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From the Editor

If I had to choose one aspect about forging that most impresses me, it would be the fact that once we learn and master the fundamentals, there is nothing stopping us from being inventive. To some degree, this is even true while we are still learning those fundamentals. The only thing that can stop us is our own fears, frustrations, and lack of focus.

By nature, metalworkers are inventors. We take a raw bar and manipulate it into a thing of beauty...and to me, a well made tool is just as wonderful a thing to behold as an ornamental piece. But we had to put in many hours of practice, often creating numerous pieces that didn’t quite hit the bullseye, and consequently were useless. Some might call those pieces failures. However, I call those near misses: stepping stones to success.

Just like boxers, metalworkers need to learn to pick themselves up when knocked down. This “knockout punch” can happen from burning an almost finished project or piece, a misguided blow of the hammer, a miscalculation, criticism, etc. However, good metalworkers always strive for success and never settle for "good enough."

We can take a lesson from Harland "Colonel" Sanders of Kentucky Fried Chicken fame. At age 65, with his original restaurant failing because a new interstate redirected traffic away from it, he took to the road looking for other restaurants to sell the rights of his chicken recipe. In the course of doing so, he lived out of his car for two years, and was turned down 1,009 times before he finally found a restaurant owner who would agree to use his recipe. However, nine years later, after selling to over 600 restaurants, he sold the Kentucky Fried Chicken Company for $2,000,000.

That is not just perseverance...it is determination, drive, and belief in oneself. With that brand of tenacity, I think Colonel Sanders could have been a great blacksmith.

It is that type of grit that helps us become better craftsmen. Because, we often attempt to make something we have never made before, and sometimes we have not learned the process for making a specific motif. Thus, we need to become inventive, reviewing what we already have learned and apply that knowledge (an educated guess) to figure out the process. I look upon these new forms as welcome challenges, a sort of mini adventure.
To keep things fresh and exciting, when given the chance I add a motif that I have never forged to a design. Doing so challenges me and adds a bit of drama to the project.

To begin figuring out a new motif, I review what I have already learned that might relate to the new form. As I have emphasized in other editorials, drawing is essential to the process of creating, so I sketch different views and/or concepts of the motif.

Next, I make some test pieces. Some call them "sketches in iron" while others call them "mistake pieces." I do not like the latter name as it implies that you will fail. Often, my test pieces are successful and thus become part of the project. It may take one, two or even five attempts to figure out a new motif. The key is to learn something from each attempt and apply that new knowledge to the next.

When teaching, I sometimes see beginners get frustrated when their first attempts do not live up to their expectations. I then explain, "Take a deep breath and relax. This is your first day of forging and your first attempt at this form. Be patient. Even a master blacksmith expects to make several test pieces before he realizes success." Like the Colonel...the master blacksmith perseveres. He turns his failures into successes. If he learns from his mistakes, then there is no failure.

So, expect to make several attempts at a new motif before succeeding. As you grow as a metalworker, some of your first attempts will be successful and people might call that luck. But your "luck" came from experience through hours and hours of practice. Patience, perseverance and a positive attitude are learned and valuable assets.

As Yoda said to Luke Skywalker, "Do or do not...there is no try." However, some folks say, "You cannot do without first trying." But I believe Yoda's message is that if you do not believe you will succeed, likely you will fail. I know this was a fantasy movie, but I do find wisdom in Yoda's words. Faith in oneself is important.

But sometimes we just haven't a clue and need to seek advice from other experienced metalworkers. This is where the power of being an ABANA member shines. By attending conferences, reading the magazines, and perusing the website, we make valuable connections with those who can help us.

Finally, I conclude this editorial with a quote I have on the walls of my office and also in my studio:

**The Entrepreneur's Creed**

"It's not the critic who counts, not the man who points out how the strong man stumbled, or where the doer of deeds could have done better. The credit goes to the man who is actually in the arena; whose face is marred by sweat and dust and blood; who strives valiantly; who errs and comes short again and again; who knows the great enthusiasms; the great devotions, and spends himself in a worthy cause; who, at best, knows in the end the triumph of high achievement, and who, at the worst, if he fails, at least fails while daring greatly, so that his place shall never be with those cold and timid souls who know neither victory or defeat." - Teddy Roosevelt

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**Did You Know?**

### A Word About Forge Welding Flux

The word "flux" is derived from the Latin word "fluxus" meaning "flow." It can be a medium for cleaning or purifying, and is also used as a flowing agent. It is used to extract metals and also for joining metals when brazing and welding.

In the case of welding and brazing, it serves two purposes: it dissolves oxides already present, and prevents further oxidation of the metal when very hot. This is important as it is oxides that prevent flow and fusion of metals from one to another. Flux is not a glue or an adhesive.

