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Cover
"The Blacksmith" (1870-80) by Constantin Meunier (1831-1910). From the Burrell Collection, Glasgow, Scotland. Photograph courtesy of Henry Gilliam.
10,000-lb. double arch steam hammer . . .

This hammer was removed from a Southern Pacific Railroad shop in Sacramento, California where they built the Pullman cars. Their shop facilities were themselves a complete city. They had their own water and power systems, wood mill, foundry, sheet metal shop, radiator building facilities, hospital, and machine shop with wheel making capability. The hammer was removed from a pyramid of oak timbers each 14 inches square.

The oil pump mounted on the right leg is the same as ones used on steam locomotives. The steam inlet is the white pipe at top. The exhaust is the 8-inch vertical pipe. Steam can be seen coming from the water drain pipe which connects to the bottom of the cylinder. "Woody" Woods is the hammer driver; Don Hawley is on the tongs; and "Mac" McCoy is holding the stopper block. At the right edge of the photo, on the table, lays a pair of 6-inch swages weighing about 100 pounds.

The sowe block shows the repair band described in the Fall 1982 issue of the Anvil's Ring (Vol. 10, No. 3, p. 8).

The hammer was taller than the bridge crane, so it was set up outside the building. The bridge crane could run up against the hammer; a roof was added on.

The material being forged is 90-10. In this circumstance the 90 is columbium and the 10 is tungsten. The material as pictured is actually ready to forge. It was heated to about 500 F, then pulled from the furnace and painted heavily with a special glass compound. This was to prevent the ingot from oxidizing during the heating and forging cycles (the producer of the ingot supplied the glass). The actual forging temperature was 2300 F. This very expensive forging was to be used in space. The ingot was melted from raw material, then remelted into an ingot mold. This was done by an electronic beam in a very large vacuum furnace. This furnace was 20 feet in diameter and perhaps 20 feet high. At about midpoint there was a catwalk with peep holes for visual inspection of the inside. It was interesting to see the beam directed on the end of a first melt ingot — the ingot rotated and dripped like a giant candle.

The photo shows part of an old riveted and bolted jib crane. A tag line is hanging on the far right end of it. It was used to help swing the crane from hammer to furnace. The black looking spot on the web at the left side is actually a hole we burned. This was the balance point we hooked onto to stand it up. The heaviest individual forging I used this crane for was a 3000-pound piece of 18-inch diameter iron. It has a hand operated hoist (very good for forging) and has been used to move 10,000-pound pieces.

The bridge crane can be seen behind. It had a six-button control — east-west on the bridge; north-south on the trolley; and up-down on the hoist.
Mounting the 10,000-lb double arch hammer...

1-a. The wall at the rear side of the pocket for the 10,000-pound hammer base or anvil as it is sometimes called. The two rear anchor bolts (far side of the photo) hold down the left column or arch of the hammer. Just the top of one right leg anchor bolt is shown. (see fig. 4, page 6 of the Fall 1982 issue, A.R. vol. 10, No. 3)

Also shown is a "special box" to maintain an opening so the one key at the bottom of the sow block and below ground level can be ram driven in and out.

1-b. The cribbing that will provide the anvil base and the timbers that will be under the base. The 7-foot thick concrete block (with rebar on 12-inch centers) has already been poured.

The retaining walls around the perimeter were made of large pieces of salvaged ¼-inch thick plate and reinforced with used railroad track.

1-c. The left side mounting pad bolted in place. The two back bolts holding this pad are the same as those shown in 1-a. The locating lugs for the leg flange are cast as part of this pad. The legs are bolted to these pads. Space is provided to use wedges between the lugs and the leg flange for fine adjustment and line up of the ram guide areas.

The timbers and base with the sow block and die are in place. The left leg is held back of vertical, so the ram can be more easily lowered into the guides.

1-d. The ram of the hammer is held in the up position. Cables run through the dovetail where the die will be keyed. The guide for one side of the ram can be seen. This is an integral part of the ram casting. It is a 3" x 5" cross section.

This cylinder is 100 inches from top of lower flange to top of cylinder. The inside diameter is 20 inches. The piston rod is 8½ inches in diameter. Remember, this hammer was made in 1890.

1-e. Lowering the ram into the female guides. The guides are an integral part of the legs. The jacks under the cheeks of the arch are lowered to permit the guided or upper part of the legs to come in to a vertical and close fit in the ram.

1-f. Getting the cylinder flange set down over the dowels. I forged an ingot into flat bar that was rolled into sheet and used for the skin on the first reentry vehicle in the space program.

I can't describe the feel through the longs when you make a forging with such a hammer. With a tricky forging on flat dies, to command it to go your way when it wants to go another, is the second best feeling there is.
Mounting the 20,000-lb. drop hammer...

2-a. The 80-ton piece of the two piece base. The ram guides are in place. Eight hold-down bolts and coil springs can be seen. These are locked to this base. The bosses and cross shaft for the foot pedal can be seen on the front of the base. We did not use these. Converting this hammer to lever control should not be confused with the change I made on the 500-pound hammer for a single blow mode.

2-b. Setting down the second leg. In the background one sees the rebrickling of a forge furnace. The right-hand-side door-jamb is being built. The outside width was 8 feet. The walls were 18 inches. Losing the 18-inch deep rear wall and the front jambs, we ended with floor space of 5' x 5'. This was an old furnace purchased from a San Francisco shipyard facility.

These legs (or columns) had so many cracks, that in 1972, they were removed. Old welds and extended cracks were air-arc'd out, rewelded and, one at a time, put it into a car bottom furnace to be stress relieved. During the few days of welding they were kept in a preheated condition.

2-c. The control levers I made can be seen on the right leg — one with a counterweight. In the background is a furnace (one of two that served this hammer) that has been cleaned out to the steel plate. The arch pattern can be seen. The arch goes between and anchors to the jambs. It has a different radius than the roof.

On the left leg are three holes that accommodate the bolts that hold the guides in position. One welded crack can be seen on the inside of the right leg. It runs down into the guide-adjusting-nut part of the column.

2-d. The cylinder with the flange and tie plate. The plate interlocks with the top of the legs to keep them from spreading.

I made a shed type roof to go over the work area. It was designed to be removed by a crane if this situation presented itself.

The customer after buying me out in 1970, bought a new 700-horsepower boiler for power. This was a Scotch Marine type and got up steam fast.

2-e. This small crane was brought in after a 200-ton crane had set down the two base pieces weighing 64 and 80 tons. These are the piston and rod. The piston is 23 inches in diameter. The rod is 9 inches in diameter. The overall length is 120 inches. That’s me getting in position on top of the cylinder. No one is going to let that piston down so fast. I don’t have time to get the rings started. Next, the cylinder head was put on — with a gasket of course. This was an old hammer and had steam cut grooves on the cylinder. I have had lots of experience on making a gasket work.

2-f. The piston rod in place is being held up by a saddle and chain. Just a short way from Jim’s glove is the pocket for the ram guides. The back of this pocket is machined at an angle. The small pocket at the same level as the rod end is where the adjusting nut is. There are three holes from the rear of the pocket to the right side of the column for holding the guides in position. Jim is standing where the srow block will fit. He is on top of an 80-ton casting. After this dovetail is made hospital clean, the sow will be put down. The sow block was about 5 feet long, 4 feet wide and 13 inches thick. Next the key will be driven in. Note the large radius in the corner of the sow for the key. This key was 12 inches wide, 66 inches long and about 4 inches thick at the big end. It had the usual taper of 1/4 inch to the foot.

Next, the 4-inch diameter tie rod, with coil spring and solid sleeve spacer slipped on it, would be shoved through the other leg. Last, another coil spring, nut and keeper pin would be put in place.

On top of the sow block went the dies. Together they measured 42 inches. One was 12 inches thick and the other 9 inches. This hammer might take the work out of it, but someone still has to handle those big pieces — even a 400-pound piece of aluminum gets tricky to push around on the die. Just remember, there is no substitute for power.
Forging with the 20,000-lb. drop hammer . . .

3-a. Upsetting a 12 inch by 60 inch piece of 304 stainless steel. Any upset more than three times the diameter is most difficult. In this case it was five times.

It was necessary to remove the bottom die because there was only 60 inches of daylight between the dies. Note that the forging is sitting in the dovetail of the sow block. One fork of a forklift is keeping the top of the forging tipped as the smith positions the bottom with a pry bar. We had made similar upsets without removing the bottom die, using a 2-inch stroke to start. In this case we didn't have 2 inches.

3-b. The upset being made. As this was done, the forging was laid down on the die to be straightened. This is tough work — push, pull, turn to all four sides, stand it up etc. After the second heat, the die was able to be put back. Note the cotton gloves. At far right are the hand levers. This hammer came as a foot operated one, all right for the simple work done on regular drop hammer operation.

The springs are on long bolts (studs) that anchor into the hammer base. The forging is almost ready to punch, but it has to be turned to lie on the die and be rolled or "shingled", making it the same diameter the entire length of the forging. Bob Day is the smith.

3-c. A 4140 steel tapered pin has been driven into the stainless steel forging, slightly bulging the end. The forging has been laid down and is being shingled. A shingling bar has been put into position, since this piece is somewhat heavy to shingle by hand held shingling tongs. Behind the forging is a barrier to keep the forging from rolling back. It is being turned in place by use of the pry bars.

The pin may want to come out before shingling has been completed, so the man on the left will hold against it. The big end of this pin is about 7½ inches. The small end is about 6 inches. It is about 10 inches long. The pin is driven in each end, and a plug is sheared out to give a 7 inch hole.

3-d. The forging, now a sleeve, is set between the mandrel stands. These are keyed into the base block. Normally the sow block would be there with a die on it. This hammer rarely (never) had a bottom die on it.

The mandrel is at right — 6-inch round, heat treated 4142 (4140). A forging such as this, especially when finished up on the cold side, shortens the life of the mandrel. We got three mandrels out of a 20-foot bar. One end is forged to 4 inches square, and a handle bar assembly bolted on using four 1¼-inch diameter heat treated bolts. You can also see a pair of pick-ups hanging in a chain. These heavy duty pick-ups are used to shift position or rotate the normal sized (100 lb. to 1,000 lb.) ring. That can be fast, heavy, hard work, but what pectorals you develop!

Punching a hole . . .

4-a. The 20,000-lb. steam drop hammer (top die is 3000-lb., 32-inch octagon and the bottom die is 42-inch square) forging 304 stainless steel. The corners were knocked off a 10-inch square billet, stood up and upset to 5 inches thick by 24-inch outside diameter. A 7-inch punch was driven into the forging. A few more light taps and the forging will be turned over and the punch driven through to remove a plug about ¾ inch thick by 6½—7 inch outside diameter. It will then be mandrel'd out. Note the sow block is in — key on the right side behind spreader bar.

4-b. Putting the stainless steel forging between mandrel stands. The pick-ups hanging from a chain are in use. A fork lift brought the forging from the die of the hammer to this 3000-pound single arch hammer. From the size of the hole, you can tell it has already been mandrel'd once, flattened back to 5 inches, and now being mandrel'd again. Since this is a 650-pound forging, the smith is able to use the pickups to take the ring from the forklift and swing it between the stands so his men can slide the mandrel through the hole.
The 1984 Conference saw a new departure in taking and amplifying a single theme — Design. It was a remarkably constructive and well developed conference, especially considering that it dealt with a subject so difficult to define. We had a series of talks, each completely different, which most competently covered every aspect of the theme. Particularly valuable were a series of design case histories in which six smiths each discussed the design origin, development and making of one of their recent major works. Of these I found three of particular interest.

Jim Horrobin showed slides of a most unusual modern building, Crown Reach, on the embankment near Vauxhall Bridge, London, for which he had designed and made eleven gates of varying shape and size. The building itself presented two very different aspects: the outer one smooth and curvaceous with a scalloped roof line, the other or inner side of a rough texture, its walls and windows broken up into an almost crystalline structure. These architectural variations provided the inspiration for the design of the gates. The curves and scallops of the front of the building were reflected in the top line of some of the gates, 3 meters high on one side and sweeping down in a single curve to a lower opposite post; the design is one of verticals and fairly dense to provide privacy. On the inner side of the building, square tubing was fixed to the vertical bars in different positions to reflect the cube-like architectural pattern.

As it was a large contract with a penalty if not completed on time, Jim was assisted by an ex-Farnham College student and two other helpers without previous blacksmithing experience. One had been a thatcher, and the other was a Frenchman with little English. It speaks much for Jim's philosophy, that rather than produce the gates on a factory system, he preferred individual helpers to produce whole gates and thereby derive job satisfaction.

Jim stressed the importance of designing, saying that he spends as much time drawing as smithing; so many problems can be sorted out at the drawing board stage. The design itself aided the inexperienced assistants, since the components were simple to make, and to save time, the posts were cut out of RSJ by an outside firm.

Railings and lamps at Oriel House, off Edgware Road, London were also discussed. Two bands at the top of the rails and three at the base were derived from the design in the glass at the top of the building. These rails were designed roughly in 2-metre sec-
tions, each weighing 2 hundredweight, so that transport should not be too difficult.

Mike Malleson spoke about a most unusual commission. Two years ago he was asked to replace a dead cherry tree with a work in iron. The site was a wholly enclosed back garden, and soil fungus made growing a new tree impossible. The derelict tree was still standing, some branches snapped off short and the bark fractured and peeling from the trunk. Mike made a three-dimensional ‘drawing’ in copper wire and sheet, and after discussion with the client, followed this with a forged maquette for the replacement. The trunk and branches of the finished piece were made of tube wedges being cut out of the ‘branch’ tubes to facilitate bending. A piece of \( \frac{1}{4} \) in. plate was used for the bark, wrapping round the lower part of the trunk. As the steel had a high carbon content, it began to crack as the edges were forged out thinly; this problem, however, proved to be controllable and produced the desired effect. Oxy-acetylene cutting produced some characteristic lace-like ‘wear’ in the bark.

