



SOFA SOUNDS

SOFA
SOUTHERN OHIO FORGE & ANVIL

FEBRUARY/MARCH 1986

Artist-Blacksmiths Association of North America

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Ken Scharabok (513-252-3001)

MARK YOUR CALENDAR:

Unless otherwise indicated, all meetings will be held at the Studebaker Homestead on Route 202, four miles north of I-70. Guest and the public are invited. Bring items and tools you have made for display. Please don't park on the grass, there is plenty of parking around the production buildings.

February 1st, 1PM

BUSINESS MEETING followed by a demonstration of sand casting by Ron Thompson. Ron will be trying a technique which may be useful for casting by the average smith.

February 8th, 9AM

Work on the homestead gate. Bring your forging hammers and come prepared to work. Lunch (hot dogs and beans) will be provided by SOFA.

March 1st, 1PM

BUSINESS MEETING followed by a demonstration by Hans Peot on making a hardy bick.

March 8th, 9AM

Work on the homestead gate. See the entry for February 8th.

March 22nd - 23rd

"Hammer, Anvil and Forge: the 19th Century Blacksmith" conference sponsored by Conner Prairie (just north of Indianapolis) and the Indiana Blacksmiths' Ass'n at Conner Prairie. This conference will feature hands-on workshops. If you don't receive an application form by mid-February, contact Brenda Myers, Conner Prairie, 13400 Allisonville Rd., Nobelsville, IN 46060-4499, 317-776-6000.

April 5th, 1PM

BUSINESS MEETING followed by a demonstration of the Clayton Knot by Emmert Studebaker. This is one you won't want to miss.

April 12th, 9AM

Work on the homestead gate. See the entry for February 8th.

May 3rd, 1PM

BUSINESS MEETING followed by a review of the techniques used to build the Whitaker Workshop project by either Mr. Whitaker or the participants.

Creative & Friendly

Emmert has received an additional shipment of 24 tons of good coal from West Virginia (see analysis in last newsletter). He would like to sell as much as possible before it has to be moved by front end loader to the bin. Cost is \$7 plus tax per hundred pounds. Please bring your own containers. Price will probably be higher once it is put into the bin. This coal is what we use at the meetings. ... Interested in having Emmert cut you out a swage block from 3" stock? If so, talk to him at the next meeting.

May 10th, 9AM	Work on the homestead gate. See the entry for February 8th.
June 7th, 1PM	BUSINESS MEETING followed by a demonstration on making spoons by Terry Garman.
August 13th - 17th	1986 ABANA National Conference at Flagstaff, AZ. This one should be well worth the trip.

MEETING NOTES:

Most of the December 7th business meeting concerned the SOFA Whitaker Workshop scheduled for April 27th - May 3rd next year. Members interested in participating in the workshop were encouraged to submit a brief resume of the work in order for Mr. Whitaker, or the local group officers, to determine who would best benefit from the workshop. See the last newsletter for additional details.

Ms. Suzanne Mitolo attended the meeting. She is the coordinator of the City of Dayton Beautification/Restoration Program. The group will be working with her to determine the project for the workshop.

The raffle raised \$58.00 to support the newsletter. Xenia member Ron Howard won a beautiful miniature bowie knife necklace donated by Miamisburg member Scott Shoemaker (Scott also brought along a large knife he had made which was a work of art). Fairborn member David Hartman won a pair of 1/2" square jaw tongs made and donated by New Carlisle member Hans Peot. Hans arc welds these together and I encourage him to write up an article for the newsletter on his procedures. Vandalia member Dow VanArnam won the hinge and pin made by Larry Wood at the last meeting. Mt. Blanchard member Ed Hullihan won a large sledge hammer head donated by Greenville member Ron Van Vickle. Dayton member Art Holz won back a small anvil he had previously donated - apparently it was destined to stay in his workshop. Steve Roth won a kitchen knife and sharpener donated by Dayton member Owen Vance. Lima member Bud Rolston won three files.