**Superior Flux and Mfg.,** of Cleveland, OH (maker of EZ-Weld™) says: "A flux that spreads itself on the surface properly will look flatter and cover more surface area. This is known as wetting to the surface. A flux that doesn't wet to the surface will stay where you put it and not clean any other areas. The thing in the flux that allows it to spread effectively is called the wetting agent. A wetting agent is also known as a surfactant. A good wetting agent leads to the flux being more efficient."

From Superior Flux and Manufacturing: EZ-Weld, Forge borax, and Crescent Weld. Most of the metalworkers you know use these products. Also available, not from Superior: 20 Mule Team Borax. Of those who use 20 mule team borax, some feel that it should be baked to be effective, but most use it out of the box with no problems.

I have heard many folks debate about what is in EZ-Weld, especially the original stuff made before 1991. **Anti-Borax Compound Company** (ABCC) of Fort Wayne, IN sold the rights to make their flux compounds to Superior Flux after ABCC ran out of their main ingredient...an unusual type of chip from metal turnings. ABCC originally bought a train-car load of the chips, but ran out of it by 1990. I know much about EZ-Weld as I was Superior Flux's test site to re-develop the compound.

It had to be re-developed as nobody knew what made those metal chips special. So, Superior analyzed it and tried to chemically reproduce it. The initial reproduction of EZ-Weld didn't work at all. I know this because after I opened a can in 1991, I couldn't forge weld successfully. I knew of another capable smith who also opened a new can and found it to be worthless. That prompted me to call the manufacturer (Superior Flux), who informed me that they were having problems. I offered to be a test site for them, and so they began to send me samples via UPS. After testing several samples over the course of a month, one day (along with five other samples) I tested sample #D1-68HW ... it worked. Huzzah!!

To ensure it worked in different forging conditions, I asked Linda Cohen (Superior Flux's Inside Sales Manager) to send samples to Francis Whitaker, Clay Spencer, and several other capable smiths around the country. The general consensus was positive, and so that product sample became the new EZ-Weld compound.
In the new EZ-Weld, there aren’t any of those old metal chips, but there is a high percentage of metal (about 40%) to facilitate the process of forge welding.

Another interesting fact about EZ-Weld is that many blacksmiths believe that since it was originally made by the Anti-Borax Compound Co. that there isn’t any borax in it. In a recent conversation with Linda, she laughed and said that ALL of their welding fluxes contain borax.

As with any industrial compounds, read the material safety data sheets (also known as MSDS or SDS sheets) to find out what measures should be taken to protect yourself when using them.

Finally, see Doug Wilson’s article on page 13 of this issue for more on forge welding. Also, see ABANA’s website (www.abana.org) and go to “Resources”, and then go to “Controlled Hand Forging Lessons.” Lesson #10 is an in-depth article about forge welding (and it is a free download!) 

- Dan Nauman

Right:
Box of old Anti-Borax Compound Co. EZ-Weld Flux.
In this article I will describe methods for making three different styles of candle cup and three styles of drip pan, all inspired by historic examples (though my processes may differ). None will be as quick to make as extruded tubing candle cups and pre punched disk drip pans, but all will have more character.

WRAPPED CYLINDRICAL CANDLE CUP 7/8” ID.

The pattern (image #8) measures 2” x 3-1/16” overall. The wall height is 1-3/4” with 1/4” tenons. The tenons are centered 1-9/16” from each other and 3/4” from the ends of the piece. They taper from 5/16” to 1/4” at the ends. Cut from 16 ga. steel the candle cups can be formed cold.

When making more than one, I cut a 2” strip and lay out patterns end to end. The sides of the tenons are cut to the base line with a hack saw or chisel and the waste between them cut away by chiseling along the base line.

The chisel should be ground straight (no crown) and have square corners to cut the tenons cleanly. (image #9) The cuts can be dressed with a mill file so the base line is straight except for the tenons.

The ends of the rectangle should be hammer tapered to produce a more pleasing overlap in the finished cup. What will be the top edge can also be feathered for a more delicate appearance (image #10).
I like to have my mandrels tapered (image #11) since I often find it easier to get a round form by rolling the steel more tightly than desired and drifting with the mandrel to enlarge it.

As with rolling anything, I begin by curling the ends because they are more difficult than the middle to bend later. The ends are rolled over a rounded edge of the anvil and the center curved with the pein over a swage block or the step of the anvil. (The edge of the anvil face must be rounded because a square edge will mar the work). The vise can be used to help close the cylinder on the mandrel (images #12a-d).

The tenons are tweaked and filed to fit the mortises when the drip pan is done. After the two are joined, the top of the cup may be flared to add detail, stiffen the form, and to make it easier to insert the candle.