No doubt other blacksmiths would like to find equally eccentric clients — one wonders if this is the first metal tree to be produced in this country since the willow tree at Chatsworth from whose branches used to spurt jets of water.

Charles Normandale had entered an open competition, competing with artists in other disciplines, to embellish a hall in the City of London designed by William Whitfield for the Institute of Accountants. He had not found the hall particularly inspiring; since it was a rather extraordinary room no less than 60 feet long by 18 feet wide and already contained several fine works of art including two John Piper paintings. The whole of one wall was filled strongly and rather monotonously with vertical fenestration, broken only by the single horizontal of a very long table set before the window. He was anxious to design nothing that would conflict with the other art works, particularly with a fine modern tapestry hanging. He decided that the metalwork ought to appear as an integral part of the building itself, as if it had been there from the start. He picked on the horizontal line and ran a broad band of steel plates pierced with simple rectangular openings along the whole 60 foot side of the room. The weight will be 1 ½ tons and it will be held away from the windows on brackets made of 4-in. square solid. The panel will be finished by a bronzing technique in which bronze colour is transferred to the warm plate by brushing it with a bronze brush. The work is expected to take five
months to complete and will cost some £25,000. It is hoped that when the commission is finished and installed we shall be able to send ABANA photographs.

It was interesting to see the form in which the design had been presented to the judging panel headed by Sir Hugh Casson; a large photograph of the window side of the room was used, overlaid with sheet of acetate on which the design for the metalwork was shown in black; the whole mounted on card and contained in a clear envelope. This would have met with the approval of Melvin Pinnock, who gave a most informative and helpful lecture on “Draughtsmanship and Presentation”, showing how important it is to offer the design in a professional manner whether it be a client or in competition.

The final lecture on design was a masterly summing up of the subject by Peter Parkinson. He sought to define the difference between the decorated and the decorative. He contrasted slides of a late 19th century stove, covered with pattern or in other words “decorated”, with objects of intrinsic beauty of form such as bronze-age axe heads and microlith arrow heads which were in themselves “decorative”. He discussed optical illusion, symmetry and the asymmetrical; the neat balance of black letter print; scale; the tradition of Celtic design; and the changing styles of fashion — such as Rococo. He questioned the well springs for inspiration — nature and close up photographs of plants — paths already trodden by Fritz Kuhn and Samuel Yellin with such great effect.

The visiting demonstrator was Jan Dudesek, born in Czecho-

slovakia and now living in Switzerland. He showed slides of his work and talked about his approach to design and forging. Early pieces were grilles and grave crosses of a traditional middle European nature. There was a wide variety, rather jolly simple pictorial designs followed by restoration work of a high quality. There were several magnificent 18th century style signs with particularly lively and attractive cockerels forming part of the design — also a fine peacock sign on an inn in Zurich.

Gradually Dudesek’s work took on a modern look, candlesticks and fire tools of extreme grace and beauty, as indeed were those shown at the Victoria and Albert Museum Exhibition in 1982. The fire tools there rested on a large natural pebble as a stand. He was becoming particularly fascinated by the combination of iron and stone. One of his works shown at Lindau was an outdoor lamp of three stems with an enormous boulder standing apart from the iron but a necessary part of the group. It was possible to see how later iron gates of solid sheet form and often triangular shape, came to take the same relationship to stone gate posts; the work always becoming larger and more architectural. In something of the same way, his fire accoutrements, such as grills or griddles, were also pared down to the essentials, taking on a definite end of the 20th century look.

A series of slides showed his work for a cemetery, all the gates and barriers being based on triangular shapes and heavily symbolic. Movement by wind and the integration of water were also taking place.
4. Graham Sutherland Memorial wall sculpture by David Petersen.
5. "Blacksmith" by Rachel Reckitt.
6. Fire grate by Julian Coode.
7. David Petersen.
8. Wall sculpture by Tim Fortune.
9. Wall sculpture by Tim Fortune.

(photographs by Amina Chatwin)
The final set of slides showed pieces for a public park in Zurich; the work had become contemporary abstract sculpture — uncompromising stark tubes with a little carefully thought out colour. In one instance, a very long red tube was suspended, balanced over a river and in a form of audience participation passers by on the bridge above can, if they wish, swing round the tube by a hand wheel mounted on the side of the bridge rail.

Jan Dudesek can be said to be one of the most original blacksmiths working as a sculptor in the world today. His philosophy is that he doesn’t like to see beauty spoilt; if a tube is all one could wish in elegance, why spoil it by bashing it about unnecessarily? However, as when all modern art is taken to its logical conclusion, subtracting all that is irrelevant, one is in danger of arriving at something of a void.

This is not an easily acceptable art. The latest work of Jan Dudesek is so stripped to the bare essentials that members found it difficult to accept the renunciation of his earlier style based completely on fine smithing.

The exhibition was the fourth that Mike Roberts has designed and arranged for BABA, for which we all owe him a great debt of gratitude. One work in particular added to its stature; we were fortunate to have the opportunity of seeing the wall hung memorial to the artist Graham Sutherland by David Petersen. Commissioned by the curators of the Graham and Kathleen Sutherland Foundation Trust, the work will be sited above a doorway in the Gallery at Picton Castle, Rhos, Nr Haverfordwest. It is a beautiful work carried out entirely in forging and honest blacksmithing techniques. A sea bird caught in a thorn bush (the great crescent shaped thorns so reminiscent of Graham Sutherland’s paintings) symbolises the artist’s fascination with the Pembrokeshire landscape and the commitment he came to feel for a much loved area. The background mirrors his frequently used scheme of composition of a horizontal landscape superimposed with a circular motif. It would only be possible to pay homage of this nature in a medium other than the original, and David Petersen’s own artistry has made iron an exceptionally happy choice.

Rachel Reckitt showed three sculptures: a Polo Player, a Dancer and a Blacksmith: the latter, formed an effective part of the introductory section of the exhibition setting out a wide variety of blacksmith’s favourite hammers.

Julian Coode exhibited a graceful bracket for a hanging basket and a fire grate, particularly satisfying in design, with what appeared to be a row of round topped trees across the front. Also shown was his plant form cross that won the very fine BABA trophy, by Anthony Robinson, for the best contemporary work at the Royal Show. A hand mirror by Peter Parkinson was reminiscent in its graceful simplicity of line of the famous Celtic bronze mirrors of the Early Iron Age. Tim Fortune showed several wall sculptures in mild steel and copper, some depicting reeds and landscape and one a shoal of fish.
10. Table by Alan Dawson.
11. Orchid Lamp by Alan Dawson.
12. Ivy leaf table by Martin Reeves.
13. Melvin Pinnock (center) with Martin (left) and Duncan Reeves.
15. Detail of candle stand by David Beaumont.
(photographs by Amina Chatwin)
Alan Dawson had developed his earlier "Lily" lamp into a whole genus of very decorative "orchid" lamps and one eye-catching green palm tree lamp — also shown, an interesting table in his characteristic style.

Melvin Pinnock and Martin Reeves have been joined by Martin's brother Duncan and have moved to a forge in a more rural location, near Canterbury, where they can play Croquet in the lunch hour! Melvin, with Duncan, exhibited three lights in plant form, and Martin showed a coffee table in the shape of an ivy leaf.

There were perhaps rather less traditional pieces than usual, though Tommy Tucker exhibited a fine repoussé gate overthrow of exceptional workmanship and fine design; he also gave a talk and demonstration on repoussé work. There was a very elaborate nine branch candle stand incorporating copper, its base wreathed in roses, by David Beaumont. Hector Cole showed a graceful modern gate; he has developed a style which produces uncluttered modern work which still manages to retain all the elegance of the 18th century.

Styles of lighting shown were varied. Mat Gilpin's candle stand was flowerlike, and Len Hutton's hanging wall light tubular. There was not quite so much small work as usual, and there is some concern that members may feel they are expected to send only elaborate pieces — which is far from the original intention. It was, therefore, especially pleasing to see a straightforward traditional country gate from Midlothian by Phil Johnson. There were more elaborate gates from Tony Wootton, Graham Hodgett's three dimensional, and Rod Richens, with flowers.

In choosing one work from so many to present the Addy Taylor cup, Jan Dudesek looked for a piece that had clean and exciting technique; the kind of smithing that pointed the way ahead. The choice was a fire gate by Ian Lamb (The Rowhurst Forge) of simple solid bars whose acute bending produced all one could require of an object intrinsically decorative in its formation; it was also unusual in that the inner and outer form was held in tension by front and back rods, rather than being fixed to them.

Highly commended was a small bowl from several shown by David Tucker. Made from three pieces of shaped plate, flanged and welded together, it presented a very unusual design, the form attractive and varied from all angles. The whole group of bowls was interesting; the earliest made were boldly riveted from a number of pieces of pressed plate, until the bowl shapes gradually refined and the rivets disappeared. David, who has just completed his BA (Hons) Metals course at the West Surrey College of Art, has also evolved a unique method of colouring and patterning his work by the use of chemicals, heat and controlled rusting.

In 1985 the Conference will be held at Coalbrookdale in Shropshire, the home of the Ironbridge Gorge Museum and the famous iron bridge that spans the river Severn. Cast by Abraham Darby III and erected in 1779, it is even more renowned now than when it was first made. The picturesque scenery of the dale that has delighted artists from Turner to Piper is filled with sites relevant to the history of iron working from the remains of 18th century blast furnaces to a recently re-erected puddling workshop. All this as well as the museum of cast ironwork — how are we going to find time for the Conference!
16. Gate by Hector Cole.
17. Candleholder by Mat Gilpin.
19. Gate with flowers by Rod Richens.
20. Bowl by David Tucker. (highly commended)
21. David Tucker
22. Patterned and coloured bowl by David Tucker.

(photographs by Amina Chatwin)
On the Welding of Wrought Iron and Mild Steel

by Wallace M. Yater
In Chapter 1 "The History of Pressure Welding" of The Solid Phase Welding of Metals, Ronald Tylecote includes this very interesting drawing of glut welding the sternframe for a large ship. About it, he states:

By the middle of the 19th century, wrought iron technology had reached its zenith, and large forgings weighing as much as 30 tons could be made by the process of "laying-up". This process first required the making of slabs by piling pieces of forged puddled iron on top of each other and welding them into a slab weighing about 2 cwt. [224 lbs]. These were then forged together, now using steam hammers and mechanical handling facilities. By this means a double crank shaft weighing 30 tons was made for the ironclad Monarch and a propeller shaft weighing 35 tons for the Great Eastern.

When it came to the stern frame, the piling and forging process was not adequate [T. Putnam, Engineering 1885, Oct. 20, 504]. These items could be as large as 36 x 14 feet, and were of such a shape that they could not be forged by conventional presses and hammers. It was now necessary to go backwards and resort to the welding of individually forged sections.

The stern frame of the Great Eastern weighed 25 tons and had to be made, like many after it, by joining as many as three large forgings by "glut" welding. In this process the individual forgings are fastened together in their correct relative position by straps and bolts (impression courtesy of R.C. Benson). The ends to be joined are given a double "V" preparation, heated to a welding heat in a coke fire built round them on the floor of the forge and then moved into position under a steam hammer. The filler pieces or "gluts", first wedge-shaped and later square, were heated in a separate fire and placed in position and gently hammered. Too much force would break the straps and bolts, so great experience was necessary to get a good weld without using too much pressure. After the first glut had been put into position, the frame was turned over and the second one inserted.

Tylecote goes on to add as a later development:

The technique of joining had not altered; only the method of heating had changed, water-gas (old time city gas made with water and a coke fire).

The advent of Bessemer steel in the 1860's led to investigation of its forge-welding properties. Experiments by Welding [man's name] in Berlin (Anon., Journal of the Iron and Steel Institute, 1884, 225-227) showed that perfect welds were the exception and the welding of "ingot iron" (low carbon Bessemer steel) should be avoided. In Austria, however, ingot iron whether made by the Bessemer or open hearth process, was generally considered to be weldable. Tests were carried out on low-carbon (0.1%) Bessemer steel, recarburized to 0.25% C with spiegelisen [German mirror iron, a crystalline white cast iron containing carbon and manganese]. The analysis gave 0.21% carbon, 0.13% silicon and 0.48% manganese. The specimens were 2.75 inches square section, forged down to wedge-shaped ends which were scarf-welded with the aid of sand. After welding they were reheated and forged into 0.71-inch square bars 14 inches long. These were turned into 0.59-inch diameter welded test pieces. Average results were as follows:

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<th>Ultimate tensile strength in tons per square inch</th>
<th>Elongation %</th>
<th>Reduction in area %</th>
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<td>unwelded steel</td>
<td>35.3</td>
<td>18.8</td>
<td>57.5</td>
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<tr>
<td>welded steel</td>
<td>34.8</td>
<td>19.1</td>
<td>55.4</td>
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</tbody>
</table>

The gauge length was 8.0 inches and a marked yield point was noted at a stress of about 21 tons per square inch.

The conclusion, not unnaturally, was that forge welding was certainly satisfactory in material of this composition. Due to the absence of inherent slag, mild steel has always been more difficult to forge weld than wrought iron. But, there is little doubt that a smith well versed in the art can handle it with consistent results.

I wish to thank Ronald Tylecote and his publisher, Edward Arnold Ltd., London, for their permission to reproduce this material.
The September 1980 issue of the Anvil's Ring was comprised of a collection of Blacksmith plates from the Encyclopédie of Diderot and d'Alembert. To aid your understanding of the prints, James L. Kirkland is providing translations of the French text for each plate. Here is the translation for plate 36 in our collection augmented by Mr. Kirkland's well-researched notes.