Following the business meeting we had two demonstrations. Dow VanArnam gave a presentation/demonstration on proper hammering techniques. He said that his beginning blacksmithing instructor was Bill Gichner, who insisted that he learn proper hammering techniques before even lighting a fire.

Dow said that there are three aspects to hammering, the hammer, the anvil and the free hand holding the stock. The hammer hand needs to be taught to strike the proper place, with the proper hammer face angle and with the proper force. The anvil is one-half of the blow since it provides force from the opposite direction. He called the free hand the thinking hand because it moves the material around on the anvil to get maximum results from the hammer and anvil. For someone just beginning he recommended a hammer with a soft face so you bogger up the hammer and not the anvil when you miss the work. You can resurface a hammer face much easier than an anvil face. He likes hammers with rounded corners, a crowned face, long head with the balance point just in front of the handle center and long hammer handles (about 15"). The handle should be nicely tapered and thick so you can get a good grip on it.

On the proper anvil height, his rule of thumb is whatever height feels comfortable. For heavy work or hammering, a lower anvil might be more comfortable while for lighter work or hammering, a higher one might be more comfortable. Like your Editor, Dow prefers the anvil horn facing towards the hammer hand. This keeps your hammer hand away from the hardy hole (in case you forgot to take out that hot cut hardie) and allows you to work over the horn, using it as a bottom fuller, easier.

The free hand controls the position of the material on the anvil. As a training exercise he recommended hammering on a piece of lead since it will respond like hot

metal. First try for consistency, then accuracy. The work should be held square to the anvil side.

Dow demonstrated three basic hammering strokes: the wrist for light, very accurate blows; the elbow and wrist for medium blows with some loss of accuracy; and the shoulder, elbow and wrist for heavy blows. Whatever the stroke, the key is the wrist which is where the whip action comes from. Also whatever the stroke, the elbow should be tucked into the side to prevent developing "blacksmith's elbow" which is the equivalent of "tennis elbow", but I think different tendons are involved. If you develop "blacksmith's elbow" expect to wait about a year before you can do serious hammering again.

To conclude the presentation Dow made a couple of small leaves out of 1/4" rod. He recommended practicing on a few leaves before doing other work as a refresher.

Following Dow your Editor (a.k.a. Three Heats) demonstrated making a ram's head on a 36" length of 1/2" square stock for a poker from forging the head to curling the horns. See the April/May 1985 SOFA SOUNDS for the detailed steps involved. New members can get a copy of the instructions by sending me a 22¢ postage stamp. I donated one of my ram's head pokers to the National Ornamental Metal Museum in Memphis, TN for their annual auction to raise operating funds. They advised me it went for \$47.50 - how about that!

Following the meeting several members stayed around to watch (and kibitz) Ron Thompson make a hammer head. Ron got a lot of sound advice. About 95% of it was sound and the rest good advice.

During the January 11th business meeting Hans Peot reviewed the actions taken at the SOFA Board of Directors/Officers meeting prior to the group business meeting and demonstration:

- We are still reviewing the feasibility of having a Round-Up during the same year as the national conference in Arizona. The concern is to not detract from the national event. In the interim, please let us know if you would like to see a particular demonstrator at a Round-Up, this year or in the future.

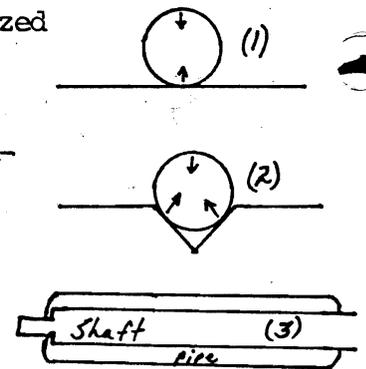
- Larry Wood is still working with officials from the City of Dayton on a project for the Whitaker Workshop on April 28th - May 2nd. Due to some concern being expressed on the cost of the workshop, it was decided to reduce the cost from \$250 to \$150 per person. This charge covers the Whitakers transportation, any honorarium if accepted, and the cost of materials. It appears will be have a workforce of competent smiths for Mr. Whitaker. Noon meal will be available at the Progressive Equipment Co. lunchroom.