The assembly should be normalized after previous cold hammering to prepare for flaring, which can be done over a notch in a piece of bar (image #13).
TAPERED CANDLE CUP
3/4” ID

To be most attractive, this style should be a curved taper like the end of a cigar or bullet rather than a straight cone. I have seen examples of this style used with and without a drip pan. Though use without a drip pan can be messy, it was not uncommon for this style to be forged at the end of the same piece of iron from which the candle holder arm was made (image #15).

I forge this style in pairs, tenon to tenon. Starting with 5” of ¼” x 1” bar, I pinch down the center of the bar with a stout pein over a bottom fuller, of about the same size, allowing thickness to increase until the center is about 3/8” square. I true up the bar so the ends are in line and the narrowed portion centered (image #16).

Both ends are spread with the pein and smoothed with the face of the hammer until width reaches 2 ¾” at what will be the open end. The side edges should form pleasing arcs, and be feathered for a more attractive overlap (image #17).

The most important step to achieving a pleasing look is to stretch a bulge in the lower center of each flare at the beginning of the rolling process (image #18). This is done over the swage with a cross pein with rounded ends (to prevent sharp dents). Without achieving this, the back side will end up straight with the only curve on the seam side. For this reason, the rolling does not start with the edges this time.

Rolling is continued over the swage (image #19).

Driving the cup onto the torpedo end of the mandrel will help with the shape. With the cup on the mandrel held in the vise, the tenon end can be struck if it is off center. (When striking on a mandrel in a vise, blows to the side will not dislodge the mandrel as quickly as downward blows.) The transition between rolled cup and solid material can be worked over the horn with a domed face hammer or broad pein (image #20).

I made special curved jaw tongs for holding candle cups. Slim pointed pick-up tongs will also work. When the candle cup on either end has been shaped they can be sawed apart and a tenon, long enough to pass through drip pan and candle holder arm, can be filed (image #21).
You will sometimes see a simpler historic alternative in which the end of an arm is shouldered and spread to wrap around a candle. The iron encircles the candle without much taper and is open at the bottom (image #22).

**OPEN STYLE CANDLE SOCKET 7/8” ID**

This open style candle socket is forged from 2 ½” of ¼” x ½” bar. I mark ½” from each end with a center punch on the edge, leaving 1 ½” in the middle. I use the round spring fuller to pinch the metal to half its width just inside the punch marks and round off the corners a bit (image #24a + 24b). A guillotine tool or top and bottom fullers would also do. Actually, a ½” wide flat ended pair of fullers or dies with rounded edges would save a good bit of time in forging the upright arms.

The center segment thus formed gets a ¼ twist leaving the ends in their original plane (image #25).

With the pein, spread both ends to increase their width and bring thickness to about 1/8” (image #26).

Holding the center segment in the vise upset each end to square up the transition between the arms and pads and give pads more width (image #27).

Dress edges on square horn or 1” stock formed into a hardy tool (image #28).

Use the hammer over the near edge of the anvil (or the spring fuller or guillotine tool) to reduce each side of the center segment to 1/2”-5/8” in length and increasing the length of the narrow sections. Note: I could say 9/16” but I’m not working to that kind of accuracy (image #29).

The center section should be beveled dramatically with the pein to increase the width and thin the edges. It can be punched at this time while the end pads are still 1/8” thick (image #30).
Pein the ends, to thin and increase width, leaving a center ridge in line with the arm. This can be dressed by turning the piece over with the ridge against a rounded edge of the anvil and striking the back (image #31).

Twist the piece so the center and ends are in the same plane and the ridges on the ends are on the same side as the flat of the center section. Forge out remnants of the twist (image #32).

Bend the first arm in the vise where the material begins to widen at the center section (image #33).

Bend the second arm holding the base in a pair of tongs pinched in the vise (image #34).

I lay out a pattern 3 3/8" in diameter on 14 ga. steel. The center punch mark for the compass serves to locate the center rivet hole. For the 7/8" candle cup there will be a mortise 5/16" x 1/16" laid out 7/16" either side of the center (image #37).

I cut 3 1/2" squares from which I chisel or shear the discs (image #38). Edges get cleaned up with a file. The center hole (3/16" punched or drilled) and mortises are made while the piece is flat.

Adjust and true up cold (image #35).
My hole punching comes out better (a bolster hole as little as 1/32” over the diameter of the punch can be used) and my bolsters last longer, if I take the extra step of first making a dimple in the steel with the center punch over wood. This dimple centers itself over the bolster and centers the punch on the top side (image #39). Before flattening the pucker produced by punching, I drive the punch in from the back side over a larger hole in the bolster to stretch the metal and prevent the hole closing so much when hammered.

My punch for the mortises is hollow ground and the bolster is a piece of square stock bent double with a space left about 1/8” wide (image #40). The long slot in the bolster for the mortise makes placement easier than punching round holes. Often, the punch will cut 3 sides and the hanging piece will need to be cut off in the vise with a chisel.

