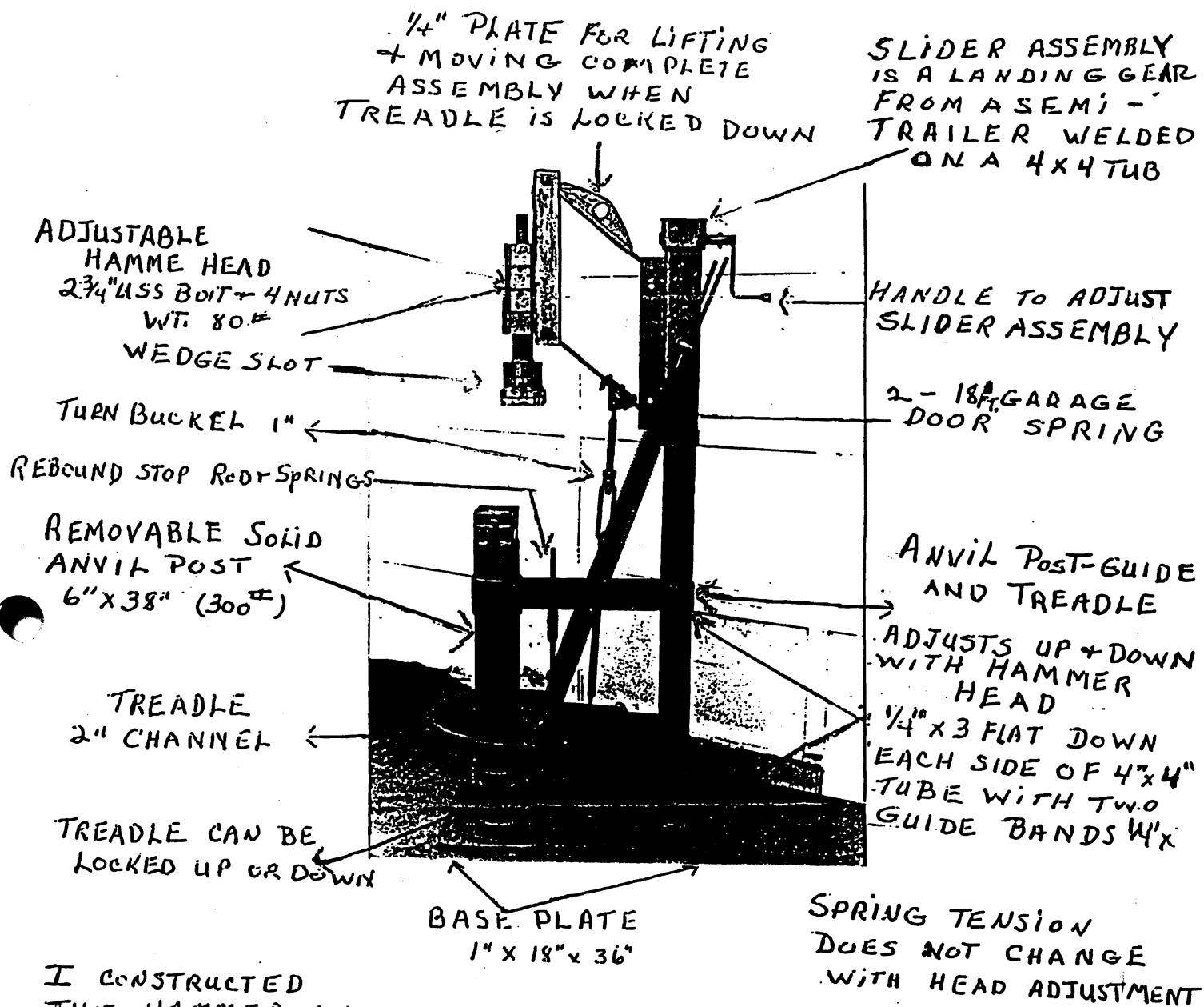
Get a round pipe that will just fit inside the square tubing (see "B"). Cut 3/4" off the pipe to weld to 1/2" round rod to make the second thing that makes it work. Cut several 1/2" x 4" round rods to weld on the short pipe (see "C"). Lay rods on metal plate to act as a ground clamp connection. Lay pipe ring on top of rods. Weld the first rod starting on the left or right side, then insert a 1/8" welding rod at each end for spacing before welding the next rod. Weld inside of pipe ring. The finished piece will look like "D."