The raffle brought in an additional \$55 to support the newsletter. Kettering member Ham Hammond won the ram's head poker demonstrated at the previous meeting. Sidney member Ron Thompson won a book donated by Emmert Studebaker titled Towards a New Iron Age, Dayton member Winston Oakes won a book donated by Larry Wood titled Steel and Aluminum Stock List, and Covington (OH) member Ben Wunder won about eight railroad spikes donated by William Fleckenstein. The next raffle should have some rather nice items in it.

I didn't count noses, but there were at least 45 members, guest and the public at the meeting. This seems to be a normal size crowd at our meetings lately.

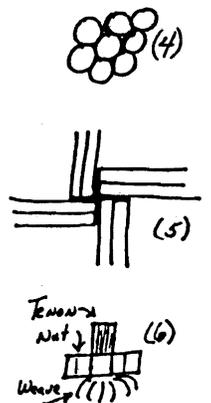
Following the business meeting Dick Franklin put on an excellent demonstration on making three different handles for fireplace pokers or sets:

- The first handle was one I'll call a cattail head for want to a better description. Dick started with a piece of 1/2" galvanized pipe about 6" long. After burning off the zinc coating (and relaying the caution to not breathe the fumes while this was occurring), Dick crimped over one end to leave a 3/8" opening (the size stock for the shaft). He said he used to do this on the anvil face (without good results) until someone advised him to use a "V" block instead. The difference can be seen in illustrations 1 and 2. If hitting down on the anvil face, the force is exerted in two directions, resulting in a natural tendency for the pipe to take on an oval shape. If done in a "V" block (or suitable bottom swage), the force is exerted from several directions, helping to keep the pipe round. Once the shaft fit snugly in the first end, Dick crimped the other end over to fit a tenon made on the end of the shaft. The tenon allowed Dick to rivet it over the end, holding the handle securely in place (illustration 3). It was pointed out that the tenon just needs to be riveted enough to hold on the handle. Any extra material could be worked into the stem-like projection on the top of a cattail or drawn out and made into a circle for a hanging poker.

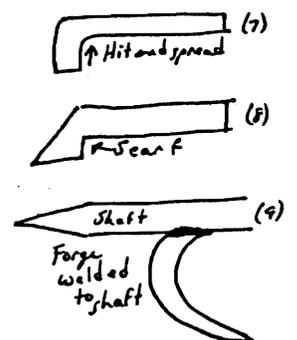


- The second poker handle was the typical basket handle made from seven rods. There were forge welded at both ends and then twisted in one direction (as tight as possible - trying for consistency in the twists). For a twisting wrench Dick used an adjustable wrench with a handle welded to the top. He then slightly untwisted the bundle to form the basket handle. There are a number of variations on this handle. Dick pointed out the importance of having a consistent heat when twisting.

- The third handle was the one which was really impressive, an eight strand weaved handle. Dick used eight mild steel welding rods 14" in length and spot welded one end in the pattern illustrated (4). Seven rods are put in the basket pattern and the eighth is put off to one side. The other end was held together with tape. Dick then forge welded the arc welded end sufficient for later scarfing (and forge welding to a 3/8" shank) and removed the tape. He then reheated the forge welded area and bent over the strands until they formed four sides in the shape illustrated (5). Dick then weaved the strands back and forth, starting with the coldest pair first, tamped them down with a hammer and reheated between each weave from the four sides. When at the top, he brought the eight rods back to center, forge welded them, and added a large nut for a decorative bulb. To forge weld on the nut Dick stressed the importance of first cutting the nut from the side to the threads to leave a space for the nut to shrink while forge welding to the tenon. Otherwise, the nut is likely to remain loose. Dick then rounded the nut to form a bulb. He said that this can be done with either of the two previous handles also.