As an improvement over holding the disc in position over a raising stake I made a jig with two holes for a 3/16” pin that keeps the center of the disk a set distance from the hardened raising edge. One hole is centered 1 1/8” from the raising edge and the one used here 1 3/8”. The hardened edge is blunt and has an arc tighter than the diameter of either disc size (image #41).

The first pass with a raising hammer or light cross pein is made just beyond the edge of the jig turning the rim of the disc down (image #42).

The second pass (rotating the disc the opposite direction) is made a little further out (image #43). Two passes usually suffice with some final attention given to high spots.

A planishing hammer can then be used to smooth the marks from the raising hammer. If the disc is not flat from all the work on the rim, this can often be remedied by hammering the bottom some. The rim can be smoothed with a file to finish the piece (image #44).

I most often use this style pan with the rolled cylindrical candle cup as it takes the two mortises most readily. The tenons are trimmed to protrude 3/32” through the pan. They are peened lengthwise with a light blunt cross pein, as there is no support below the sides of the tenons (image #45). The cup and pan would be riveted, through the hole in the pan, to a candle holder arm, or could be fastened to a tenon formed at the end of an arm.
INTEGRALLY FORGED Drip Pan

In this case, drip pans were forged at the end of the same bar as the candle holder arm. I used 5/16” x 1” here and marked off for the pan 2 ¼” back from the end. At the far edge of the anvil I forge a pair of shoulders necking down the width of the arm (image #47). A spring fuller or other tools can also be used taking care not to go too deep. On the photographed piece I drew the width down at the end in preparation for tapering the thickness.

At the far edge of the anvil I taper the thickness of the tip of the bar. On the near edge I forge a shoulder just past the transition into what will be the pan. This taper leaves the thickest area in the middle of the mass for the pan (image #48).

The bulk of metal in the center produces a rounded shape under blows from the cross pein. As the disc develops the hammer is angled to direct material where needed (image #49).

When the material is spread as much as possible without becoming dangerously thin, the center of the round area should be located and center punched. After marking with a compass, (check that all pans on the same candleholder can be scribed the same size) trim to the line with chisel or shear and finish with a file. Punch the center hole for attaching the candle cup and sink the pan over the end of a large pipe or in a suitable depression in a swage block (image #50). This style is suitable for use with the tapered cup or the open style.

SUNKEN DRIP PAN

I use 14 or 12 ga. for this style. This disk was cut 2 ¾” in diameter before edges were feathered with a long bevel that has no discernible transition to the flat in the center. A 3/16” hole is punched in the middle. It can be dished over a swedge block or section of pipe of suitable diameter (image #52). This style is suitable for the tapered candle cup or the open style. The tenon on the tapered cup and rivet through the open style socket will attach the cup and pan to a candle holder arm. A candela-bra arm can also be forged with a tenon to pass through the pan and the base of the open style candle cup.
Critter Projects

By
Doug Wilson
HB Staff Writer

Photos by D. Wilson

Preface

It is often more efficient to add mass to a bar than to start large and forge the rest down, or to split it. To accomplish these forms, forge welding is a great solution.

Forge Welding: Practising the Dance

It is critical that you move the workpieces quickly from the fire to the anvil, placing them one on top of the other. Your hammer must be on top of the anvil exactly where you will want to reach for it. The bottom piece will be in your hammer hand. The top piece will be pressed down on top of the bottom piece. Let go of the bottom piece (or the tongs holding the bottom piece), and then pick up your hammer.

Practice this sequence of movements until you are comfortable and quick moving them before you get them hot. Pay attention to which sides are up or down. Once you are comfortable with the dance, remember to keep your fire clean, deep and bright, with plenty of coke high around the workpieces.

Heat the workpieces until they are bright yellow before adding flux to them. Continue heating, turning them over a time or two to ensure a through and through heat. If one piece is smaller than the other, put it nearer the margin of the fire or higher up. Heat until they are as bright as the brightest part of the fire. At that temperature, you will see that the flux is runny and active. When the pieces are put together on the anvil, use quick but light blows. Stop hitting as soon as you see scale cracking off the welded area. Quickly wire brush, reflux and put them back in the fire for another heat.

One more note: Practice this dance with small scrap pieces. As they near welding heat touch them together. The flux should web between them and often you will feel them stick together. If you see sparks in the fire, you’re too hot. To know if a weld is sound, lay the work on the top of the fire and take a heat without turning the work over. If there is a lag in heat transfer from bottom to top (bottom yellow and top orange) there is a void in the weld zone. Reheat and flux and take another welding heat.

GATE KEEPER CRITTER

Image #1

This is an example of creating a large mass quickly by forge welding another section of steel to the parent material.