**Translation**

**Title:** Serrurier. Tools for the workbench.

**Fig. 1.** Wrench

**Fig. 2.** Small scroll wrench and hook wrench. A. the scroll wrench. B. the hook wrench.

**Fig. 3.** Very small scroll wrench and hook wrench. A. the scroll wrench. B. the hook wrench.

**Fig. 4.** Double iron for cutting tole. A. the eye serving as the spring.

**Fig. 5.** Scroll wrench for mounting crosswise on an anvil. A. the scroll wrench. B. the mounting.

**Fig. 6.** Small scroll wrench for mounting lengthwise on an anvil. A. the scroll wrench. B. the mounting.

**Fig. 7.** Scroll wrench for anvil, without mounting. A. the scroll wrench. B. the tenon.

**Fig. 8.** Machine for boring. A. the upright. B. the spring. C. the palette. D. the bridle. E. the screw.

**Fig. 9.** Drill. A. the arbor. B. the handle. CC. the cords. D. the counterweight. E. the box. F. the drill.

**Fig. 10.** Machine for boring. A. the elbowed piece serving as a pivot. B. the puppet. C. the drill. D. the box. (drill socket).

**Fig. 11.** Drill socket.

**Fig. 12.** Elbowed piece. A. the pivot for the drill. B. the mortise.

**Fig. 13.** Puppet. A. the hole (bearing). B. the tenon. C. the mortise for the key.

**Fig. 14.** Drill for boring iron. A. the cutting edge.

**Fig. 15.** Drill for boring copper. A. the cutting edge.

**Fig. 16.** Square countersink bit. A. the bit.

**Fig. 17.** Round countersink bit. A. the bit.

**Fig. 18.** Balance for weighing iron. A. the hook with foot. B. the beam. CC. the plates.

**Figs. 19 & 20.** Weights for weighing the iron. AA. the rings.

**Fig. 21.** Small balance for weighing nails etc. A. the bracket. B. the beam. CC. the pans.

**Notes**

(The numbers for the notes are keyed to the numbers for the figures above.)

1. This wrench is used principally for twisting flat bar iron, the bar being held by a similar wrench or in the jaws of a vise.

2 & 3. These are combination scroll wrenches and flat-bar wrenches. Note that the spacing of the posts on the "scroll end" is much greater than that of the flat-bar end. Wrenches similar to these are still made and sold in France today.

4. I have never read a description of how this tool was used. I suppose that the thin sheet metal to be cut was placed between the parallel legs of the tool, then the tool was gripped in the vise. The chisel was then used to cut along the edge of the parallel legs. This would produce a precise, undistorted edge on the piece gripped in the tool.

5, 6, & 7. These tools for the anvil are still widely used today.

8. There was a wide variety of "boring machines". Most of them appear to have been 10 to 18 inches high and were made to turn the bits Figs. 14 through 17. Unfortunately, Diderot didn't show the entire machine assembled for use. I have tried to show this in my Fig. N-1 which I adapted from an illustration in Du Monceau's classic textbook on blacksmithing. The palette, c, is often shown with several holes presumably for holding the bit at angles to the work. The drill socket (spool or bobbin) was then turned with the bow. The modern translation for the French term for this machine is "hand drill".

9. This is the familiar "pump drill" used since prehistoric times.
10 & 11. These parts comprise an assembly that could be used with the boring machine of Fig. 8 where the framework, screw and palette of Fig. 8 would be used to supply the force to press the bit against the work.

13. The term “puppet” applies to French drilling machines and lathes and generally means the headstock, tailstock or journal. It is an old term not usually in modern dictionaries.

14 & 15. Note that the diameter of each drill is reduced immediately behind the cutting edge.

16. Evidently the cutting edge is the square corner. Du Monceau shows this type in his book.

17. The Diderot illustration does not show any longitudinal flutes or cutting edges on the round countersink bit. Du Monceau describes them as “with grooves” and illustrates them likewise.

18. This is the large type of balance with square plates for weighing bars of materials as well as bulk material. (See the bottom view in Plate 6 of the Anvil’s Ring series). Note that the square plates permitted the iron bars to rest conveniently and symmetrically. This was not possible with the “tripod” arrangement of the pans as shown for the small balance of Fig. 21. The balances and weights shown here in Figs. 18 through 21 were part of the blacksmith’s shop equipment and were usually made by tradesmen known as “balanciers”. In the 1700’s the balanciers were governed by the mint; their work was marked with their name, a crown and fleur-de-lys. The patron of the balanciers was Saint Miché who is often shown at the judgment weighing the souls “before the sovereign judge.”

Sometimes the balanciers had certain parts of their balances made by other tradesmen: the beams were made by blacksmiths (securiers) and the pans were made by the makers of pots and pans (chaudronniers).

Jousse, in his “Treatise on Blacksmithing” (1627) directed close attention to “placing the axle directly in the center of the beam, to make it as round as possible to enter the holes in the journals, which also should be made as round as possible to fit the axle... and make the tempering of the axle and the journals as hard as we are able, so as neither the axle nor the journal wear the one or the other...”

Jousse concludes: “the long beams are the best provided they are pierced exactly in the middle as near the underside as possible, otherwise they will be found defective... take special care here. I don’t wish to tell about all of the cheating that you can use (in making unfair balances) because I am afraid that I would teach those who would use them dishonestly.”

References
Wrought Metalwork, 10

Lighting Fixtures

By Bernard Heatherley
The controlling element in the design of good lighting fixtures has always been the illuminant itself; and it is proper that this should be so in wrought metal fixtures and at the present time. The unconscious application of this principle has brought into being many lovely forms and has shown that every form of artificial lighting so far used is capable of treatment in good taste. Unfortunately, a number of designers have felt that the current illuminant must be cloaked in the dress of some preceding era before its use can be tolerated and we see forms that were developed as indispensable to the needs of rush light, candle, whale oil, kerosene, etc., pretending to help in the work of electricity. This seems a rather shame-faced attitude towards something which is, in many minds, our era’s proudest boast. Many of the lighting fixtures extant almost tie themselves in knots in the effort to be quaint, such as the “candle burning” lantern hung on an iron pole from which it cannot be removed (although you are supposed to think that it can), the fixtures with false candles employing bobèches to catch the grease which drops from the electric light bulb, or those with an oil reservoir from which, supposedly, the electric light draws its fuel! Such ignoble design is usually carried out for wrought metal purposes — ignoble material — gas pipe and the like — through which wires may run so that the true source of the light may not be seen. All this argues the absence of sincerity, tolerance of the poorest kind of imitation, and lack of design ingenuity.

In designing lighting fixtures our minds should not first jump to some 16th or 18th Century fixture we have seen and then consider how it would look in such and such a place. We should first think of the need for the light, the range it must have, the necessary intensity and the exact position it should occupy. Our problem then resolves itself into safely supporting an electric bulb or bulbs in a given position, carrying the illuminant to them from a more or less remote source — and doing these things beautifully. There is no reason why we should not make well and traditionally wrought fixtures directly for modern lighting.

There are some historical forms of fixtures perfectly suited to use with electricity and our desire for sincerity of design must not blind us to their advantages. We see this in considering exterior lighting fixtures of which the commonest type is the lantern. Lantern forms were developed to protect a flame from the wind and in turn to protect themselves from the weather. It might, then, at first appear that electricity’s immunity to being blown out would allow us to dispense with such protection. The fittings and materials used in conveying the current to the bulbs, however, must be closely guarded from the elements and from interference. The electrical underwriters make quite strict demands in this connection. Also, an unenclosed light seems less effective as well as being much less pleasant than an enclosed one, so that the desirability of glass or some other shielding and diffusing agent is indicated — with its need of framing. So considered, it appears advisable to box in an electric light and at this point, if we like, we can turn to precedent for suggestions. If one resents precedent, the attempt might be made to assemble mentally all the considerations bearing on lantern design and create accordingly. The result would undoubtedly be the production of one version or another of a lantern body tapering inwards towards the bottom and having a pitched and vented roof. So long as rain and snow fall, pitched roofs will throw them off, and the side that slopes inward runs less chance of conducting water from the eaves than does a vertical side. The possibilities with the latter are that water will enter the lantern body or that it will freeze between metal and glass, bending the metal or forcing the glass out of position. The heat generated by an electric bulb needs venting no less than the smoke from oil or candle. The piercings for such vents have always provided fine decorative opportunities.

One demand made by electricity which was not so important with more elementary illuminants is utter rigidity in a fixture and its supports. The appeal of a pendant lantern, hanging either from a high soffit by chain or by a ring from a bracket must be subject to the practical consideration that when such a fixture swings in the wind it puts upon the electric wires the very action we use to break them — or at least, to break the insulation. Because of this, it is sometimes attempted to obtain the effect of a truly hanging lantern by making it with a ring at the top which loops over the bracket, but actually making it rigid by riveting the ring to the bracket. This is open to criticism as design, in favor of a detail that is frankly rigid. The decorative value of chains is frequently weakened by the interfering line of the wires threaded through them. They may sometimes be freed from this interference by bringing the wire to the lantern quite openly from a point other than that where the lantern is supported. Such a point could be on a level with the lantern even though the support is many feet above. The wires could be taken along a rod which would also act as a brace, or could be threaded through a decorative cord which would fall to a graceful line. If the wires must come from the point of support, a rod may be substituted for the chain, being open to very decorative treatment and less subject to interference from the wires. This concession must be made to chronic wire hiders — that where exposed wires would give an ugly line, they may be so controlled as not to interfere with the design — even to the point of using tubing in some cases. But this is very different psychology from trying to disguise 20th Century means as 18th Century effects. Tubing has certain disadvantages. It is expensive and will not permit the vigorous handling possible with a solid bar. It is not made in all the sizes or all the metals one is liable to need. But where it is the only way to avoid interference with design or where wire may not be even partially exposed, it has its uses. Otherwise, a solid bar grooveed with the fuller to accommodate the wires is satisfactory, although the lead-covered cable used for exterior work is well enough protected in itself and may lay on ungrooved members. Such of the laws covering electrical installations which tend towards awkwardness must be taken as a challenge to a designer’s ingenuity. One awkward requirement is the outlet box — easily enough handled when the design permits the use of a canopy, but difficult with such designs as do not want this big spot. A sunken outlet box, cemented or boarded over, is one solution but as the average electrician sees nothing wrong with boxes it is well to establish that certain boxes are to be sunk.

The two great diverse types of exterior lanterns are those which are more or less heavily forged, showing a lot of metal, and those which tend towards tinsmith’s work — having, with certain exceptions, large openings and showing little metal. Chronologically, the forged type came first, its origin being in the cresset, a sort of metal basket set on a bracket in which the mediaeval torches were held. The cresset developed very naturally into the lantern — or the light enclosure, for today the type is often roofless and unglazed. In such cases the electric bulbs are individually enclosed and all attachments made weatherproof. The offense of the raw light is mitigated by the decorative encasement which breaks it up. Experience shows that exterior lanterns of sheet metal are best made of non-corrosive metal. Having so little substance, extensive damage is apt to be done before corrosion is noticed and frequent service would be necessary to prevent it. Supports being more substantial, opportunities for nice combinations offer themselves. Brass, bronze, and copper
Outline of type of spider to support socket & bulb

Type of Tinsmith’s Lantern Showing One Method of Securing Rigidity Between Lantern & Bracket

1. Types of lantern roof vents
2. Cut out, modelled, pierced; riveted or soldered in place.
3. Less expensive. Cut in roof, metal bumped up.
4. Still less expense. Two cuts in roof, piece bent up.

Wire support riveted to metal edging

Although great elaboration is possible to interior fixtures, economy may sometimes be necessary; rather than buy cheap elaboration, use simple work properly made as above. Interior fixtures seldom need roofs & may be mere frames to hold diffusing agent. 1. Frame holding glass or mica—hung by chain or rod. 2. Mica cylinder with edges bound. Rests on socket which hangs by electric cord. 3. Glass with edges bound. Good glass cylinders are rare.

A good kerosene reservoir form suggesting adaptation.

Legitimate adaptation of kerosene reservoir form, providing space where needed for splicing wires, form could be spun in brass, etc., or adapted for turning in wood holes to form splicing.

Lighting Fixtures.
lanterns may be supported by iron members. If uniformity of color is desired, monel metal will satisfy the non-corrosive requirements of the sheet work and lend itself to forging for the supports. The making of wrought metal lighting fixtures calls for no process not already touched upon, welding, riveting, and collaring being used as well as the general forging processes, modeling, and occasionally soldering.

One common fault in connection with exterior lanterns lies in making them too small in scale. They may often be made an eighth to a quarter larger than what looks about the right size on paper. The tendency towards smallness for cheapness’ sake, and the custom of making selection in a showroom — at close range — make the stock fixture very open to faulty scale. So important a part of architectural composition should be studied in relation to its actual position and the careful craftsman will often make full-size models for the study of scale at the job. Another point of design worth watching carefully is the projection of a supporting bracket. In work of wrought character, brackets usually gain as their protection is increased — even to an exaggerated degree.

The ease with which electric current may be distributed about a building has revived a system of localized lighting from which general illumination is also obtained. This, besides providing concentrated light where needed for reading, etc., has begotten a number of interior fixture types capable of being wrought very beautifully. The decline in the ceiling hanging fixture for general illumination, thus started, is halted by the needs of any closely massed group whose action places them about a table or in any space not requiring concentrated light. The reversion to the pleasant light of candles for dining sometimes eliminates the dining room ceiling fixture, but does not eliminate wrought fixtures which find much precedent in candelabra. While the only objection to the practice of making wrought fixtures and carrying them in stock for future sale is that the fixtures would be adapted to a position instead of being designed for that position, the actual situation in the field of stock “wrought” fixtures is a sad one. Too often, even in expensive fixtures, they are made of bent pipe with machine-stamped leaves and flowers for decoration, mechanically put together and painted with color or gilt (which hides little things like the grinding of the torch weld or the poor quality of the material). They express the achievement of form by commercial expediency rather than by the ethics of right making, and the forms themselves lack logic and taste. Thus we see poor representations of galleons, in silhouette or in the round, carrying electric lights in their holds; or it may be an elf playing pipes, or dogs chasing deer through the air. Such work may mix materials as antithetical as iron (considerably hammered) and glass prisms. Imitation candles must, apparently, be sheltered from imitation winds by clear glass globes (lacking the excuse of diffusion) and the ceiling above must be shielded from imitation smoke! Specially made fixtures must also face similar indictments when insincerely conceived and made — when, instead of meeting a lighting problem in a practical way and making it beautiful in its own right, they befog the issue by straining after some “effect.” Many “modern” fixtures illustrate this, being abstract conceptions of planes and curves fitted to an electric light.