- To put the log puller on the other end Dick prefers to add on a separate piece rather than folding over and faggot welding the shaft. To prepare the short piece Dick started with about a 3" - 4" piece of 3/8" stock and prepared it as illustrated (7-9). He used a water hose clamp to hold it on the shaft for forge welding. It can be put on in either direction and lifted up or folded back to the handle.



Following the meeting about a dozen members stayed to work on the homestead gate for about two hours. As I have pointed out previously, you can learn quite a lot of blacksmithing techniques by helping on this project as it entails just about every technique.

The group is meeting on the Saturday after the regular meeting to work exclusively on the gate. We met on the 18th and made good progress on one side of the gate since the frame and bottom rings had been previously made and installed.

TIPS ON BUYING A POWER HAMMER (By Fred Caylor from the newsletter of the Upper Mid-West Blacksmith's Ass'n):

1. If you don't know what to look for, take along someone who does.
2. Don't worry about the condition of the babbit in the shaft journals or clutch pulley, unless they are so bad there might be wear in the shaft. Follow directions in a back issue of The Anvil's Ring and pour your own.
3. Check for wear in the toggle pins and look for elongated wear in the arms and toggles. If elongated they will have to be bored out and oversized pins made.
4. It is very common for the upper arms to have been repaired. If done properly they will function as good as new. But if they have been put back together in a slight twist, this will cause the toggle holes to not line up properly and will wear the pins as fast as you can make them. Remedy--ream the holes through arm and toggle while in correct position. Make oversize pins.
5. Check for wear inside of the ram where toggle cross pieces ride. We recently found one which was so badly worn they had to be filled with weld and remilled to size. This calls for hours of work and special machinery.
6. Check for wear in the vee guides on front and rear ram guides. These control the path of the ram and it would take a lot of work to correct. The aforementioned hammer had the front guides worn almost through and had to be rebuilt and reshaped due to warpage from welding heat. This hammer was worn out from lack of lubrication.
7. Last, but not least, don't let your desire to own a hammer at a bargain price induce you to buy one which needs work which you can't do yourself or afford to have done. A poor hammer is worse than no hammer at all. Save your money and buy one which you will enjoy using and can make money with. Price should be secondary if you have work for it.
8. One thing I would like to suggest is that when you acquire your hammer, take the time to strip it down completely. This way you can inspect it throughout. As you are cleaning it, make repairs right then and there. This is a good time to repaint the parts before you reassemble. When you are finished, you will have a piece of equipment you will be proud of and it will give you years of service. After all, it did take years for the hammer to get in such a sorry condition.

NOTE: Fred reconditions and repairs power hammers and is an acknowledged authority on the subject.

ASSOCIATED POWER HAMMER TIPS AND TECHNIQUES:

- At the 1985 Round-Up, Jack Brubaker gave an impromptu power hammer lesson to Ted Tucker. On what size hammer is best, Jack noted that a 25 lb hammer is good for drawing out small stock and is particularly admirable for the nice rippling "planished" surface it can leave. This surface is the result of the rapid, light blows it will hit, which is also its biggest problem. In order for it to hit hard enough to do serious work it must run very fast. If you put a handheld tool under this size hammer, you might choose between running the hammer slow enough to give you control of the tool (but too slow to do any serious work) or fast enough to move metal (but too fast to safely control). A 50 lb hammer is much safer to run because it runs

slower and most small work can be done without running the hammer beyond one-half speed which gives you even more control. You can use a hot cutter or spring fuller between the dies of a 50 lb quite safely and with good control. Even more control of individual blows and safer operation are possible with a 100 lb hammer. However, a beginner who may be most comfortable with 3/8" round and similar light stock might feel initially that there were required to apply a lot of concentration to hold back a 100 lb hammer. In the long run, anyone would be glad they had a 100 lb hammer, but a 50 lb one is an excellent compromise. It will do both light and medium sized work comfortably and safely. Jack prefers to sit on a stool while working on a power hammer as he feels it gives him better control - long pieces can be held under his arm. As I recall, Jack also said that the prices of used 25 lb and 50 lb hammers are not significantly different. In short, it would seem that the larger the hammer, the slower the blows required, with resulting greater control.