Stock:
1” Round bar for post and head.
3/8” x 1” for bulk of head/skull.
3/8” round bar for the forge welded ring.

The Keeper Bar

Stock: 1” round bar makes the snout of the ‘critter’. The addition of a forge welded collar of 3/8” x 1” stock creates the mass for the critter’s skull.

Take a bright yellow heat. Make a 90 degree bend 3” from the end of the bar.

Making and Forge Welding the Skull Collar

1. Cut a 3-1/4” length of 3/8”x 1”. Forge a taper on each end to 1/8” x 1” wide x 3/4” long. Bend the bar into a U-shape around the 1” round bar. Reheat if necessary and bend the tapered ends in against the 1” round under the snout. Brush any scale off with a wire brush.

2. Place the work carefully into a clean, deep fire and heat to yellow. There should be bright coke beneath your workpiece and up around the sides as well. Keep the air blast moderate (not high), and be sure the fire does not get hollow beneath your workpiece.
Flux the head and collar. (I use 20 Mule Team Borax™). You can do this with a spoon while the workpiece is in the fire. Bring the work to a welding heat, frequently rotating it 90 degrees left and right as the heat rises. This will help ensure that the 1” round core piece reaches welding heat before burning the collar.

3. When the workpiece is as bright as the brightest part of the fire, the flux will be active and shiny. The 1” round and the 3/8” collar should be a uniform bright heat. (You should not see the steel sparkling/burning!) Lift the workpiece out of the fire. Pick up your hammer as you place the workpiece on the anvil. Hit with quick but light blows while rotating the piece back and forth 180 degrees. If the weld has not been completed, quickly wire brush, reflux and take a second welding heat to finish it.

Notes:
- It would be a good idea to practice this with smaller stock until you’re confident about the process: (1/2” round bar and 3/16” x 1/2” flat bar.)
- I use 20 Mule Team Borax™ (from the local grocery store) right out of the box. When applied to hot steel it bubbles a bit. After welding is completed I reheat the metal to yellow and brush it with a wire hand brush to remove residual scale and flux. If the workpiece has small elements, they will chill rapidly and thus it takes several heats to clean them.

Punching the Eyes
Do this before you do the nostrils and mouth. Two punches are required. You can quickly make an eye punch by driving a large center punch into the end of a piece of tool steel. Allow it to air cool (normalize). The end of the new punch must then be ground down to a narrow edge around the conical center punch imprint. Note: You can quickly experiment with your eye punch by pushing the punch into oil-based modeling clay.

Using the eye Punch
1. Heat the skull to bright yellow. Secure the bar vertically in your vise.
2. Drive the eye punch in at a 45 degree downward angle. The leading edge will upset the eyebrow. The hollow end will form the eyeball. If you want a pupil in the eye, use your center punch. The pupil can easily be made cold.

The Mouth
I used a flat slot punch to make an opening perpendicular to the end of the bar. When the slot is punched, upset the end of the bar and open the mouth. After upsetting, drive a 3/8” drift through the hole to accommodate the ring.

The Nostrils
These are punched with a large conical center punch at yellow heat. Keep going until you are satisfied with the amount of bulging metal.

The Ring
Stock: 3/8” round bar x 3” long.

Scarf each end of the bar. Scarfs will be on opposite sides of the bar (see image #2). Heat the bar and push it through the mouth; equal lengths out each side. Bend each end 90 degrees and in line with each other. Take another heat and align the scarfs one over the other.

Heat the scarfed ends to yellow, flux, heat to welding temperature and weld with quick, but light blows. A few blows should be all you need.

Note: If the ring doesn’t move freely, reheat the ring, grab it with tongs and swing it back and forth (up and down) as it cools.

Bird's Head
Fire Tool Handle
Forging the Bill and Welding Metal onto the Skull Top

1. Draw a taper on the end of the 3/4” square bar 2-1/2” long x 3/16” square (on the narrow end), and 1/2” square (at the wide end). This will become the bill. The wide end is shouldered on two adjacent sides by hitting half-face blows over the near edge of the anvil. After drawing the taper, forge the corners down so you have 1/8” flats on all four corners (see images #4 - 6).

2. Make a 90 degree bend in the 1/4” x 3/4” flat bar 3/4” from the end. Notch the bar nearly all the way through, 3/4” from the 90 degree bend. Forge weld the flat bar to the 3/4” square bar at the edge of the shouldered bill section. Break off the parent bar. Take a second welding heat to finish the weld. Heat the head to yellow and set bar in vise with the bill pointing up. Punch the eyes with a hollow ended punch (see notes in “Gate Keeper Critter” text).

3. Split the bill with a narrow slitting chisel with the bar in the vise, bill point upward. Work at a bright yellow heat. Watch both diagonal corners as the splitting progresses to ensure your split stays centered on the diagonal corners. Rocking the chisel back and forth slightly between hits will help you keep the slit centered as the cutting progresses.