Some exponents of illuminating science, in a passion to do away with “spots,” are anxious to conceal all sources of light. Apart from the fact that such lighting tends away from the natural (in its elimination of shadows, causing one to feel a ”floating” sensation — not being sure where the floor is) its percentage of good would hardly compensate for the loss to decoration coming from the discontinuance of well designed, well made, and well placed fixtures.

This article is the tenth in a series on the subject of wrought metalwork, written by a man who is particularly well qualified by training and experience to discuss for architects the matters pertaining to the metal crafts. He was born at London, England, and trained there first in furniture design and after in architecture. He came to the United States in 1921 and thereafter spent two and a half years under Samuel Yellin. He then engaged in architectural work in Philadelphia, Rochester, N.Y., and Utica, N.Y. He is a member of the A.I.A. and a registered architect in the State of New York. Late in 1931 Mr. Heatherley rejoined Mr. Yellin’s organization and spent about fifteen months in charge of his shop. He is now a metal craftsman in his own name.

Reprinted from the November 1934 Pencil Points, courtesy of Reinhold Publishing.
I begin by transferring from the scale drawing, in blueprint form, a full sized chalk rendering on a steel sheet (figure 1). From here measurements pertaining to the frame are calculated. The holes to be punched for the collars are laid out on the straight bar and punched hot before bending into the circle. If the holes were punched after the circle was formed, distortions would occur during forging to bring it out of round. To lay out the holes one must first figure the circumference of the circle to give the length of stock needed. Using a wheel traveler, rolling it along the center line of the round frame of the full sized drawing, the distance between holes is determined. It is critical to follow the center line of the frame because it will not change during the bending, as the outside of the frame will lengthen and the inside will shrink. For example, if the traveler were rolled on the outside of the frame the distance would be greater than if rolled on the inside diameter of the frame. Once the distances are known they are drawn on the straight frame stock. Because this grille is sandwiched between moulding to attach it to the oak door, I inset the collar slots only 3/4" to give room for the moulding on the outside face of the frame. These holes are slit and drifted using a center punch mark as a reference point. The thinner the slitting chisel the less chance of stretch during the forging. Once the holes are punched they are plugged snugly with appropriately sized pieces to prevent distortion during the cold bending over the swage block. Figure 1 shows the finished frame with plugs in place along with the swage block used in it’s forming. With the wheel traveler shown, the stem and leaf lengths are determined. Start at the crotch of a junction, allowing material for the weld, and measure to the base of the leaf. I use the crotch as the primary reference, because it is here that the branches must separate to insure uniformity with it’s drawing. The leaves are forged from 5/8" square (figure 2). Since they are freely forged and vary slightly in length, the base of the leaf is used as the top point of reference. Measuring with the traveler between these two points will give the stem lengths at
each junction. Forging to dimension is the primary problem for this particular project, so these measurements should be carefully considered. I make a test piece to equate the stock needed in the welds as well as how much it will draw during the forging.

There are 29 pieces making up the branches and leaves. All are welded in precise relationship to one another, so when they unfold they will create the desired pattern as in the original drawing. Some deliberate changes in composition can be made at this time, but one must remember that the frame with its holes cannot be altered easily. I began the assemblage by welding three leaf clusters, (figure 3) then added these to the longer stems to make up three main units (figure 4) which were eventually welded to each other (figure 5). The design must be taken apart backwards mentally to determine the sequence in which it should be constructed. I use wire to wrap the individual pieces together for welding in the fire. They are left on until all pieces have been united. This will reduce the chance of the relatively thin stems of the numerous leaves wanting to go their own way during the consecutive forging, causing added confusion to an already seemingly tangled mass.

Using the forge, torch and bending forks, the floral sections are separated and scrolled into their final positions, (figures 6 & 7). The wire brush is used heavily at this stage to remove remaining flux and scale while the pieces are being heated for bending.

The apple was made from an 8-in. and 5-in. diameter piece of 16-ga. pewter raised, as in a vessel, on stakes and snarling irons, (figure 8). The two halves of the apple were soldered and assembled securely to the stem by a decorative bolt running through the plaster filled apple and screwing into the stem. A countersunk rivet pierces the stem and bolt to keep it in place.

(Tom Joyce will be teaching a masters course at Southern Illinois University during June and July. See the Coming Events section for details.)
An Investigation of the Properties of Smithing Coals

By H. J. Sloman

This article submitted by Mitch Fitzgibbon of Westfield, New York was originally published in the Penn State College Bulletin, "The Mining Experiment Station" March 1, 1922 State College, Pennsylvania. It is republished with the permission and good wishes of The Pennsylvania State University.
A question that has puzzled numerous consumers and producers of smiting coal is, "What makes this coal a smiting coal, and why?" It seems to the writer that such a question is analogous to "What makes a coal a good cokeing coal, and why?" This latter question is one which has long been a stumbling block to producers, consumers and men engaged in research on the properties of coal.

To date, the problem of determining what makes a coal good for coking has yet to be definitely solved. We do know what properties a coking coal should possess but often two coals of practically the same analysis may be had and one might make an excellent coke while the other would not produce the slightest resemblance to a coke structure.

What is a smiting coal, or what is a coking coal, may be likened unto the old time question, "What is electricity?" Hence the writer is not attempting to solve these questions which have confused scientists for years, because to solve "What is a smiting coal?" he would necessarily have to solve "What is a coking coal?" inasmuch as the first property which a smiting coal must possess is that it would produce a good durable coke arch on the forge. The text of what is to follow should perhaps be described as what properties a smiting coal should possess, what makes one type of coal better than another for smiting purposes — or, in other words, it is a discussion of the relative properties of certain types of coals for smiting purposes. Some rather conclusive data have been accumulated by the writer and all of the text which is to follow has been substantiated by exhaustive tests in the laboratory and forge shop.

The problem of determining what the properties of a smiting coal should be, was suggested to Dr. E.S. Moore, Dean of the School of Mines of The Pennsylvania State College, by some coal operators in Pennsylvania who were mining this type of coal, and the writer was delegated by Dr. Moore to undertake the experimental work on this subject, which seemed to be of considerable importance and yet one concerning which little was hitherto definitely known.

Before beginning a definite line of attack, it was attempted to ascertain, from numerous sources, something about the properties a coal should possess in order to be classed as desirable for smiting purposes. Accordingly, correspondence was conducted with numerous journals, technical societies, geological surveys and the U.S. Bureau of Mines; however the substance of the answers to all inquiries was that little was known.

Numerous books and articles on coal were investigated and the substance of the information furnished was that a smiting coal should have low ash, less than one per cent sulphur, high heating value and form a good coke arch on the forge. With merely such statements and practically nothing to substantiate them, the writer began the investigational work.

In preparing this report, the writer desires to acknowledge his indebtedness to Dean R.L. Sackett for his kindness in permitting him to use the standard forge in the School of Engineering and to Dr. D.F. McFarland for free use of the equipment of the Department of Metallurgy in the making of the coal analyses.

Selection of Samples

The first step was to select representative samples of well known coals, some of recognized smiting quality. Samples were obtained from the low and medium-volatile coal sections of Central Pennsylvania, from the New River and Pocahontas low-volatile seams of West Virginia, from the high-volatile section of Westmoreland County, Pennsylvania, and from the high-volatile Illinois No. 6 seam. Nine representative samples were obtained; they were designated with letters "A" to "I" inclusive and they will be referred to as such in the text which is to follow. The identity of the coal samples in each case was retained by the Director of the Experiment Station at the request of the writer until all tests were completed.

Sample "A" came from near Homer City, Indiana County, Pennsylvania, and was obtained from selected coal of the lower bench of the Upper Freeport seam commonly known as the "E" seam. Sample "B" came from the Lower Kittanning or "B" seam located near Portage, Cambria County, Pennsylvania; sample "C" from the Pittsburgh seam near Greenburg, Westmoreland County, Pennsylvania; sample "D" from the Lower Kittanning or "B" seam near Lilly, Cambria County, Pennsylvania; sample "E" from the Upper Freeport or "E" seam near Lilly, Cambria County, Pennsylvania and sample "F" from the Lower Freeport or "D" seam near Barnesboro, Cambria County, Pennsylvania. It is well to note that samples "A" to "I" inclusive were obtained from the central and western bituminous fields of Pennsylvania. Sample "G" came from the Berkeley seam in the New River district of West Virginia; sample "H" came from the Pocahontas No. 3 seam of West Virginia and sample "I" came from the Illinois No. 6 seam near Johnston City, Williamson County, Illinois. With the exception of samples "C" and "I" these coals are recognized as good smiting coals and are being marketed as such. All the samples were given the same treatment and subjected to the same tests.

Analysis of Samples Tested

The samples were mixed thoroughly, "Coned" and "Quartered" until a "quarter" could be selected not too large for an analysis sample. The quarter selected for analysis was passed through a gyratory crusher and then through a disc grinder. The sample was then screened, the oversize regrind to all pass through a "60 mesh" screen and then analyzed for moisture, ash, volatile matter and fixed carbon as outlined in the U.S. Bureau of Mines Technical Paper Number 76. Sulphur determinations were made according to the Esehka method as also outlined in the same paper.

The next step was to use part of the analysis sample for a calorific value determination (B.T.U.'s) which was accomplished by using an Emerson Bomb Calorimeter.

The result of analyses and calorific value determinations follow for all of the samples:

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Winter 84/85
Forge Tests
Time Welding Tests

A standard blacksmith forge was used, equipped with a mechanical blower and overhead exhaust. Twenty-five pounds of coal were used on the forge for each test and the first test was made to determine the time necessary to bring wrought iron bars up to welding temperature ("heat"). Bars of ¾", ½" and ¾" diameter were used for this test.

Wrought iron was selected for various reasons in making the welding test; first because wrought iron is the most easily welded of all the iron metals and perhaps the most used in every day forge practice. Wrought iron has been defined as pure iron, with more or less slag impurities according to the degree of puddling to which it has been subjected during the process of production. When pure it should contain practically no combined carbon and its melting point is 1500°C, or 2732°F, with no previous partial melting. It is well to mention here that the higher the carbon content the lower becomes the melting point and the greater becomes the difficulty of welding. When iron contains 1 per cent carbon it softens at 2066°F. and melts at 2651°F.; with 2 per cent carbon it softens at 2066°F. and melts at 2534°F.; with 3 per cent carbon it softens at 2066°F. and melts at 2372°F. and with 4.3 per cent carbon it melts at 2066° F. with no previous partial melting. This last point, 4.3 per cent carbon content in iron, is the point at which the eutectic is obtained, or that point of combination of carbon with iron which has the lowest melting point.

A good grade of wrought iron bar was used which closely resembled a mild steel bar. There is little difference between the physical characteristics of the two; the principal differences are that wrought iron contains practically no combined carbon while mild steel contains no slag. Mention should be made of the fact that the same grade of bar was used in all tests. It might be well to note also that any carbon content up to 3/10 of one per cent in iron is considered as mild steel; from 3/10 to 6/10 of one percent we have medium carbon steel; from 6/10 of 1 percent to 1.7 per cent carbon we have high carbon steel and above 1.7 per cent we get into the cast iron grades.

In making a weld, the iron is not completely melted, but the pieces which are to be joined are heated until their surfaces are in a state of ineipent fusion or partial liquification. Hence the welding temperature is somewhat lower than the melting temperature, and for wrought iron it has been established as between 2550°F. and 2750°F. The time taken to bring the test pieces up to a welding temperature was thought to be more desirable than that required in heating to a red, cherry, white heat, etc., because it is easy to observe when a piece is at the welding heat. Sparks begin to fly off from the iron and it shows signs of partial melting on the outer surface. Heating time tests for color heats would leave too much to the quickness and accuracy of the eye, and the personal element would be too great. The time old adage “Seeing is believing” will not hold good for temperature determinations in metallurgical and forge work.

In the actual determination of the time taken to bring the test pieces to a welding temperature (“heat”) the method employed was to have, as nearly as possible, the initial temperature of the fire at the same point and about the temperature of a forge when not under blast; this was determined as hereinafter described as between 1350°F. and 1550°F. As mentioned before, the test pieces of wrought iron bars were ¾", ½" and ¾" inches in diameter. From 10 to 20 welding heats for each size of iron with each coal sample, were made, and a stop watch was used to record the time necessary to bring a cold piece of iron up to the welding temperature.