- Also see SOFA SOUNDS, Dec 84/Jan 85, for using popular wood to enhance the brake grip of a Champion and the last issue for a different way to make upper and lower dies.

- A few modifications on Little Giant trip hammers can yield a much better running, more controllable hammer. Dragging of the bearing surface which is always in motion when the motor is running, that is, the clutch bearing, is a chief culprit when it comes to a hammer hitting that extra stroke you didn't want after you lifted off, and of poor pedal response and premature wear. To correct this problem, run your belts as loose as you can without their slipping, to avoid side loading of this bearing. Use of a light oil here helps a lot, along with cleaning out existing heavy grease. If belt slip is a problem, try going to a wider belt if you are using a flat belt, or use a motor pulley which will take more V-belts if you choose this drive. Do this rather than increasing the belt tension. Use a fairly heavy grease on the main bearings to help slow the hammer rapidly when the clutch is disengaged and to protect a bit from the shock of the reaction to the actual forging. Do not permit any significant clearance to develop in these main bearings as once they start to hammer up and down in response to the blows they will wear at a greater accelerated rate. I prefer to use only one spring to disengage the clutch and lift the pedal and I locate it at the clutch throw-out fork. In doing it this way, all linkage parts, as well as the pedal, are hanging of their own weight. This removes all slack from the linkage and greatly improves the feel of the clutch. I have seen many factory set up hammers with the spring on the foot pedal and I feel this is wrong. If a piece of the linkage comes loose for any reason, the hammer may not come to a stop. I use as light a spring as will do the job and this makes for a more sensitive pedal. I have seen factory set-up hammers with a spring down on the pedal so strong that the long rod bowed every time the operator lifted off. Strive for a small total pedal movement to do the job. (By Paul Lacy III from the newsletter of the California Blacksmiths' Ass'n).

- I just disassembled a 25lb Little Giant preparatory to restoration and discovered the most unique adaptation I have ever seen. Evidently the old Smith who owned the hammer felt as strongly as I do about the need to slow down the RPM (contrary to Little Giant's recommendation). What he did was to take a four spoke 15" flat belt pulley, cut out the hub and reduced the length of the spokes so that it fit snugly over the original clutch pulley, they cut and drilled spacers for bolts to go through the outer pulley and the original. He then copper riveted a piece of 3" leather belting around the outside pulley. This allowed him to run leather against leather resulting in good gripping action. With the larger clutch pulley it will be possible to use a larger motor pulley resulting in better gripping action. This hammer was terribly greasy but seemed to have no wear except for the toggle pins. (By Fred Caylor from the newsletter of the Upper Mid-West Blacksmith's Ass'n).

- Did you know that the usual method of calculating power hammer size is a minimum of 50 pounds of falling weight for each square inch of cross section to be forged? Also that the hammer anvil stand is usually made about 20 times heavier than the falling parts weight? Power hammers do not have a mind of their own and are only as

safe as the operator. They are also very unforgiving to those who violate the rules of safe operation. (By Stan Strickland in the November 1985 ABANA President's message).

- Thoughts while nursing a smashed finger (#\$\$\$@*!%&\$¢@@) (*%&¢). I was loading a trip hammer into the back of a pickup truck. One little slip and when I grabbed the thing, I smashed the end of the ring finger on my left hand. Popped the nail up from the back and had to get medical treatment and a big bandaid and splint and sling and all that good stuff. Then I signed and decided that from now on, I would have the proper equipment to do the job at hand. That might be a hoist, or maybe even a wrecker or crane or whatever it takes. Get the right equipment for your own safety. Indeed I hired a wrecker to move the trip hammer into the truck two days later - sadder but wiser. It cost a heck of a lot more than the cost of the wrecker in medical bills and time spent in pain and stuff like that. No more heavy stuff from now on. Amen! (By Jim Ryan from the newsletter of the Upper Mid-West Blacksmith's Ass'n).