4. Open the bill over the horn of the anvil by bending the lower portion of the bill away from the upper portion about 45 degrees. Bend the tip of the lower portion to about 1/2” radius back toward the upper portion (see image #7).
Making the Ring

Bend the 3/16” round bar in the center to make a U-shape with parallel legs of equal length and 3/4” apart. Scarf the ends on the corner of the anvil step (see image #8). Heat the legs and bend so the scarfs overlap each other. Forge weld the ends together with several quick light hits on the face of the anvil. Refine inside and outside surfaces of the weld with ring held at 45 degrees over the tip of the horn.

Inserting the Ring in the Bill

Reheat the bill to orange. Slip the ring into the open bill and tap the lower portion up to touch the upper bill. Finish by tapping the upper bill tip smoothly against the lower bill. 
*Note: The ring will be free to move in the bill, allowing it to clink and rattle when you handle the poker (see image #9). Yes, the bird can speak!*

Twisting the Handle

The corners of the bar are forged down to 3/16” chamfers. Heat the bar to a bright orange. Set the bar in the vise 5” below the back of the skull and twist 2-1/2 revolutions. Remove from vise. Take another bright orange heat and forge the twisted section back to a square cross section. Heat to bright orange a final time, set the bar in the vise again and twist the same section the opposite direction.

Here are some other critter’s that use some of these same processes.
Members' Challenge!

Can you forge this motif?

Metalworkers by nature are problem solvers. Well, ABANA challenges you to recreate this motif from "Masterpiece" by Cyril Colnik (1871-1958).

Here’s how this will work: Test your forging abilities by making this motif and documenting the process with photos and with a short article as to how you made it. The person who best reproduces the motif will have his/her documented process printed in The Blacksmith's Blow. Further, the winning entry will receive a $30.00 gift certificate from Blacksmith's Depot!

Notes about this motif:
- Note that the outside rim of the spiral is a bit flared.
- Size is roughly 5”-6” long.

Submission requirements:
- Deadline for entries: January 1, 2019
- Images should be 300 dpi
- Text should be in either Word doc or PDF format.
- E-mail entries to: bheditor@abana.org
- (Do not send to Blacksmiths Depot!)
- Good luck!

See their ad on page 5!

Above, and detail (left): Cyril Colnik’s Masterpiece (Villa Terrace Decorative Arts Museum, Milwaukee, WI.)

Above: Front of motif

Back of motif
MAKING A BALL END COAT HOOK

BY
Dan Nauman
HB Editor

Photos by D. Nauman

This is a process of making a ball on the end of a flat bar. A hap-hazard approach to this would likely result with the mass at the end of the bar opening up, revealing cold shuts. The main aspect to this method is that the end of the bar collapses in a corkscrew fashion which causes the metal to continually tighten onto itself. The size of the resulting ball is determined by how much metal is used to form the ball.

In this exercise, I am using a 1/4” x 1” x 11” bar. Note: for your visual references, I am using the 1” pritchel hole to gauge the bar’s changes in the process.

Step 1: Center punch 1-1/4” from both ends of the bar, and also the middle of the bar (5-1/2” from the end).

Step 2: Use a 1/2” diameter spring fuller to neck in the bars at the center punch marks 1-1/4” from each end. I use a treadle hammer to hit the fuller. Flip the bar 180 degrees when fullering to keep the fullered area centered on the bar. Stop when the bar is necked down to about 1/2” (image #1).

Step #3: Draw down the area on the inside of the bar (on both ends of the bar) on the far side of the anvil where the corners are well rounded. This gradual taper should go all the way back to the middle center punch mark. The cross section of the bar should start out square where fullered, and gradually become rectangular as the taper approaches the middle of the bar (Image #2).

Step #3: Using the ball-end of a ball peen hammer, bend one corner of the end of the bar downward into the hardy hole. I use the corner of the hardy hole to bolster the bar with the corner of the bar extending into the hole. Then, flip the bar 180 degrees and repeat. This begins the "corkscrew" effect (image #3 shows the end of the bar).

Step 4: Take a yellow-white heat on the end of the bar, ensuring the whole paddle-like end is very hot. Brace the shoulder of the paddle against a well rounded edge of the anvil and hit the end of the bar sharply (image #4). Flip the bar 180 degrees every two or three hits so the bar begins to collapse evenly. Keep the mass on the end of the bar centered over the stem.

I stopped forging to take some pictures to show how the paddle collapses and tightens (images #5 and #6). Note how the shoulder has become a bit sloped in image #5. This will happen while the paddle is collapsing. Occasionally redefine the shoulder on the well rounded edge of the anvil as shown in image #7.