Cut 1-1/4" pipe for short legs that should reach just below the square tubing. Use three or four, whichever you desire. Weld the short legs on, being sure to set them at an angle, like a tripod. Then drill and tap a 1/4" thread for a thumb screw to hold a 1" pipe to extend the legs to a height to suit you. When you want to move it, loosen the thumb screws, lift up, and the legs will drop out.

Well, where do the clinkers go? They are blown to the ends of the grate and then drop off to the bottom of the forge. It works all day. Fill the forge full of coal to use; this will help coke your coal as you use it. As it burns down, rake it into the center from the edges. This will not burn more coal this way, as you control the size of the fire with your water can.



TREADLE HAMMER
ADJUSTABLE ^{WITH} HEAD.



I CONSTRUCTED
THIS HAMMER IN
MY SHOP WITH
MATERIAL LYING
AROUND SHOP WITH
EXCEPTION OF
THE 2-GARAGE^{DOOR} SPRING
AND 4-2³/₄" USS NUTS.



LESTER SIX

BLACKSMITHING

R.D. 2 BOX 304
NEW CUMBERLAND, WV 26047

PHONE (304) 387-1907

SPRING TENSION
DOES NOT CHANGE
WITH HEAD ADJUSTMENT

Note:-

I built this
hammer to put some
of my wild ideas
into action and find
out my potential
the hammer works
very well;

Lester Six

Old Files & New Knives

by James Kelly

The following article from *Muzzleblast Magazine*, a publication of the National Muzzleloading Rifle Association, was submitted by Dick Rightmyer. It gives some history of hardening steel, file-making history, and tips for those who would like to use old files as a source of steel for knife blades. I have always heard this steel was not a good source for knife blades because it could not be tempered properly, but this article proves otherwise.

Used files are the handiest source of high-carbon steel available to the home craftsman. Treat them right and they'll make wood chisels finer than any on the market, as well as excellent knives. But, if you forge them like mild steel and heat-treat carelessly, the result can be brittle tools with crumbly edges. Doing it right means forging and hardening from controlled, moderate to low temperature.

First, some light background in steel metallurgy. Most of you know that steel is hardened by heating to red heat, then quenching in oil or water. Do this to low-carbon steel and nothing much happens; it will remain rather soft, because steel must have a certain amount of carbon in it before it will harden. Roughly speaking, the higher the carbon, the higher the heat-treated hardness and wear-resistance, but the lower the toughness.

Some examples: Commonly available cold-drawn steel is generally AISI 1018. The "10" means plain carbon steel, the "18" means a nominal 0.18% by weight carbon. Heat this steel red-hot, quench in cold water and it will harden a little, but not enough to be useful. Normally, the only heat-treatment done to 1018 would be to case-carburize it. Common machine shafting, axles, and some modern shotgun barrels are AISI 1035 (nominally 0.35% carbon). This steel responds to heat-treatment. If small pieces are water-quenched, and then tempered peacock blue, they will attain a spring hardness (but no, this does not mean that 1035 is a useful spring steel). AISI 1060 (0.55 to 0.65% carbon) is used for sledgehammers and cold chisels, which must be hard, yet take a beating. As the carbon content of steel increases, the as-quenched hardness also increases, up to a level of about 0.6% carbon. Above this, higher carbon increases hardness; that is, resistance does continue to improve with still higher carbon, above 0.6%. The excess carbon can form many fine, hard iron carbide particles which help retain sharp edges and resist abrasion. Common wood saws and older

power lawnmower blades are AISI 1070 to 1080 (0.7% to 0.8% carbon). Axes are 1086 and star drills are 1095.

A 1095, with carbon ranging from 0.90 to 1.03%, is the highest carbon steel you can find in steel warehouses. Since the beginning of this decade, Nicholson/Black Diamond files have been 1095. The 1095 steel makes good general purpose knives, daggers, fire steels and woodworking tools.

Back to files. Obviously, file teeth must be extremely hard and wear-resistant to stay sharp while cutting metal. For centuries, files have been made either of soft iron, which is then case-hardened, or of high-carbon steel. Even high-carbon steel files may be coated with some mixture to lightly case-harden them. Thus the razor-fine cutting edge doesn't burn off when heated cherry red to harden it.