- I also have a three page article from the newsletter of the Indiana Blacksmiths' Ass'n, predominately on tempering power hammer springs. For a copy send me a first class stamp.

THIS AND THAT:

The book The Hand Forged Knife is available from Knife World (P.O. Box 3395, Knoxville, TN 37917, paperback, 135 pages, many photos, \$12.95 postpaid). Book is specifically on using modern tool steels.

The City of Haverhill, Iowa is looking for blacksmiths to compete for \$2,250 in cash prizes at their Farm Arts and Artisans Festival, August 2-3, 1986. There is a \$10 entry fee for competition and \$25 non-competition but who will sell their wares. Deadline for application is May 1, 1986. For further information contact Dolores Jennings, Box 128, Haverhill, Iowa 50120 (515-475-3432).

Due to problem at the printers, some of the SOFA SOUNDS for December 85/January 86 contained two page threes. If you copy is this way, contact the Editor for a replacement page.

The Ohio Horseshoeing School (2545 Ohio 235, Xenia, OH 45385) teaches two courses in horseshoeing. The eight-week course is \$1,200 and the two-week course is \$500. Course subjects include: the anatomy and physiology of a horse; the art of making and trimming the shoe; how to correct or improve faulty gaits; the treatment, disease, conditions and injuries of the feet and legs; welding as it relates to horseshoeing; speed in shoeing; safety for the horse and farrier; proper use of tools and bookkeeping. The school is accredited by the Ohio State Board of Schools and College Registration.

Norman Larson (5426 Hwy. 246, Lompoc, CA 93536) has now published a descriptive brochure on the blacksmithing and decorative ironworking books he carries. Most are out-of-print elsewhere or foreign. Another source of out-of-print blacksmithing-related books is Jim Fleming (Rt. 1, Box 784, Bonanza, OR 97623).

The Cedar Lakes Crafts Center (Ripley, WV 25271 - 304-372-6263) will give a weekend workshop on "Blacksmithing: Gatemaking with an Angle" on March 7-9 by Frederic Crist. For further info contact the center.

Peter Ross Workshop: U.W. at La Crosse, La Crosse, WI, March 26-28. Sponsored by the University's Art Dept. A three-day seminar on blacksmith with the resident master blacksmith at Colonial Williamsburg. Free admission. No registration. Contact Bill Fiorini, 1590 Hwy. 16, La Crescent, MN 55947.

At the January 18th gate work session, Duane Wegley brought along a book titled A Frontier Fur Trade Blacksmith Shop 1796-1812 by John D. Light and Henry Vaglik (Canadian Government Publishing Center, Supply and Services - Canada, Hull, Quebec, CANADA K1A 0S9, \$8.95, paperback). Duane anticipated it was about items made and techniques but it turned out to be an archaeological report, including analysis of the various metals unearthed. For the history buffs.

LEGENDARY DAMASCUS (WOOTZ) STEEL:

After eluding bladesmiths since the late-Middle Ages, the ancient art of casting Damascus steel has been rediscovered. Known as wootz (or crystalline damask, watered steel, jauhar, ondanique, andaine, hundwani, alkinde, Khorasan (black steel) and Ispahan (yellow steel), it was used in India and the Near East for knives, swords and the very best cutting tools. Patterns appear as fairly short random lines, something like flattened steel wool.