The results of this test followed:

<table>
<thead>
<tr>
<th>Sample</th>
<th>¾&quot; Diam.</th>
<th>½&quot; Diam.</th>
<th>¾&quot; Diam.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Average 45 sec.</td>
<td>Average 1&quot;-15&quot;</td>
<td>Average 1&quot;-45&quot;</td>
</tr>
<tr>
<td>B</td>
<td>43</td>
<td>1&quot;-13&quot;</td>
<td>1&quot;-37&quot;</td>
</tr>
<tr>
<td>C</td>
<td>48</td>
<td>1&quot;-18&quot;</td>
<td>1&quot;-43&quot;</td>
</tr>
<tr>
<td>D</td>
<td>55</td>
<td>1&quot;-20&quot;</td>
<td>1&quot;-50&quot;</td>
</tr>
<tr>
<td>E</td>
<td>50</td>
<td>1&quot;-20&quot;</td>
<td>1&quot;-55&quot;</td>
</tr>
<tr>
<td>F</td>
<td>55</td>
<td>1&quot;-23&quot;</td>
<td>1&quot;-48&quot;</td>
</tr>
<tr>
<td>G</td>
<td>40</td>
<td>1&quot;-15&quot;</td>
<td>1&quot;-38&quot;</td>
</tr>
<tr>
<td>H</td>
<td>38</td>
<td>1&quot;-10&quot;</td>
<td>1&quot;-35&quot;</td>
</tr>
<tr>
<td>I</td>
<td>50-60</td>
<td>1&quot;-20&quot;-1&quot;-30&quot;</td>
<td>1&quot;-55&quot;-2&quot;-0&quot;</td>
</tr>
</tbody>
</table>

Temperature Tests for the Various Coals

It was next thought desirable to run tests for temperature determinations on the various samples to see how the fire behaved under blast and also what the action was when the blast was shut off and the fire allowed to cool down. A Leeds & Northrup Potentiometer Indicator was used with a platinum-platinum rhodium thermocouple to determine various temperatures. Briefly, the action of this combination is as follows: The potentiometer records a difference of potential in millivolts between the hot and cold junctions of the thermocouple. The hot junction of the thermocouple is in the fire; the cold junction is at the instrument. The thermocouple had previously been standardized against a standard thermocouple and a curve was plotted with temperatures in degrees Centigrade as ordinates and millivolts as abscissas for it; in other words, when a reading in millivolts was taken on the instrument the curve was referred to and a corresponding temperature for every millivolt reading could be found. The thermocouple was of the ordinary laboratory type — consisting of two wires insulated from each other by inserting them in a duplex, or two hole porcelain tube. The wires were joined together at the hot junction insulated from each other at all other points and then attached to the millivolt meter at the positive and negative poles. One wire of the thermocouple was of platinum (positive) and the other platinum ten per cent rhodium (negative). Before the thermocouple could be placed in the fire it had to be inserted in a closed fused silica tube for protection. In the heart of the fire there is not complete combustion of carbon to carbon dioxide but a quantity of carbon monoxide is evolved, due to an insufficient supply of oxygen for complete combustion. This carbon monoxide is later converted to carbon dioxide as it rises through the fire and gets a full supply of oxygen from the air. If the bare thermocouple were inserted into the fire, the carbon monoxide would attack the platinum and destroy the couple, so the entire couple is inserted in the closed silica tube for protection against the carbon monoxide gas. There is a slightly greater delay of transfer of heat from fire to tube to couple than there would be with just a single transfer of from fire to couple but it is not noticeable for practical purposes and need not be accounted for in this type of test.

The fires in all cases were the same in initial temperature as they were in making the welding heat tests, that is, between 1350°F. and 1550°F. (observed on the potentiometer). Blasts were turned on and temperatures recorded every 10 seconds until the fires reached somewhere between 2700°F. and 2900°F.; then blasts were turned off and temperatures read every 10 seconds in cooling. This test was run from three to six times for each sample of coal, so good average results were obtained. From the data obtained, it was observed that all of the samples quickly reached fairly high heats under blast, and no marked
difference was observed in the temperatures and time except that after considerable usage some samples deteriorated more quickly than others. Samples A, B, G and H seemed to lead slightly in the ability to reach high heats quickly with the blast on.

The ability of the various coals to cool down after the blast had been shut off was somewhat different. By an examination of the two accompanying charts it will be noted that characteristic curves are plotted for samples A, B and C on one plate and F, G and H on the other. As will be remembered by referring to the analysis table samples “D” and “E” were similar in composition to samples “B” and “G”, while sample “I”, except for the moisture content, was similar to sample “C”. These also gave about the same characteristic curves for heating and cooling as the coals they resembled, so that the six curves plotted just about represented the characteristics of all the nine samples. The curves were plotted with temperatures in Fahrenheit degrees as ordinates and time as abscissae. For the benefit of those who are perhaps not familiar with the term Fahrenheit degree it may be added that is the kind of degree registered on the ordinary household thermometer.

Referring to Figures 1 and 2, it is noticed that there is not an appreciable difference in the samples during the heating up period or when the blast is on, but, in cooling there is quite a difference. It should be stated here that the curves from their beginnings to the high peak, show temperature conditions with blast on and from the peak points for the remainder of the curves, that is, in the descending parts, they show temperature conditions with the blast off, or in other words, cooling conditions after blast. From Figure 1, it is noticed that in cooling, the curve for sample B is the most abrupt, sample A is the next in rapidity of cooling and sample C has a comparatively gentle cooling curve. From the analysis table sample B is seen to be a fairly low volatile coal, sample A a medium volatile coal and sample C a high volatile coal.

Examining Figure 2 it will be noticed that the ascending portions, or that part of each curve representing temperatures with the blast on, are not materially different, while the cooling or descending parts of the curves show sample F to be the most gentle, sample G next and sample H the most abrupt. Again referring to the analysis table we see that sample F is a medium-volatile coal, sample G is a fairly low-volatile coal and sample H a very low-volatile coal.

The condition of the fires for the various coal samples during the heats was different in practically all cases. Sample A formed a good, hard, firm, durable coke which arched itself well over the tuyeres and withstood long blasts at high heats without undue dissipation or disintegration. It was the best sample of all for its general adaptability to smelting purposes. Sample B formed a good, hard, durable coke and in all respects was a good second to sample A. Sample C formed an excellent coke on the forge but the time necessary to form the coke was longer than with samples A or B, this being due to the high volatile content of the sample which first had to be driven off. A great quantity of smoke was given off in the “coking” stage and after some usage the fire was noticed to dissipate more quickly than the first of samples A or B. Sample D formed a good firm coke without much smoke but the fire did not stand up as well as A or B, although it was better than C. Sample E formed a good firm coke which stood up well under the blast without undue dissipation and could be classed about the same as sample D.

Sample F formed a fair coke which deteriorated more rapidly than the above mentioned samples and was of a more sluggish nature in obtaining welding temperatures, as shown by the time-welding test given in the preceding table. Sample G formed a good, hard, firm durable coke which stood up well without showing undue dissipation. Sample H formed a coke quickly, which disintegrated after several heats and the coke was not so hard and firm as any of the above mentioned samples. Sample I showed only a partial ability to coke and at first made a hot fire which after a little use was inclined to go dead and refused to respond to the blast. With this last sample much smoke was evolved, due to its high volatile content, and the fire would not stand strong blasts for any length of time without going to pieces.

Economy and Cleanliness of Fire

After running each of the above tests for a period of five hours in as nearly uniform conditions as possible, the fires were put out and the residue allowed to cool over night. On the following morning the unburnt coal, coke and ash were weighed, as was the resultant clinker. It should be kept in mind that 25 pounds of coal were used at the start in each case.

Residue After Use

<table>
<thead>
<tr>
<th>Sample</th>
<th>A</th>
<th>11½</th>
<th>lb. coal and coke</th>
<th>⅞</th>
<th>lb. clinker</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>11½</td>
<td>&quot;</td>
<td>⅞</td>
<td>&quot;</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>9</td>
<td>&quot;</td>
<td>¾</td>
<td>&quot;</td>
</tr>
<tr>
<td></td>
<td>D</td>
<td>10</td>
<td>&quot;</td>
<td>1</td>
<td>&quot;</td>
</tr>
<tr>
<td></td>
<td>E</td>
<td>9½</td>
<td>&quot;</td>
<td>¾</td>
<td>&quot;</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>11</td>
<td>&quot;</td>
<td>⅞</td>
<td>&quot;</td>
</tr>
<tr>
<td></td>
<td>G</td>
<td>9½</td>
<td>&quot;</td>
<td>⅞</td>
<td>&quot;</td>
</tr>
<tr>
<td></td>
<td>H</td>
<td>11½</td>
<td>&quot;</td>
<td>⅞</td>
<td>&quot;</td>
</tr>
<tr>
<td></td>
<td>I</td>
<td>8</td>
<td>&quot;</td>
<td>⅞</td>
<td>&quot;</td>
</tr>
</tbody>
</table>

From the above results it will be observed that samples A and I show up best for cleanliness, having the smallest weights of clinker, while samples A, B and H show greatest economy. More unburned coal remained after the test with the three last named samples than with any of the others.

Sulphur

The question of drawing a line to distinguish or separate coals desirable for smelting purposes, from coals undesirable because of a certain percentage of sulphur content, is one that is difficult to solve for various reasons. Sulphur, we know, occurs in coal in four forms, (a) Pyrite or Marcasite, (b) Organic Sulphur, (c) Sulphate Sulphur, usually in the form of gypsum, (d) Free sulphur. The first form is perhaps the most undesirable of all; Pyrite and Marcasite both have the chemical formula FeS₂, and differ only in crystalline form. Little can be said regarding the chemical form in which organic sulphur is found in coal except that it is a combination of carbon and sulphur. A great amount of research work has been conducted by Dr. Alfred R. Powell of the U.S. Bureau of Mines, and Professor S.W. Parr of the University of Illinois, to determine the forms and amounts in which sulphur appears in various coals, and their work has proved that pyrite sulphur and organic sulphur occur more commonly than the other forms; however, sulphate sulphur principally in the form of gypsum (calcium sulphate) sometimes runs high, particularly in certain grades of Illinois coal. The two scientists mentioned have devised a means of segregating and of making a quantitative analysis of the various forms of sulphur. Free sulphur is rather uncommon and is negligible because it is driven off with the volatile
matter during the coking stage.

In all types of coking coals, which will include smithing coals, it may be said that from 25 to 50 per cent of the sulphur content is driven off with the volatile matter during the coking stage. Naturally these figures must have a broad range because the sulphur content in different coals varies considerably, not only in regard to total percentage, but in the forms in which the sulphur is present.

Organic sulphur will undergo practically no change during the coking stage and it appears to be in a fairly stable combination with the coal or coke; the sulphate sulphur disappears as such, but remains in the coke in a form yet undetermined. Neither of these produce great effects on the coal or coke except that they cut down the heating value, because sulphur has a heating value of only 2250 calories per gram or 4050 B.T.U. per pound (this figure may vary slightly.)

It appears that the really undesirable constituent in coal, as far as sulphur is concerned, is pyrite or marcasite, FeS2. It so happens that as the total sulphur content increases this constituent increases relatively. With low sulphur coals the organic sulphur is often as great or greater than the pyritic sulphur, but the latter increases greatly as the total sulphur content increases. If the pyrite or marcasite is in bands, flakes or nodules quite a portion of it may be removed by washing. FeS2, having a much high specific gravity than coal, may be washed out and separated by jigs, or on concentrators, but when pyrite or marcasite occurs in a finely divided slate it is practically impossible to get rid of it. It is this finely divided FeS2 which causes most of our trouble.

It is well to remark here why sulphur is such an undesirable element. When iron is heated in a forge, and as it approaches a good red heat, it begins to reach out for impurities; sulphur is an element which it will readily absorb when hot. The sulphur is absorbed by the iron in the form of a gas, which is produced because of partial roasting of the FeS2 in the coal. The inner portion of the coal on the forge has an insufficient supply of oxygen for complete roasting, and the breaking up of the FeS2 into FeS and S is the result. Some of the latter (S) passes off as a gas with the other volatile constituents. Sulphur in iron causes the undesirable feature of "red shortness" which means brittleness when hot, and it prevents forging of iron when hot, especially in drawing out fine points and in hot punching. Part of the sulphur gas produced from the FeS2 is absorbed by the hot iron and it forms minute globules of FeS between the grains or crystals of the iron and coats them. These globules do not intimately mix with the metal, they show no cohesive tendency, and, in working the iron or steel, they cause splitting. This feature is particularly noticeable in hot punching and drawing iron into points.

Aside from the fact that sulphur produces "red shortness," another undesirable feature is the FeS may combine with such forms of silica and alumina as are in the ash and produce a fusible slag, commonly recognized as "clinker." Although in some cases the ash may contain self fluxing materials, for the most part clinkers are thought by many investigators to be the result of an action of the sulphur present in the coal. Clinkers are undesirable as they make it difficult to keep the fire clean and any accumulation of them will shut off or obstruct the forge blast.

The writer made numerous forge tests for "red shortness" with the various coal samples and this effect was not apparent in any case. Sample F had the highest sulphur content, 1.36 per cent and did not produce this effect. The tests were to draw the iron out into fine points while hot and also to punch in hot iron sheets.

It seems that all other things being equal the old statement that a smithing coal should contain less than one per cent of sulphur is entirely too conservative. Exhaustive tests would have to be run for the effects of sulphur and also analyses would have to be made for the forms in which the sulphur occurs. It is obvious that the general Eschka method for analysis of sulphur as total sulphur does not give an efficient determination because, for example, sulphate sulphur produces no ill effects other than lowering the heating value, while the sulphide sulphur is quite injurious.

Conclusions

From the foregoing the following conclusions are drawn regarding the properties of smithing coals:

1. Low moisture is necessary. High moisture will cut down the calorific value, and high moisture is uneconomical. For example, sample "I" has a moisture content of 5.78 per cent and in a car of 50 tons a buyer would be purchasing 2.89 or almost 3 tons of water, which is prohibitive for the extra premium demanded for smithing coal. Further, the high moisture content of sample "I" is the cause of the low calorific value, which, along with other features, renders this coal unfit for smithing purposes.

2. Low ash is necessary for the following reasons: high ash cuts down the calorific value, causes dirty fires, and if the ash has a low fusing point it increases the quantity of clinkers and is uneconomical from the buyer's standpoint. A good smithing coal should not have an ash content exceeding about 7 per cent.

3. A high calorific or thermal value of over 14,000 B.T.U.; this is necessary to insure high, quick heats on the forge. Economy in this feature may be proven by the fact that a coal which will produce high quick heats is a time saver for the blacksmith.

4. Low to medium volatile coal ranging from about 19 to 26 per cent volatile matter. A low volatile coal is desirable because of the lack of smoke during the coking stage, a minimum of wasted heat and the ability of the fire to cool down quickly after blast; but a medium volatile is also desirable because of its ability to form a higher grade of coke, with a good, hard, cellular structure, and to coke and arch quickly, the latter making it durable and capable of withstanding frequent blasts and hard usage.

5. Quick and positive coking qualities; a smithing coal should produce a good coke which will arch well in the forge and produce a good hot, live fire.

6. The coal should produce a fire that will be sensitive to the blasts and yet not produce a fire that tends to disintegrate quickly and fly from the fire-box under blast. The fire should not become dissipated quickly and not become hollow and dead due to hard firing.