In *The Thirteenth Book of Natural Magick* 1589, G. B. Della Porta describes "Ways whereby Iron may be made extreme hard." To harden files, he says:

"Take Ox hoofs, and put them into an Oven to dry, that they may be powdered fine; mingle well one part of this with as much common Salt, beaten Glass, and Chimney-soot, and beat them together, and lay them up for your use in a wooden Vessel hanging in the smoke; for the salt will melt with any moisture of the place or Air. The powder being prepared, make your Iron like to a file; then cut it chequer-wise, and crossways, with a sharp edge tool: having made the Iron tender and soft, as I said, then make an Iron chest fit to lay up your files in, and put them into it, strewing on the powder of course, that they may be covered all over: then put on the cover, and lute well the chinks with clay and straw, that the smoke of the powder may not breathe out; and then lay a heap of burning coals all over it, that it may be red-hot about an hour: when you think the powder to be burnt and consumed, take the chest out from the coals with Iron pinchers, and plunge the files into very cold water, and so they will become extremely hard. This is the usual temper for files; for we fear not if the files should be wrested by cold waters."

This 400-year-old process is metallurgically correct. The chimney soot, of course, is a nearly pure source of carbon to carburize or case-harden the surface. "Ox hooves," along with carbon, provide nitrogen which further improves sliding wear-resistance. Salt and glass melt the whole mess together to provide intimate contact with the iron. They also probably catalyze, or speed up, the high temperature chemical reactions which get the carbon into the iron. And, even today the "usual temper for files" is just as they come from the quench, with no further reheat (or draw).

Until recent years, when the EPA became overly concerned, modern practice was to coat high carbon steel files with a roughly similar mixture before hardening from a protective lead bath. The modern version of Ox hooves is potassium ferrocyanide, $K_4Fe(CN)_6$. This is mixed with flour and bone black, and all are boiled together in salt water. Both files and rasps were coated with this "cyanide loaf." Rasps still are, as it is necessary to case-harden the 1035 steel from which they are made.

While the currently used 1095 processes into a very good file, I suggest you get hold of pre-1980 files to make the best edge holding tools. These older files will be of 1.2 to 1.4% carbon steel, which is higher carbon than can be found anywhere else. Other than your memory, there are a couple of ways to tell which are the older files. One is that files marked only "Black Diamond" were made in 1975 or earlier, and are definitely 10130 (1.3% carbon) steel. After that year, the manufacturer stamped Black Diamond on one side and Nicholson on the other. The other distinction is the tang. It used to be that to save metal, the tangs were hot-rolled from the file blank with little waste. By 1978, it was more economical to use a longer blank and shear off metal to form the tang. A sheared tang will appear obviously different than a hot-rolled tang.

The ultra-high carbon of these older files makes the steel capable of taking and holding a razor edge and suits it for the finest of wood-cutting tools. This high carbon also makes the steel more tricky to forge and heat-treat than, say, an AISI 1070 spring steel. If you overheat and coarsen the grain of your file steel, it will not be capable of taking the finest edge.

That old Nicholson file in your scrap box was heated for about five minutes in a molten lead bath at 1440°F, quenched in brine to get maximum hardness, and then not tempered at all.

Let's do the simplest job first, and make a straight wood chisel or wood-turning tool out of that old file. Most commercially available wood chisels are not really meant to either take or hold a fine edge. The best on the market these days are, sad to say, Japanese such as Oiichi or Iyoro. Well, you can match these chisels. Just grind your file to the shape you want, usually with a 25° to 30° bevel. Use plenty of water so not to soften it or, worse yet, crack it. The best bet is to first scrub off all old oil and grease. This is necessary for domestic tranquility as you are about to temper the thing 350°F in wife's oven, for a good hour! This will relieve a lot of internal stress (like taking one small glass of wine) and prevent the

fine edge from chipping. The safest thing to do is temper before you grind it to shape, so it is less likely to crack in grinding. I suggest 300-350°F, which is a very light straw. After tempering for an hour, the straw may deepen somewhat. Do not trust temperature settings on kitchen ovens, try a scrap piece first and go by the temper color, or by a Tempilstik.