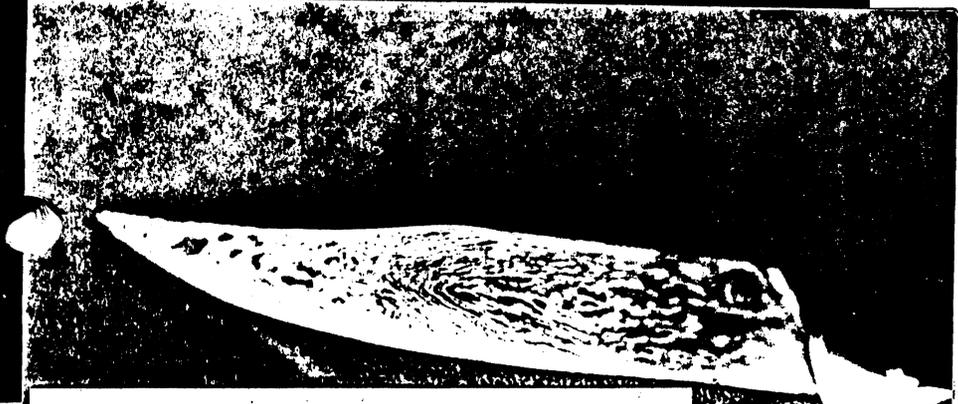
Wootz was very high carbon steel, about 1.5% or higher, produced by packing iron, charcoal and latex-bearing leaves into a sealed crucible. A group of the crucibles would then be put into a furnace and heated until the iron absorbed enough carbon to lower its melting point below the furnace temperature. The crucibles with the melted steel inside were then removed from the heat and air-cooled fairly quickly. This made the eutectoid steel (an alloy with a melting point lower than any of the combinations of the same component) freeze out first (about .8% carbon). The still molten cementite (iron carbide, a very high carbon steel) then formed between branches of eutectoid steel, resulting in an intermingling of carbon content. This cake of steel was then heat treated anywhere from a few hours to a few days to drive off excess carbon. All hot forging was done below 1,300°F (dark cherry red) to save the large grain formed by long, high temperatures. After forging, grinding and heat treating, the blade was etched or "watered" with a kasis (ferric sulphate) or zag (zinc sulphate) solution and finished. Predominately cementite grain blades etched out as white or yellow (Ispahan) and predominately eutectoid blades etched out gray or black (Khorasan).

In 1981, working with a traditional forge and unique processing applications, Robert Job, of Hawthorne, NJ, recreated the first wootz Damascus blades in modern times which exhibited both the macro-structure and the micro-structure first seen in weapons of the period of Alexander the Great, about 300BC.

Metallurgical researchers for the past several centuries had been attempting to duplicate the original Damascus steel, famed for its unparalleled hardness, tensile strength, ability to hold an extremely sharp edge, and extreme flexibility, as opposed to the forge welded blades developed by Asian and European smiths and popular in the U.S. today. The latter articially duplicates the pattern and properties of the famous Damascus weapons by forge welding and reforge welding alternating layers of high and low carbon steels into many layers.

Robert Job first publicly demonstrated wootz production at a meeting of blacksmiths in Gainesville, FL in February, 1981. Unlike much of the high quality steels being produced today which exhibit similar properties, the Job process requires no alloys or heat treating after casting and forging and exhibits wear and toughness characteristics superior to the best cold worked alloy steel on the market today. Blades produced under this process are too hard to file, yet can be bent to a full 90° and returned to their original shape with no visual damage to the structure of the steel.

The four upper photographs of finished wootz blades were provided by Al Pendray, of Williston, FL, one of two bladesmiths now casting and finishing blades by the Job process. The other blacksmith is Stephen Swertzer, also of Williston. Al produces several variations of wootz blades. The bottom photograph is a Damascus-pattern knife for comparison.