7. Low sulphur is desirable, but if a coal possesses all of the above good features of a smithing coal, the writer is convinced that a coal containing even more than one per cent sulphur may be used for smithing purposes. The evidence on which he bases this conclusion follows: (a) The per cent of sulphur in form of FeS2 in the total sulphur content may not be high enough to cause red shortness. (b) A certain percentage of sulphur is driven off during the coking process. (c) Sulphate sulphur does not produce any ill effects other than lowering the heating value. Nature has made the path fairly easy for us in determining the limitations which the sulphur content puts on a coal for smithing purposes. Almost invariably high sulphur is accompanied by high ash, which in all cases cuts down the heating value and causes dirty, cokering fires which will take the coal out of the smithing class even without our looking to the feature of whether the coal produces "red shortness."
The other day, the Upper Midwest Blacksmiths' Association got together at Bill Fiorini's shop. I told them I'd promised your editor I'd send him another column for Beginners' Corner. I asked the smiths at the meeting what I should tell the beginners. And they agreed on the number one suggestion — make sure your iron is hot enough.

So how hot is hot enough? Bob Bergman said, "a dripping white heat, just starting to spark." Others said at least a yellow heat. Too many beginners don't get it hot enough. I know that it was one of my problems. You can hit all day and the iron will just not move very well.

So OK, let's talk about heat. Alexander Weigars' book, 'The Modern Blacksmith,' has a good chart in color on the back of it. You should own this book. It is one of the basic books for a beginning smith. More about books later. You can get this book from any of the book sellers that advertise in 'The Anvil's Ring.'

Let's start at the bottom of Weigars' list and see what we can say about forging mild steel at each color. We are talking about basic beginning forging, getting iron hot and hitting it.

Black heat .................................................. No
Dark cherry red ........................................... No
Cherry red .................................................. No
Medium cherry red ....................................... No

    (Bright red)
Light cherry red ......................................... No
Orange ..................................................... Maybe
Light Orange ............................................. Probably
Medium yellow .......................................... Yes
Light yellow .............................................. Yes
Pale yellow ............................................... Yes
White ....................................................... Yes
Dripping white .......................................... Yes
Barely sparking ......................................... Yes
Pyrotechnic ............................................... Too Late!

I added a few colors that Weigars left out, but you will see those colors too when you get the iron hot enough. There's a reason behind all of this. I'll give you an example that you can easily understand.

Did you ever take a stick of butter, real butter, out of the refrigerator and try to spread it on a slice of fresh bread? Impossible. Forget it. But, if you got the butter to the right temperature, it spreads easily without tearing the bread. And if you get it too hot, you can't get it on the knife.

It's exactly the same with iron. You've known about the butter since you were four, so apply the same idea to forging. There is a temperature range where iron will move easily when squeezed between the hammer and the anvil, and any attempt to spread the iron, or butter, when it is too cold just won't work. So figure on a yellow heat and your iron will move, and you won't get a sore arm just beating on a dead horse.

Point number two that most beginners need to know — when the iron is hot, (yellow, remember) then hit it. Really hit it. Don't pet it; don't pat it; don't tap it; don't stroke it; Hit it! Hard!

There will be times later when you may want to tap it a bit, but that is for finishing not the basic forging. So for now hit it; hit it hard; and hit it squarely. The yellow or white iron will spread like warm butter.
Now that we have talked about heating and hitting, let's talk about the seven basic steps in shaping iron. Here is where I go out on a limb and state that I think the best book for a beginner, the first book for a beginner and if you can only afford one book, the only book for beginners is *Plain and Ornemental Forging* by Ernst Schwartzkopf. I have 26 books on ironwork and still like it best. Again, it is available in reprint form from the book sellers advertised here.

Schwartzkopf does a good job with the basics: drawing out, tapering, upsetting, twisting, bending, splitting, cutting, punching, fastening, grooving. (I know, that's not seven, but who's counting?) There are other books that teach this as well, and I will not get into a list of what to get, but you have to learn these basics. It is knowing where to hit that helps.

So there are your Upper Midwest Blacksmiths' Association suggestions. Get it hot, hit it hard and know where to hit it. With that little bit of help you can make most anything you want to. Who said that blacksmithing was hard?

When I asked the members of UMBA what a beginner should make, the first answer was blacksmith tongs. The next was a cold chisel and then other tools. I really wanted something that is a little more universal and a lot easier to start with than tongs. So I decided to talk about hooks. They are the thing that more blacksmiths make more of than anything else I know.

At our meeting John Lane had a dandy little plaque he had made showing the steps he took in making a coat hook. He says when he gives a demo, the people like to see what goes into making a finished product like that. It was just great, so let's go through the stages of making a coat hook.

Start with about 6 inches of \( \frac{3}{8} \) in. round rod, and put a 90° bend an inch from each end. Now heat the end yellow or hotter and mash it down into a rounded, flattened upset — one at each end. Next, draw out the middle to an even round, about \( \frac{5}{16} \) or \( \frac{3}{8} \) inch. This will lengthen the piece considerably.

The next step is to draw out the top piece and put a little supporting triangle in the top part. It is best illustrated in Streeter's book *Professional Smithing* on page 32. You put the round part on the edge of the anvil at an angle and draw out and thin the edge leaving a thicker part in the middle. Then reverse it for the other part of the top. Punch or drill two screw holes.

The other end is dished a little. You can do this several ways: putting the hot iron over a swedge block hole, over the end of a piece of pipe, over the pithchel hole in a badly worn anvil, or even over the end of a rounded stake. You will find that it is easier to dish it from the concave side than from the convex. Just make sure that the concave side is up when you are finished.

All that is left is to bend the hook into a pleasing shape and finish it. Use some emery cloth to make sure that there are no rough edges to catch any clothing that may hang on it. Use a wire brush after every step in the process. Don't dip it in the water after the last brushing as that will make the finish flake off in places and look leprous. Wax it when it is almost cool, hang it and be proud of it.

If you have any comments or things you would like to know, just drop me a note: Jim Ryan, 175 Alpine Street, Dubuque, Iowa 52001. Just send me your questions, and I'll find someone who can answer them for you. I probably won't know myself, because after all, I'm a beginner too.
Exhibits

Midwest Metals Symposium

University Art Gallery
University of Wisconsin-La Crosse
La Crosse, Wisconsin

Feb. 25-Mar. 8

The Art Department of the University of Wisconsin-La Crosse, is hosting the Midwest Metals Symposium. The symposium will feature lectures and demonstrations by Daryl Meier, David Pimintel and Linda Threadgill. The University Art Gallery will be sponsoring three exhibitions of current metal smithing as part of the symposium. The three exhibitions are as follows:

1. Daryl Meier, an exhibition of recent Damascus work.

2. An Invitational of Mid-western Professional Metalsmiths, featuring:
   - Bruce LePage
   - David Pimintel
   - Eleanor Moty
   - Dale Wedig
   - Bob Walsh
   - Eric Moebius
   - Linda Threadgill
   - Lisa D'Agostino
   - Chuck Evans
   - Bill Florini

3. A Juried Exhibition of Student Metal Work
   Juror: David Pimintel

1. Damascus thrusting dagger by Daryl Meier.
2. Cycles by Robert Walsh.
Today's blacksmiths have moved beyond the chestnut trees and the villages. Many of them are now ensconced in large urban workshops where the signs outside the entrances might read: "Sculptor" or "Metalsmith" or "Blacksmith/Artist". Yet, the old-fashioned skills of the village smithy still remain; aided, in some cases, by modern technology. Blacksmiths, now more than ever, have the opportunity to pursue purely artistic endeavors. The result is a blossoming in iron across the country. In this connection, Signature is pleased to announce a major, national exhibition featuring the work of 25 blacksmith/artists to take place at our galleries in Boston and Hyannis, Massachusetts.

Included in the exhibition will be such diverse items as jewelry, a pocket watch, a chandelier, book-ends, sculptural pieces, fireplace tools, a wine rack, cross-country skis, a sled, and a garden gate.

Philip Baldwin
Michael Bondi
Stephen Bondi
Joe Bonifas
Jack Brubaker
C. Fletcher Coddington
Frederic A. Crist
Brian & Judy Cummings

Ira DeKoven
John Dittmeier
Debra Feiner
Michael Ficalora
Jimmy L. Fikes
Dimitri Gerakaris
Robert Griffeth
Brent Kington

Mary Klein
Daryl Meier
Pete Minier
Joel Schwartz
Dean Scranton
Richard Sextone
Terry Steel
Robert Timberlake
Jim Wallace

1. "Jester #3" by Frederic Crist.
2. Coffe Table by Stephen Bondi.
3. "Puka, the Friendly Dragon" by C. Fletcher Coddington.
Letters

In Memoriam

An end came to the life of Vada Clark Beetler this December 7th, 1984.

As her friends and colleagues, we can only share with you a sense of mute bereavement, only grasp at meaning which lies beyond our reach. We cannot know a reason; we can only suffer, each within ourselves, that which is gone.

A master of masters, a talent among talent, has been stilled. We sense, we feel, what has been taken from our lives — one who sacrificed to create, one who fought to make us richer, one who struggled to offer, to teach — to give, to add to our existence something of value, to offer us intelligence.

But let us also share in these things: for we are the heirs to a fortune — of character, of integrity, of honesty, of toughness, of dedication, of resilience, of dignity, of discipline — for these were the jewels with which she worked, and this is the wealth she left us.

From her professional colleagues and friends.

Information Sought

I am looking for some information, and I hope that you will be able to help me. My husband, Dan Boone, was born in Burnsville, NC, and brought up in the Asheville, NC area. We are looking for information on his father, Lawrence Gold Boone, and his uncle, Daniel Boone VI.

Both Lawrence and Daniel VI were blacksmiths who earned their living primarily in the western North Carolina area. Both were renowned for their iron work, and were involved in the start of the restoration at Williamsburg, VA. My husband can remember that when he was a child numerous articles were published on both Lawrence and Daniel VI. However, few of these articles have survived in the hands of the family. As my husband is a part time blacksmith, this family history is very interesting and important to him. We would appreciate any help you can give us in locating any articles, pictures, or other sources of information. The time span, as we figure it unfortunately is long — probably early 1940's into the very late 1950's (we do have a article that was published in National Geographic in June, 1958).

Again, thank you for any assistance you can give us. We will be waiting anxiously to hear from you. We will of course be happy to pay for the reproduction of any pictures, and/or articles that you find.

Judy Boone
137 Hedgewood Drive
Greenbelt, MD 20770

I am currently doing research into the material culture of an 1830–1840 blacksmith shop in central Indiana. I am interested in documenting tools, raw materials, processes and products associated with a blacksmith shop in a rural community.

References to archaeological data, historical data (particularly trade journals or manuals) from the late 18th to mid-19th century anywhere in the English speaking world would be useful.

This research will be used to improve the interpretation of the blacksmith shop at Conner Prairie Pioneer Settlement, a living history museum depicting the year 1836, and as background research for future archaeological digs by Indiana University-Purdue University, Indianapolis.

Thank you for any help that you can give us.

Thomas L. Sanders
Lead Blacksmith
Conner Prairie Pioneer Settlement

Highly Recommended

I can't urge strongly enough for blacksmithing organizations to take advantage of the Chambersburg factory's hospitality. It is the most fun way I know to spend the morning. The man to contact is Mr. Eugene Clark. They were so glad to see us, they even had refreshments ordered. Apparently they have had lots of tours — Rotary, Lions, J.C.s etc — but we were the first blacksmiths and the first group that could afford them two way dialogue — they really rolled out the red carpet. Just getting in there was fantastic, but the hands on part was indescribable. What a smorgasbord of hammers and tools — all set up right on! This is the best kept secret in blacksmithing and simply for the lack of people knowing about it.

Paul B. Lacy III, pres.
Appalachian Blacksmiths Association
Covington, Virginia

I just wanted to call your attention to a handy little booklet in paperback that fits in the pocket called The Pipe Fitters and Pipe Welder's Handbook. It is by Thomas W. Frankland, copyright 1969, and can be obtained from the publisher, Gencoe Publishing Co., Inc Front and Brown Streets, Riverside, NJ 08075. The cost is $6.95 postpaid. This booklet contains a wealth of useful information for the ironworker such as laying out angles with a steel square, angle iron brackets and the orange peel method of blanking off pipe.

Bob Woodard
Mascoutah, Missouri
Cover Story

The last volume of the Anvil's Ring had an interesting cover of a wood engraving by Rachel Reckitt. It is a fine job, but Habermann and Vacek are not left-handed. I can't get over it; is it possible that the artist drew it looking into a mirror? Any smith looking at it would recognize the error immediately.

Max Segal
Philadelphia, Pennsylvania

ed. — The reversal of the image is not the fault of the artist but a part of the process of engraving. The drawing is first made on a block of wood — preferably maple. Next, the white area or "negative space" of the drawing is carved out of the wood by means of chisels and gravers. The wood block is then rolled with black ink — the ink adhering only to the uncarved portions of the block, forming the image. The image is then transferred to a sheet of paper by means of a press or by laying the paper on the inked block and rubbing the back of the paper with a wooden paddle. The block can then be re-inked and another print made. In a limited edition, the block is marked or destroyed after a certain number of prints are made to ensure their originality. It is the printing process that reverses the image and makes the smiths left-handed. The only way to counteract this would be to draw everything backward on the original or as you suggest — looking into a mirror. Either way it would be almost impossible for the artist and would certainly loose all the spontaneity of the original drawing.

Shuttle Diplomacy

(ed. — The following letter was sent to the space program in regards to the openings for civilian passengers on the space shuttle. A copy was forwarded to the A.R. by its author. Somehow it reminds one of the story of Solomon's temple and the great feast after its building where all the artisans and craftsmen were invited but the blacksmith. But for his work, nothing would have been built. It is the editor's opinion that NASA could not make a better choice.)

This is to be considered as my application to be the first outer space blacksmith.

I feel I am deserving and well qualified. I do not shoe horses or make window grills. However, I did lots of small and large forging for several metallurgists working on the development of the space age metals.