You now have a wood chisel which will hold as good or better edge than anything on the market today.

This choice of steel and temper will not make a good bowie knife, although it would be great for a skinning knife. That 350°F temper still leaves the metal rather too brittle to handle the rough use of your average camp knife. A skinning knife must hold a good edge through a lot of cutting. Hopefully, you won't use your skinning knives to chop wood, bone, and tin cans as well.

For bowies, daggers and fire steels, I'd first suggest using a post-1980 file of 1095 steel. This will still hold a good edge but be a little tougher than the older 10130 steel. Temper a bit before grinding to shape. For most knives, I suggest tempering 500°F — a mottled brown to purple temper color. I'd use the household oven for about an hour. And don't trust the temperature setting on that dial.

We have about come to the point where we have to get serious about temperature measurement. Pyrometers, thermocouples and electronically controlled electric heat-treat furnaces just aren't in your budget, are they? Do forget about judging temperature, at red heat, by eye. Even professional heat-treaters can be off by 200°F when checked against cold, unfriendly pyrometers. Well, there is hope for the low budget shop. That is, an inexpensive and very accurate method of temperature measurement called a Tempilstik. This thing is a calibrated crayon. Let's say you spring \$6 or so for a 500°F temperature-indicating crayon. First, mark your workpiece with this crayon. Heat the metal. The crayon mark will change color; that means nothing. But, as soon as the metal reaches 500°F, that dry opaque mark will change to a distinct melted mark. Really, you should also mark it with a 525°F Tempilstik so you know if it got too hot.

These things are easy to use and they are accurate. The 500°F Tempilstik is accurate to $\pm 5^\circ\text{F}$. Above 700°F or so, the procedure is to stroke the hot metal with the Tempilstik now and again during heating. When the metal reaches temperature, the crayon will leave a liquid smear. The cost of Tempilstiks is currently \$5.90 in quantities from 1 to 9. They are carried by welding supply distributors, or may be had direct from: Tem-

pil Division, Big Three Industries, Inc., 2901 Hamilton Boulevard, South Plainfield, NJ 07080, (201) 757-8300. Minimum order is three Tempilstiks; do include postage.

Back to files. It is more fun to forge a blade to shape than to grind it, so let's get into the nitty gritty.

Forging high-carbon steel is a different matter from working mild steel. Yes, you blacksmith types know it is easier to burn high-carbon steel. But even if you don't burn it, forging a 1.3% C. file from white heat and SLOW-cooling it can coarsen the grain and make it rather brittle at any temper. One problem is all that carbon. When steel contains more than 0.8% carbon, it is easy to get a brittle carbide network. Huh? Well, the excess carbon can form a brittle iron carbide layer around each grain. Should I back up further? All metals, including steel, consist of millions of tiny crystals all stuck together. Imagine a pile of grapes that have been pressed together without breaking the skin. Each grape is roughly the same shape as a metal crystal, or "grain." If you overheat and slow-cool a file, the "skins" of each little "grape" will be hard and glass-brittle. That translates into a cutting edge that easily becomes ragged or crumbles.

I suggest forging that file, especially if it is the old 10130 steel, as though it were a true Damascus (Wootz) steel. That is, heat to a much lower temperature than usual. This means more muscle, but it will also keep the metal fine-grained, which is most important. Damascus, which could be as high as 2% carbon, is forged, starting at 1550-1600°F and finished at a blood-red, about 1200°F.

You cannot really judge a 1600°F starting temperature by eye. If you are serious about fine work and don't like throwing hours of your time into the scrap bin, invest in a couple of Tempilstiks, rated say, 1550°F and 1600°F. Once the blade has been forged, you should always anneal it to reduce chances of warping and cracking during the hardening operation. The safest way to do this is to heat 1300-1400°F for a while, then bury the thing in ashes or lime to cool slowly.

Most steels are annealed from a higher temperature. I am suggesting this lower anneal to keep the fine grain structure and fine carbide distribution you got by forging that old 1.3% carbon file down in the cherry to blood-red range.

Now that you have forged and sort of annealed the blade, grind it all over to near final shape. You MUST grind off the scaled, decarburized surface or it will crack in heat-treatment.