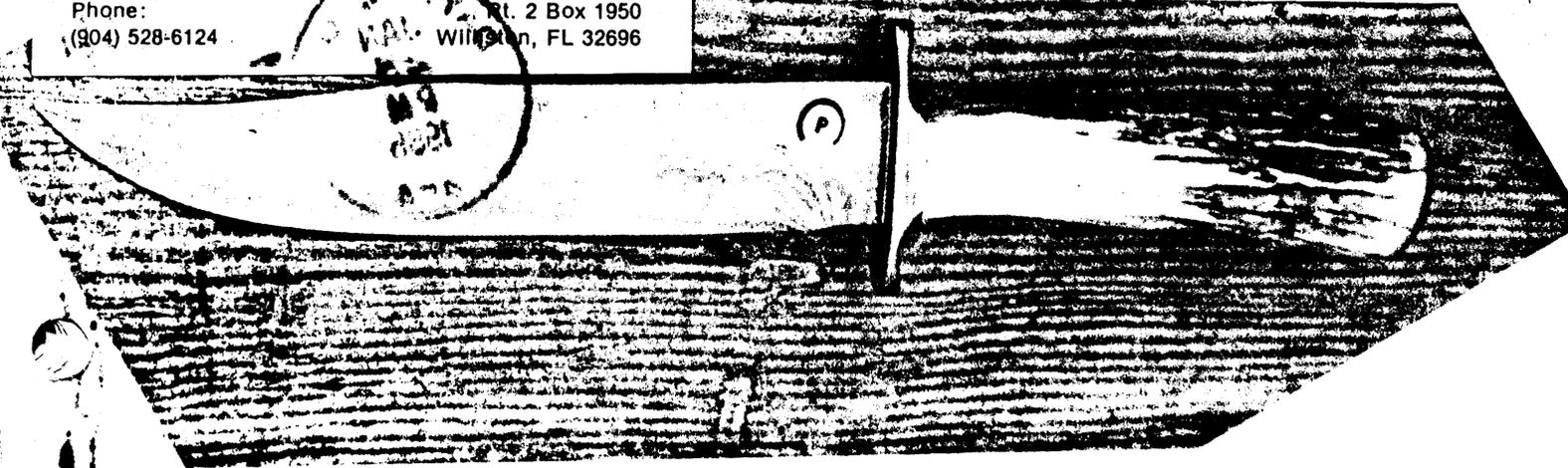
DAMASCUS KNIVES
 WOOTZ — PATTERN WELDED — CARBON STEEL

(P)

ALFRED PENDRAY
 Master Bladesmith
 Knife Makers Guild
 American Bladesmith Society

Phone: (904) 528-6124

Box 1950
 Williston, FL 32696



A limited number of blades or completed knives are available from Wootz, Intl., 1046 Goffle Rd., Hawthorne, NY 07506 - (201) 562-3398. However, before you reach for the phone, be advised that these blades are currently selling for \$200 per finished blade inch. Subsequent engraving or embellishing is extra.

For further information on Damascus steel, read the articles: "The Legendary Steel of Damascus", Parts I-III, Vol. 10, #1, Vol. 11, #2 and Vol. 11, #4 of The Anvil's Ring; "Types of Damascus Steel" by Daniel Tokar in the Jan/Feb 85 issue of The Blacksmith's Gazette or the Dec 84 newsletter of the Appalachian Blacksmiths' Ass'n; "Rediscovered: Supersteel of the Ancients" by James Trefil in the Feb 83 issue of Science Digest; and "Damascus Steels" by Oleg D. Sherby and Jeffrey Wadsworth in the Feb 85 issue of Scientific Americana.

ABANA Membership Application



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- | | |
|---|--|
| <input type="checkbox"/> New Member | <input type="checkbox"/> Renewing Membership |
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How did you learn about ABANA? _____

Reminder that the S.O.F.A. by-Laws require members to also belong to A.B.A.N.A.

- Fulltime Student \$15/yr.
- Regular Member \$25/yr.
- Family Membership (one vote) \$30/yr.
- Senior Citizen \$20/yr.
- Overseas Membership \$32/yr.
- Contributory \$50/yr.

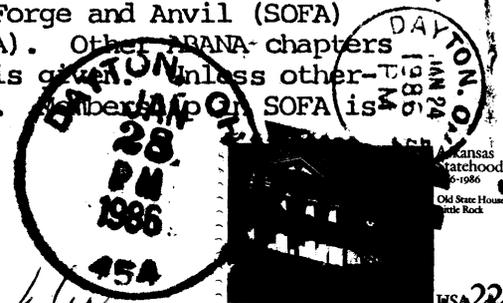
Membership in ABANA includes a subscription to "The Anvil's Ring" and reduced fees at conferences.

Send your check (U.S. funds only) along with the membership application to:

ABANA
P.O. Box 303
Cedarburg, WI 53012

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NOTE: Your SOFA membership expires 6/86.