I forged the material used as the skin on our first reentry vehicle. That was before the days of tiles. Besides common materials such as stainless steel, aluminum, copper, brass, or tool steels, I have forged the pure elements of Titanium, Molybdenum, Zirconium, Hafnium, Tantalum, Tungsten, Columbium, Yttrium, and more.

I forged many of these materials alloyed with others. I forged a single crystal of Molybdenum to determine if it, by itself, would "want" to forge to a diamond shape rather than a desired square configuration. The metallurgists thought it was due to the normal interstitial condition of several crystals, or grains, together. Strange, but in forging the single crystal I still had to contend with the problem of it wanting to go diamond.

With the metallurgists, I went through the heart ache and joys of "this will forge like butter at 2400° F., and have it fail on the first blow. Or, "we will try this, but we know it won't forge", and have it forge beautifully.

This is not a forging lesson, just a request to forge in orbit. I will appreciate your early reply. I'm not getting any younger (still in great shape) and I would like to shake hands with Vulcan.

Don Hawley
Oroville, California

But was he a REAL blacksmith ...

I am returned from an early September trip to the north and was reminded again of the difference in meanings of words from one section to another. I had already known that "Yawi!" meant a boat in the north and you in the south, but I found further differences on this trip. We visited the circa 1800 Strawberry Banke Restoration in Portsmouth, N.H. and were told again and again how utterly 'authentic' everything was in the restoration. We strolled out of one authentic house, through an authentic arbor, down an authentic path toward the authentic blacksmith shop and as we approached it I heard, "Rrrrmp, rrrrrmph, rrrrmp, Bam, Bam, Bam!". This sound was repeated over and over. I turned the corner and looked into the shop and there was an authentic blacksmith working at an authentic Reiter Air Hammer with a large authentic electric motor on top. Two thoughts went through my head: 1. Don't buy any nutmegs in this place, and 2. When Alex Bealer would not let us put a strip of roofing felt (out of sight) at the ridge of the Tulie Smith House blacksmith shop he said it was because it would not be "authentic".

John L. Myers
Cumming, Ga. 30130

Who Needs a Hog Feed

With my map in hand, I studied it as one would an insect's wing under a microscope, as I traveled down the highway. A highway that led me from hot rolling hills of brown to a distant place coated with green and cloaked in fog. The name next to the little black dot on the map, and I mean little black dot, read Eatonville, Washington. This little black dot just happens to be the home of Fire Mountain Forge.
As I drove slowly into the uneven rocky driveway I noticed that I was not alone. There were already other people there from as far away as Montana and as close as just down the road. More and more people began to arrive at this small shop and the anticipation grew quickly. “Hello” was replaced by, “What’s happenin’”, as a refrain of, “just waiting” came the reply.

Well, it didn’t take long to find out what was happening. Darryl Nelson, who owns the shop and his full-time partner Terry Carson were busy preparing their demo. As the rain began to fall, everyone crowded in to the tiny forging area just inside the front doors to watch Darryl work first. He showed us the first step in making an animal head, which is to upset the end of a 1-inch round bar to a large rivet-head shape. Then with fuller in hand he proceeded to precisely push down any material that he didn’t want sticking up; as one would a piece of clay. This then formed the overall shape of the head, of which this one was to be that of a bobcat. The rain came down harder, which seemed to be a good excuse to crowd in closer as not to miss the slightest detail. With smaller punches and chisels came the finer details which really made that piece of metal come alive. Before one could finishing sketching, taking notes or asking quick questions it was all over. There held in the vice was not just another piece of cold metal but instead a realistic head of a bobcat. A piece of art that was now permanently embedded in iron. Darryl then proceeded to do another head but this time it was to be that of a pig’s head.

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After a quick break to get something hot in our tummies and to partake of the bakery goods, thanks to Corky Storer's father, and to move around abit in order to get the blood moving again in certain parts of the anatomy; it was back to work again. This time it was Terry Carson's turn at the forge. It seemed as if the handle of the forge had hardly had a chance to stop, when Terry had a grip on it and made it work. In no time at all he had a piece of hot metal, out of the forge and on the anvil, being transformed into one of the elements of a gate they are about to begin for a client. He quickly bent a bar of yellow hot metal into a 90\(^\circ\) bend. A bend that would be good enough for most, but not for the eye of Terry. By hammering it over the far edge of the anvil, on the side, back to the face, etc. it was soon in fine shape. With a few quick upsetting blows he had a bend that was so clean that a protractor would have been impressed. But the blueprint called for even more; another 90\(^\circ\) bend just \(\frac{1}{2}\) inch past the first one. Wow! Double or nothing! This time he started the bend on the near side of the anvil and then went to the vice to clean it up. After reheating he put it in the jaws of a vice and with hand held set-hammers, swiftly and easily had the second bend to just as precise a bend as the first one. This double bend formed a lip that would allow the upright in the gate to lay in line with the rest of the frame yet enable the top of the lip to be riveted on the outside of the frame.

Someway, while all this was going on, the rain had stopped and had allowed a handful of ladies to start preparing the feast. Like a group of worker bees they went to work, but not without help. I guess that the dismal weather must have prompted them to partake of a little liquid refreshment. In fact, it seemed that they didn't even notice how much work they had really accomplished by the time that the food was ready to eat. I don't think that any of these ladies would have froze in a snow storm. But, with rose smiling faces the food was neatly stationed in its proper places and the call came in the nick of time, "Foods ready, so, get to it!!". And we did.

There was enough salad to keep a zoo full of rabbits happy. Cakes, pies and sweets so plentiful that one didn't know which to try first. Oh hell, try 'em all. Best of all was the beast of the feast. A pig roasted over night in a commercial oven to a golden perfection and held over a bed of coals to keep ready. The meat was so juicy and tender it would have made a pack of Hawaiians want to become Northwest Blacksmiths.

Iron in the Hat brought in a sizeable amount of money too. It also brought a few surprises. Dorothy Steigler, Helen Maas and Sue Nelson each won a prize from the raffle. These three started swapping between themselves so fast that even Bill Gichner couldn't keep up with them.

Clean-up went as fast as the food did. In fact the only thing that went faster than the food was the beer. As the grounds were being cleaned up, only the weather was dismal; for talk of next year's Hog Feed were already being discussed.

Michael Chisham
Petaluma, California

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New Opportunities

The New York City Percent for Art Program was established in September, 1983. Through the program, New York City Agencies commission and purchase artwork for new city-owned buildings. The funds came from 1% of the building's construction costs. So far the artist selection panels have reviewed seven projects with art budgets ranging from $8,000 to $125,000.

The program has also been overseeing the artist selection process for the Metropolitan Transit Authority's Subway Modernization Program. There has been a strong interest in selecting artwork that will be a part of the architecture. The Transit Authority has been specifically interested in commissioning metalsmiths and sculptors to create steel partitions and gates for the subway stations. I am currently looking for artists who do this kind of work.

The Percent for Art Slide Registry is open to artists throughout the country. People can contact me for an application at the Percent for Art Program, 2 Columbus Circle, New York, NY 10019, (212) 974-1150. The registry is used in the artist selection process for each project. The architects and panelists consult the registry, and a presentation is made to each panel. The registry is also open to the general public for consultation. There is no fee for registering, but there is a fee for the public consultation.

Jennifer Jo McGregor
Percent Coordinator

Carol Sedstrom, former president of American Craft Enterprises, Inc. and developer of the original "Rhinebeck" Craft Fair as well as the other national craft markets operated by A.C.E. annually in Baltimore, Dallas, San Francisco and West Springfield, Mass., announces the formation of Carol Sedstrom Associates, Inc., a New York-based company that offers new opportunities for craftspeople seeking new or expanded markets.

For the new or emerging craftsperson, Sedstrom plans a service which will offer practical advice in three essential aspects of marketing: First, slides will be evaluated and comments made on their appropriateness for submission to marketing events, exhibitions and/or funding institutions. Suggestions for technical improvements, if needed, will accompany returning slides. The second evaluation will be directed to the actual work and suggestions will be made on which of the numerous marketing channels would be most productive for the type of work being evaluated. The third set of comments will include specific suggestions as well as names and addresses of potentially interested galleries, stores, department stores, etc. The fee for this service is $75; a check should accompany ten to twenty slides marked with price, size, etc. (If slides are not available, visual material of some type must be included.) More specific information on how to apply for this service is available upon request.

For the experienced craftsperson with production capacity or who is interested in licensing designs for industrial production, CSA, Inc. offers a collaborative program with Museum Industries, a cultural licensing organization that develops products for mass market which are inspired by museum collections, artists, and architects. Sedstrom will work directly with craftspersons in developing prototypes, negotiating contracts and locating production sources. Museum Industries has developed collections for The Decorative Arts Museum in Paris, The Museum of Anthropology in Mexico City, The Museum of the American Indian and others. The collections are selling well at Neiman Marcus, Marshall Fields, Bloomingdales, Bullocks and other fine stores nationwide.

For organizations, Sedstrom is available to consult on market development for crafts in local, state and regional areas. And for the first time, Ms. Sedstrom is accepting invitations to jury shows.

Because of her close affiliation to the A.C.E. screening process she refrained from judging other shows but has recently juried for the Arnet Museum, the Fine Arts Museum in Alaska, and awarded prizes at the Philadelphia Craft Show.

For more information on Ms. Sedstrom's services, call or write:

Carol Sedstrom Associates, Inc.
240 East 27th Street
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Apprenticeship in Traditional Blacksmithing Provided Valued Experience

At The Farmers' Museum in Cooperstown the first year of training in traditional blacksmithing is drawing to a successful completion. Marsha Nelson, a native of Kentucky, served as an apprentice under the supervision of Paul Spaulding, the museum blacksmith. The training program which included forging techniques, design and layout, tool making, and finishing, also provided experience in museum work, meeting the public, and effectively interpreting the craft.

Working in a historic setting of the first half of the previous century, the major emphasis throughout the training was on traditional techniques and designs. Ms. Nelson was taught to approach her work as a smith would have two hundred years ago, without the use of any modern technology.

In a recent interview, Marsha Nelson described the keys for success in her training at the museum. "Paul is an excellent teacher. This factor combined with good facilities and a well equipped shop made the experience invaluable." The museum, its resources and library were an additional bonus.

The museum blacksmith shop was built in 1827 and it was moved to Cooperstown in 1934. The size of the shop and its equipment enabled Marsha to either work in conjunction with Paul or work independently when it was required or desirable. The shop is equipped with two stone forges, each having an original bellows, anvil, leg vise, ring mandrel, anvil, and tool bench.

Marsha described the experience as one which opened her eyes to all branches of the museum world. While improving her smithing skills, she was also learning the history of blacksmithing, and becoming comfortable with the public. A most beneficial but somewhat unexpected aspect of the program was the opportunity to assist with teaching blacksmithing workshops and doing special programs for children and adults.

Although the emphasis in the shop is on the historical interpretation and preservation of the craft, it is a working facility. The blacksmiths provide implements and tools used at the museum, as well as custom work to fill outside orders.

The Farmers' Museum will continue to offer the apprenticeship. Training is supervised by Paul Spaulding, who joined the museum staff in 1980. Mr. Spaulding received his training at Mystic Seaport Museum under Robert E. Patten. Prior to working here, he served as consultant blacksmith to the Onondaga County recreated 17th century site of St. Marie deGannentaha. Mr. Spaulding is a member of ABANA.

Applicants should have an interest in working in a museum environment. The term of the apprenticeship will vary with the qualifications and past experience of the applicant but should be for a minimum of six months. A fee of $100 per month will cover instruction and materials. Program is limited to one apprentice.

Paul Spaulding, Blacksmith
The Farmers Museum
P.O. Box 800
Cooperstown, NY 13326
The Anvil's Ring offers its Coming Events pages to all schools, galleries, organizations and individuals planning events related directly to the art of blacksmithing. Events must be open to all members of ABANA. Deadline for the Spring 1985 issue is March 31, 1985 and will list events from June 1985 on.

March

1 . . . Slide entries due for Spotlight '85, sponsored by the American Crafts Council Southeast Region and held in conjunction with the ACC-SE Summer Conference, June 27-29 at Longwood College in Farmville, VA. This exhibition is open to all artists/craftsmen in AL, FL, GA, KY, LA, MS, NC, SC, TN, VA and WV. Juried by Kenneth Bates and Ray Pierotti. Exhibition opens at the ACC-SE Conference and selected pieces will travel to approx. ten art centers and museums. For prospectus write: SPOTLIGHT '85, Art Dept., Longwood College, Farmville, VA, 23901. Phone: 804-392-9359.

4-8 . . . A workshop has been scheduled at the Cedar Lakes Crafts Center with Ira DeKoven. The workshop will focus on creative blacksmithing techniques. DeKoven is especially interested in color in his work by other metals: bronze, copper and aluminum. A graduate of the Hobart Welding School and Turley Blacksmithing School, DeKoven specializes in architectural commission work. He has exhibited his work at Rhinebeck Crafts Fair in New York; National Ornamental Iron Museum in Memphis and several juried invitational shows in the North Carolina area. Contact Tim Pyles, Crafts Center, Cedar Lakes, Ripley, WV 25271. (304) 372-6263.

8-10 & 22-24 . . . Beginning Blacksmithing — A Working Class. Tools and equipment will be provided to complete the projects. Class is limited to four students. Weekend workshop class cost is $75.00. Bring your spouse and enjoy a weekend in Historic Zoar, Ohio. You'll stay in the village in one of the original Separatists' homes, which date between 1817-1898. Classes are also available for spouses in the following categories -- Tole Painting, Calligraphy, Counted Cross Stitch, Blackwork Embroidery, Cake Decorating, and Candy Making. Most classes are 2-3 hours long and cost approximately $10.00 Total weekend cost for rooms - $20.00 single, $25.00 couple. Total weekend cost for meals - $15.00 per person. For more information on the Beginning Blacksmithing Class or the spouse classes, call Jymm at (216) 874-2237. James A. Hoffmann, P.O. Box 584, Zoar, Ohio 44697.