Shall I back up again? When you heat in the forge, some of the iron oxidizes to a blue-gray scale. That is obvious. But, some of the carbon also literally burns out of the steel's surface. This is just the opposite of case-hardening. If you leave that thin, soft low-carbon skin on the blade, paradoxically enough it WILL crack when quenched in water or brine.

To harden that file steel, heat to 1440°-1450° for about 4-5 minutes and brine quench. Again, invest in a 1425° and a 1450° Tempilstik. DO NOT over-heat it.

The quench is important. If you want to be really traditional, you could use the urine of a three-year-old goat, fed only ferns for three days. However, today there is a better way, particularly for apartment dwellers and other urban folk. That is, salt brine. Mix just 13 ounces of common salt in a gallon of fresh water. That makes a 9% salt brine. This brine will quench twice as good as water. It reduces the chances of cracking and warping and makes a harder part. Brine is, of course, less fragrant than the aforementioned animal product. Keep your brine cold or room temperature.

Don't quench file steel in oil. It won't harden well at all.

How you dunk the knife in the brine quench is important. If you belly-flop it in, it is guaranteed to warp, and it may crack. Plunge the hot knife straight into the brine and it will come out reasonably straight. It will be more straight if you quench in brine than if you quench in water. This is because brine quenches the steel more uniformly all over. Move the knife in a "figure 8" motion while it sizzles in the brine. This gives a more uniform quench. Remove it while still warm and temper as soon as possible.

Tempering quickly is important, lest the metal decide to crack while resting quietly on your workbench. The word "temper" these days means to reheat a quenched part to make it softer and tougher. For knives of file steel, I would temper at least 450°F; preferably 500°F.

If you forged a fire steel out of an AISI 1095 steel file, I would temper 500° to 600°F. You might temper first at 500°, then try striking fire. If it seems too hard, re-temper at 600°F (blue, beyond purple).

If a knife blade is crooked, temper it first before you try to straighten it. Then heat it up 300-400°F again (straw to brown) and straighten while it is hot. DO NOT heat the steel a beautiful blue and try to straighten it at this temperature.

Steel has a peculiar brittleness while it is in the blue (550°-600°F) color-temperature range.

That covers chisels, knives, and fire steel made from files.

Rasps, incidentally, are another animal entirely. A Nicholson wood rasp is not high-carbon steel, it is usually AISI 1035 (0.35% carbon). The rasp is case-hardened lightly by covering it with cyanide loaf before heating it in a lead pot to harden it. This case is only a few thousandths deep. Old rasps are worthless as far as making edge-holding tools or fire steels. They are the greatest, though, for making a throwing knife. Throwing knives needn't hold a fine edge, but they must be tough so not to break.

This toughness, by the way, is important in a farrier's rasp. When shoeing a horse, I understand it is occasionally necessary to get the beast's attention. This is accomplished by rapping him on the hoof. High carbon farrier's rasps tend to break during this endeavor. Hence, they are made of tough 1035, lightly case.

You can forge the rasp steel from high temperatures without embrittling it. When you're finished, take the forging and normalize it by heating 1575°-1650°F and air-cool. This refines the grain which may have coarsened in the forge. It is very important that the steel be fine-grained. Fine-grain steel is remarkably tougher than coarse grain. All steel forgings should be annealed or normalized to improve their toughness.

To harden that rasp steel, heat 1525°-1600°F and quench in cold brine. For a tough throwing knife, temper about 700°. This discussion holds for American-made Nicholson or Black Diamond rasps. If you want to purchase Asian products, I suggest you contact an Asian metallurgist regarding how best to treat them. □

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If you want to make a finial for the fence, here are the specs:

1. The verticals of the fence are 3/8" round stock.
2. Each vertical rod has been threaded with 3/8-16 Standard thread for approximatley 3/8".
3. Please attach a 3/8-16 hex nut to your finial or tap same to recieve the threaded rod.
4. The desired design space, not absolute, is a 2 1/2" cube or a 3" sphere centered about 1 1/2" from the top of the rod.
5. The design ideas are not limited, but keep in mind the statue and the log homestead motif of the area.
6. The finish on the fence is a high gloss epoxy. Feel free to apply your own special finish, if desired.
7. If you have any questions call Larry Gindlesperger at 513-237-2200

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