Slowly turn the bar as you are collapsing the paddle to keep the mass centered over the stem. Image #8 shows how the mass should look (a mushroom shape) before progressing to the next step.
Step 5: Heat the bar to a yellow-white heat and begin to refine the mass into a ball by first hitting the sharp edges of the mushroom (image #9), gradually spinning the mushroom as you hit. Once the sharp edges are gone, you can start shaping the mass into a round ball using the rounded anvil edge, as well as the anvil face as needed.

Image #10 shows that the mass is progressing nicely into a ball, but still needs refining. Note the transition from the stem to the ball. This is formed by using the well-rounded edge of the anvil while slowly spinning the bar as you hit. As the ball progresses, your hits should gradually decrease in intensity to refine the ball’s contour.

Step 6: Image #11 shows the ball after taking another high heat and refining against the anvil corner, and also on the anvil face. During the course of forming the ball and because you redefine the shoulder occasionally, the stem lengthens a bit. After you have formed a nice ball, refine the stem by placing the ball against a well rounded edge of the anvil while using light blows with the hammer. Also, clean up nicks from errant hits with light hammer blows. Image #11 also shows the stem’s refinement.

Step 7: Form and refine the ball on the opposite side (image #12).

Step 8: Take a bright orange heat and place the bar in the vise with the jaws even with the center punch mark in the middle of the bar. Using sharp blows, bend the bar to 90 degrees (image #13).

Step #9: Bend the bar into a hook shape using top and bottom bending forks. I drill two 1/4” holes just below the 90 degree bend for 1/4” lag screws, or for 1/4” rivets if mounting to a metal rack. Note: the balls end up being about 3/4” in diameter. The top ball on the finished hook (see image at the beginning of the article) is exactly the same size as the bottom ball, but looks a bit smaller because of the foreshortened camera angle. ■

Step 9: Bend the bar into a hook shape using top and bottom bending forks. I drill two 1/4” holes just below the 90 degree bend for 1/4” lag screws, or for 1/4” rivets if mounting to a metal rack. Note: the balls end up being about 3/4” in diameter. The top ball on the finished hook (see image at the beginning of the article) is exactly the same size as the bottom ball, but looks a bit smaller because of the foreshortened camera angle. ■
As an artist, I try to tell a story with my work or at least have a theme from which to connect all the elements to make it flow into one complete piece. This makes it more interesting as well as functional.

In creating “Saguaro Table”, I wanted to capture the feeling of the Sonoran Desert. I selected two of the more unique and recognizable plants: the towering giant saguaro cactus and the sprawling devil’s claw.

When considering the design, I focused on the extremes that are so prevalent in the desert. I designed the legs to represent the mighty saguaro; solid and sturdy.

On the top of each leg, I made the resemblance of saguaro cactus ribs, a saguaro blossom (the state flower of Arizona), and two buds. The saguaro flower is white, so rather than painting them, I used 14 gauge stainless steel which reflects a white light.

Above and right detail: “Saguaro Table” by Brian Donahue, Sierra Vista, AZ. 32” x 48” x 14”. Mild steel, stainless steel, and mesquite. Bee’s wax and linseed oil finish.

Above and left detail: “Fortitude” by Brian Donahue, Sierra Vista, AZ. 26” x 7” x 5”, mild steel. Finished with linseed oil, bee’s wax, & turpentine.

- Vertical & cross pieces: 1/2” x 2” flat bar.
- 1/2” square solid forged round to form rose stem.
- 3/16” round leaf stem.
- Rose and leaf: 14 gauge forged to shape and textured.

“Fortitude” is an interpretation of that virtue: Strength and perseverance to overcome one’s obstacles. I used mild steel as it possesses the same characteristics as fortitude.
Hammer Logic Editorial Response
(A response to an editorial in the HB Vol. 26, #2, Spring 2018)

Dan-
This will probably be one of many responses on your “Hammer Logic” piece. Though I applaud your calling attention to the issue of hammer technique for the sake of efficiency, health, and longevity, I think your prescription for technique is simplistic, and a bit dogmatic.

First, there are some problems with your “simple math”. The formula is Force = Mass x Acceleration, not velocity. What counts is not the speed of the hammer, but the rate of change in that speed. So I think that has more to do with a “snap” at the end of the blow, than the simple velocity.

Now it’s certainly conceivable that a long handle hammer could have greater acceleration than a short one, but that’s not obvious, and at this point it’s unmeasured. Even if the longer handle was better for acceleration—by how much? The increase in acceleration has to make up for the reduction in mass, and that’s not measured either. In short, if you don’t have any data to put into the formula, it’s not much use as an argument for one way of doing things.

Secondly, the relationship of the velocity of a hammer handle is not a simple lever, where force and velocity have nice simple relationship. The hammer is the end of a long chain of compound levers, which have much more complex relationships between force and velocity.