11-15 . . . Glen Gardner teaches blacksmithing at the Arrowmont School of Arts and Crafts, Box 567, Gatlinburg, TN 37738, or call (615) 436-5860. Assistantships are available. (Assistantship deadline is January 19, 1985)

11-22 . . . Frank Turley teaches a three week blacksmithing course at Turley Forge, Route 10, Box 88C, Santa Fe, New Mexico 87501.

16 . . . Basic Blacksmithing with John Dittmeier. Discover the hot working of arm and hammer: fundamentals of the forge, the history of the trade, toolmaking and ornamental applications. Saturdays (5 weeks) at the Fontanna Forge shop. Contact Delaware State College, Center for Continuing Education, Dover, DE 19901. (302) 736-5164.
May

1 ... Deadline for application and slides for the Chautauqua Crafts Festival, "85", Bestor Plaza, Chautauqua Institution, Chautauqua, NY, July 5-7 and August 9-11. Open to all art and craft media. Contact Gale Svenson, Director, Chautauqua Crafts Festivals, P.O. Box 89, Mayville, NY 14757.

2-24 ... Frank Turley teaches a three week blacksmithing course at Turley Forge, Route 10, Box 88C, Santa Fe, NM 87501.

11-12 ... Michael Saari teaches Architectural Hardware at the Brookfield Craft Center Inc., P.O. Box 122, Brookfield, CT 06804. (203) 775-4526.

17-18 ... Southeastern Regional Blacksmith Conference, Madison, Georgia, Lions Club Fair Grounds. Demonstrators — Jack Andrews, Ivan Bailey, Fred Caylor, Mike Saari, also Jud Nielson, Jay Reakirt, Mike Rose and Joe Hansberry. There will be a ladies program and demonstrations by Kitha Kierbow, Kay Herrin, Sandra Shuler and Ann Senterfitt.

Open to all Chapter and ABANA Members. Sponsored by — The Tullie Smith House Blacksmith Guild, Atlanta, Ga., The Appalachian Area Chapter of ABANA, Chattanooga, TN, The North Carolina Chapter of ABANA.

Mailing will go to all Chapter and ABANA members in the eleven southeastern states, all outside of this area that would like to have more information please contact Stan Strickland, Chairman, 1147 Danell Court, Stone Mountain, Georgia 30083.

17-19 ... A smokeless (side-draft), masonry forge building workshop has been scheduled at Cedar Lakes for the weekend. This project will feature the construction of a permanent, stationary forge that will be the central focus of the blacksmith shop and an excellent demonstration forge for future workshops. Contact Tim Pyles, Crafts Center, Cedar Lakes, Ripley, WV 25271. (304) 372-6253.

30 ... June 2 ... Semi-annual Hammer-In at the Ashokan Field Campus. This event will be a potpourri of Northeastern states Blacksmiths demonstrating what they do best. Included will be John Lupton forging an owl. For more information contact Kent Reeves, Ashokan Field Campus, RD #3, Box 216, Kingston, NY 12401.

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**SIUE GATESMITHING PROJECT**

There will be a Master Gatesmithing Project offered at Southern Illinois University at Edwardsville, June 10th through June 15th, 1985. This master blacksmithing class will have Tom Joyce of Santa Fe, New Mexico as visiting artist and Tom Gipe as instructor. The class will produce a set of forged gates for a gallery to be installed in a new building being built on campus. Experienced blacksmiths interested in this opportunity should send their resume and slides of their work to Professor Thomas D. Gipe, Department of Art and Design, Southern Illinois University at Edwardsville, Edwardsville, IL 62026-1001. Telephone (618) 692-3071. The cost of the workshop will be as follows: Non-credit ($75.00 plus $199.98 studio lab fee) or for Undergraduate (Graduate) credit ($123.60 plus $19.98 studio lab fee, admission requirements to the University must be completed).
June

9-15 ... Exploration of steel forging using hand methods and trip hammer to achieve a variety of objects and forms. Demonstrations on forging, hot and cold cutting, tapering, fullering, swaging, forge-welding, pattern welding and basic heat-treating will be enhanced by lectures, slides, and films.

The Pigeon Lake Field Station is located in the Chequamegon National Forest on the shore at Pigeon Lake. Academic credit is available if desired. Fees range from $121.00 to $300.00. For more information contact: Don C. Aabel, Director, 315 H North Hall, UW-River Falls, River Falls, WI 54022

9-21 ... Doug Wilson leads a blacksmithing workshop at Haystack Mountain School of Crafts, Deer Isle, Maine 04627. (207) 348-6946.

10-15 ... There will be a Master Gatesmith Project offered at Southern Illinois University at Edwardsville. This master blacksmithing class will have Tom Joyce of Santa Fe, New Mexico as visiting artist, and Tom Gipe as instructor. The class will produce a set of forged gates for a gallery to be installed in a new building being built on campus. Experienced blacksmiths interested in this opportunity should send their resume and slides of their work to Professor Thomas D. Gipe, Department of Art and Design, Southern Illinois University at Edwardsville, Edwardsville, Illinois 62026, telephone (618) 656-3071. The cost of the workshop will be as follows: Non-credit ($75.00 plus $19.98 studio lab fee) or for Undergraduate (Graduate) credit ($123.60 plus $19.98 studio lab fee, admission requirements to the University must be completed).

10-21 ... Nolan Putman teaches blacksmithing at the Arrowmont School of Arts and Crafts. For further information and a brochure contact: Arrowmont School of Arts and Crafts, P.O. Box 567, Gatlinburg, TN 37738, or call (615) 436-5860.

23-28 ... A one week intensive workshop on the making of pattern welded (damascus) steel. The workshop will consist of learning how to make pattern welded billets plus introduction to pattern development and finishing techniques. This is a hands on course and all students will be able to complete a project. The techniques taught can be applied to metalsmithing, decorative ironwork, and knifemaking. Forge experience is helpful but not necessary. The workshop will be taught by Glenn Gilmore. Glenn has exhibited his work and demonstrated at various locations in the Southern and Eastern States. He returned in May of this year from a four month study session with Manfred Breddohl on German ironwork and European damascus steel and in 1981 received a grant from the Michigan Council for the Arts to study pattern development with Daryl Meier. Glenn is currently a craftsman in residence in Pigeon Forge, Tn. For more information contact: John C. Campbell Folk School, Brasstown, N.C. 28902 (704) 837-2775.

23 July 12 ... L. Brent Kington leads a blacksmithing workshop for advanced smiths at Haystack Mountain School of Crafts, Deer Isle, Maine 04627. (207) 348-6946.

July

1-3 ... Blacksmithing, a productive approach with Joel Schwartz at Peters Valley. Contact Peters Valley, Layton, NJ 07851.

8-10 ... Sculptural blacksmithing, sound structures with Christopher Ray, at Peters Valley. Contact Peters Valley, Layton, NJ 07851.

12-14 ... Forge Welding from the basics to applications with Jack Andrews at Peters Valley. Contact Peters Valley, Layton, NJ 07851.

17-21 ... Basic blacksmithing with William Young at Peters Valley. Contact Peters Valley, Layton, NJ 07851.

22-August 2 ... William Fiorini teaches decorative iron construction techniques at the Arrowmont School of Arts and Crafts. For further information and a brochure contact: Arrowmont School of Arts and Crafts, P.O. Box 567, Gatlinburg, TN 37738, or call (625) 436-5860.

23 ... Power hammer techniques with William Young at Peters Valley, Contact Peters Valley, Layton, NJ 07851.

August

2-8 ... Iron expressions, seven days to make it with Carroll Bassett at Peters Valley. Contact Peters Valley, Layton, NJ 07851.

4-11 ... An invitation to all smiths to learn from the masters while enjoying the creative atmosphere of the Bishop Family Castle at Rye, Colorado. For additional information, write to Robert Henderson, 49501 Highway 50 West, Canon City, CO 81212.

10-11 ... Forging and appreciating 18th century house hardware and utensils with Tony Millham at Peters Valley. Contact Peters Valley, Layton, NJ 07851.

27-29 ... Blacksmithing, contemporary uses of traditional techniques with Frederic Crist at Peters Valley. Contact Peters Valley, Layton, NJ 07851.
Opportunity sought: Young smith who has just finished his apprenticeship seeks a position in the United States. For further information contact: Fred Caylor, ABANA Switchboard. (317) 769-6351.

Opportunity sought: Two artist-blacksmiths from Czechoslovakia with 12 years experience, skilled in all aspects of blacksmithing, including restoration, welding and acetylene, look for work in their craft anywhere in the United States. Robert and Milo, 106 Sreet Ford, Apt. #16, Middletown, NY 10940.

Opportunity: Young man needed to teach blacksmithing in a boy's summer camp from July 13-Aug. 22. Love of children and interest in teaching are more important than expertise. Good hand equipment, beautiful area, happy staff and campers. Write J.O. Bell, Camp Arrowhead, Tuxedo, NY 10987. (704) 692-8362.

Opportunity: We anticipate an opening for a blacksmith here at Zoar Village for the coming summer months. Contact Kathleen Fernandez, Curator of Interpretation, Ohio Historical Society, P.O. Box 404, Zoar, Ohio 44697.

Work-study position: in architectural ironwork available to determined aspiring blacksmith. Everything from flue dampers to large gates are the bill of fare at By Hammer and Hand, with a half dozen projects in progress most of the time. Traditional and contemporary techniques and tools provide a diverse learning experience. Write to: Russell Swider, By Hammer and Hand, P.O. Box 111, Rowe, NM 87562.

For Sale: Complete, like new 500-pound (4-B) Nazel air hammer, motor, oiler — $8000 FOB Burlington, WA. Also, 4340H 2 1/2” diameter rods, 7–10’ lengths, both ends threaded, nuts available, 17¢ per pound. Also 800 pounds wrought iron in massive rings, 50¢ per pound. (206) 856-4018 eves., weekends.


For Sale: 5B Nazel air hammer complete. Good condition. 800 lb. Erie single frame complete, air or steam operated. Gardener Denver upsetter with upsetting and swaging dies. Also has hot shear. By Hammer and Hand, Box 111, Rowe NM 87562. (505) 421-1111.

For Sale: Really fine forge tongs made to order. Specify for what material size and for light (anvil) or heavy (power hammer) or medium duty work. In the general price range of $20.00 to $35.00. Plus shipping. Satisfaction or money back. Don Hawley, 56 Canal Dr., Oroville, Ca. 95965

For Sale: Olivetti copy machine #1550. $300. Valerius Blacksmithing, 605 Jefferson St., Bensenville, IL 60106. (312) 860-2741.


For Sale: Old time blacksmith forge cast iron, clutch operated; foot operated horseshoe vise; wagon wheel steel tire shrinker. Carl Hanne, 5431 Van Dyke, Almont, MI 48003.


Blacksmith wanted: Contact Susan Showalter, RR #2, Box 102A, Nashville, Indiana 47448.

For Sale: Three Little Giant 25-lb. power hammers. Will sell outright or trade for harness making equipment or an antique carriage. Contact Neil Brown, Rt. 5, Decatur, IN 46733. (219) 724-7554 after 6 p.m.

For Sale: Liquidating remaining stock of Fairbanks, Dupont, and Beaudry power hammer parts. The stock includes dies, springs, pins, shafts, bearings, toggle arms, spring boxes, rams, spring rollers, anvils and die shoes. For a complete list of parts and prices send a S.A.S.E. to Tony Milham, 672 Drift Road, Westport, Mass. 02790.

For Sale: 5/16 Wrought iron plate. 75¢ per pound. Pick up at Cedar Creek Forge, N70 W6240 Bridge Road, Cedarburg, WI 53012. (414) 375-2201.

Studio Assistantships: Peters Valley Craft Center is now accepting written applications for volunteer summer assistantships positions in Blacksmithing, Ceramics, Fibers, Fine Metals, Woodworking, Store/Gallery operations and General Crafts Management. The assistantships are for June through August 1985. For additional information call or write Peters Valley, Layton, NJ 07851. (201) 948-5200.
The ABANA Library depends on donations of slides, films and tapes to expand its collection. All blacksmiths are invited to contribute slides of their ironwork, historical ironwork, tools, jigs and processes. If you have (or know of) any material which is of historical or educational value to ABANA members please contact:
Susan W. Showalter, Director
ABANA Library
RR #2, Box 102A
Nashville, Indiana 47448
Phone 812 988-7830

**ABANA LIBRARY RENTAL FEE SCHEDULE**

**MARCH 1985**

(To receive a description of audio visual materials available, please send us a self addressed stamped envelope.)

**ABANA LIBRARY RENTAL AGREEMENT**

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**SLIDE SETS**

| ABANA EXHIBITION 1982 (102 slides) | $20.00 |
| ARCHITECTURAL IRONWORK (60 slides) | 16.00 |
| ARCHITECTURAL IRONWORK OF US CITIES (120 slides) | 20.00 |
| ALFRED SCHMIDT '94 slides (no notes) | 16.00 |
| CARL JENNINGS: HIS WORK (95 slides) | 20.00 |
| FRANCIS WHITAKER (135 slides) (no notes) | 25.00 |
| METALSMITHING '80 (60 slides) | 16.00 |
| SID BIRT, KNIFEMAKER (60 slides) | 16.00 |
| JACK BRUBAKER (60 slides) | 16.00 |
| BLACKSMITHING TODAY (58 slides) | 16.00 |

**16mm FILMS**

| THE MAKING OF WROUGHT IRON (Yellin) (2 minutes) | 16.00 |
| BLACKSMITH WORKSHOP (30 minutes) | 25.00 |
| FIRE AND FANTASY (12 minutes) | 25.00 |

**VIDEO TAPES**

| SHARED TRADITIONS (90 minutes) | 20.00 |
| FORGING STONE CUTTING TOOLS (60 min.) | 30.00 |
| FIRE AND FANTASY (12 minutes) (97') | 20.00 |

**MATERIAL TO BE USED FOR:**

☐ Personal Use  ☐ Class
☐ Smithing group  ☐ Other
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If group, institution or other please specify name:

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