Our limbs are more like a piano mechanism than a seesaw. Biologists still argue like crazy about the mechanism of a grasshopper’s jump. Bio-mechanics just ain’t as simple as you make it out to be. But you might notice that arms and legs end with short levers, not long ones. There might be a reason for that.
So we could use some data, instead of assertions. Wouldn’t it be a great project to actually measure these things, with different smiths and their preferred techniques? Without that, we’re just guessing. But let’s put the math and science aside, and talk about experience.

Like you, I came under the sway of Francis Whitaker’s long handle technique in the late ‘70’s. But I noticed that he had trouble with his hammer wrist—he often wore a wrist support.

Holding the end of a hammer handle not only asks your wrist to do a lot of lifting with poor leverage on the upstroke, there is a great tendency to grip the handle too tight on the downstroke, to keep it from flying away, which can hurt you too, especially in your elbow.

Then, when I went to Czechoslovakia in the late ‘80’s, I was exposed to the Eastern European tradition of choking up on a heavy hammer, and building acceleration by rotating every joint from toes to fingertips. This made sense to me, and felt right, and the older smiths looked less beat up than the older American smiths I knew, so I largely converted to that approach. Both Francis and Uri Hofi (who proposed a similar technique to the Czechs) warned about the dangers of putting your thumb on the back of the handle, and I believed it as you did.

But when I went to West Africa, I watched 70 year men who had forged all their lives with their thumb on the back of the hammer, and they were still mighty lithe and nimble. But then, they were squatting down, so their whole biomechanical system was different!

The best thing I ever did to help the biomechanics of my hammer technique was taking a class in the Alexander Technique, which is a body use system favored by dancers and singers. But any discipline that helps you develop a thoughtful approach to your body’s movement is tremendously helpful. Your body is your most important machine. You should spend time tuning it, just like you do to your power hammer.

Besides the biomechanics of hammering, there is also the question of what you are doing with that hammer. A light hammer, even accelerated fast, will work material nearer the surface of the bar, and a heavier hammer will apply the force more deeply into the bar. Anyone who has used different power hammers has seen this phenomenon at work. The most useful hammer weight depends on the size of the iron you’re forging and what you’re trying to do to it.

Another important variable about choice of handle length: a shorter grip makes it easier to work at right angles to your tongue hand, as I first saw advocated by Donald Streeter, and later by the Czechs. There are huge advantages to this. Long handle people tend to work at 45 degrees to the work.

So now, 45 years into hammering iron every day, I find that I use all those things. My technique and choice of hammer vary hugely, according to what I’m trying to do. My hand shifts up and down the handle according to what I’m doing. I have 7 hammers that are in heavy rotation on my rack, ranging from 1 lb to 4 ½ lbs.

I hammer both at 90 and 45 and all other angles to the work. Sometimes I even put my thumb on the back of the hammer!

There many effective approaches to the problem of hammering hot iron all day, and different traditions have come up with different techniques. I have two friends that worked together at the Colonial Williamsburg shop for decades, where all the work is hand forging. One of them uses a 2 ½ to 3 lb. hammer on a long handle, lifts it over his head, and whips the hell out of it. One of them uses a 4 lb hammer, holds it halfway up the handle, and only rarely lifts it above his shoulder. Both smiths are wonderfully efficient, healthy, and durable.

I think the important thing about hammer technique is to think about what you’re doing, watch what happens to the iron, and pay attention to what your body tells you. If it starts to hurt, stop and continue to experiment until you find a way that accomplishes the task and keeps you healthy.
So yes, I’ve tried your tobacco blend, and didn’t like it much, after a while. In the immortal words of Sly Stone: “Different strokes for different folks!”

- Lee Sauder
Lexington, VA

(Continued on page 22)
(Continued from page 21)

Lee,
Thank you for your response to my editorial. It is obvious that you put much thought into your letter. We could debate physics all day, but the bottom line is that using a longer handle can deliver more force than a shorter handle with the same size hammer head; that was and is my main focus.

As for Francis Whitaker’s wrist support: Francis told me that was due to the fact that he had been upsetting bars improperly for nearly 70 years by bracing the bar with his other hand. His doctor told him that most of the cartilage was gone in both wrists as a result.

I also agree with your assertion about the weight of a hammer head versus the size of a bar of steel...to a point. I have used a 1.8 lb. hammer (with a long handle) as my general purpose hammer since 1995. I have moved several thousand pounds of steel expeditiously with this hammer from 1/4” to 3/4” in cross section...and without blisters or fatigue.

Lastly, though we differ on some aspects, I respect you for your concerns, and your willingness to respond.

Note: I am printing Mr. Sauder’s response as this is an important topic. I wish to be open to alternative methods of forging and allow readers to come to their own conclusions. -Ed.
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