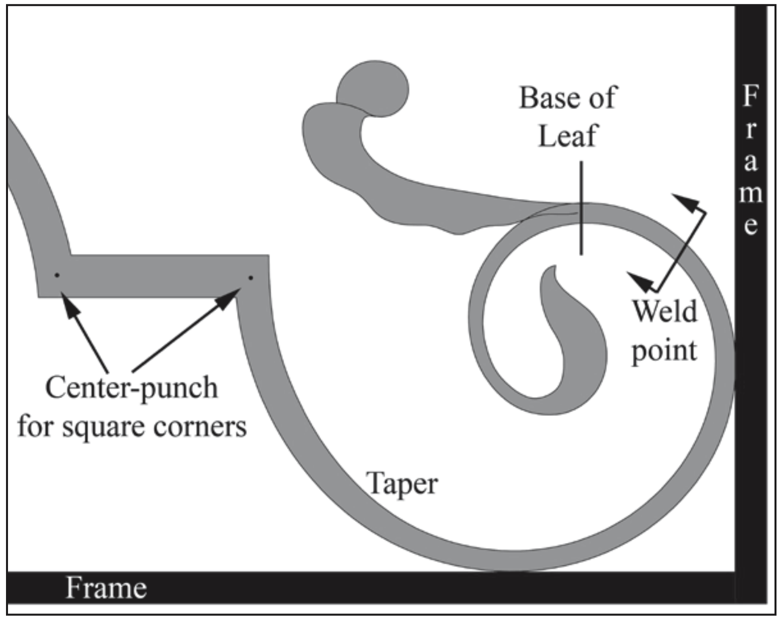
Western States / CBA level III grill. Mark Aspery

Recently, John West and I conducted some instructor training specific to the CBA level III grill project. The intent of this article is to focus upon some of the problems associated with the grill from the two upset square corners -on out to the blown over, beveled leaf scroll. A detailed description of making and turning the blown over, beveled leaf scroll and the bevelled scroll was printed in the CBA magazines -Issue July/Aug 2004 & Sept/Oct 2005 respectively and is currently on line from the CBA web site under 'Resources' and then 'Projects' from the drop down menus.

There are a number of issues associated with this part of the grill, the first being the upset square corners and where to place them on the bar and the second being how to connect the water leaf to the scroll.



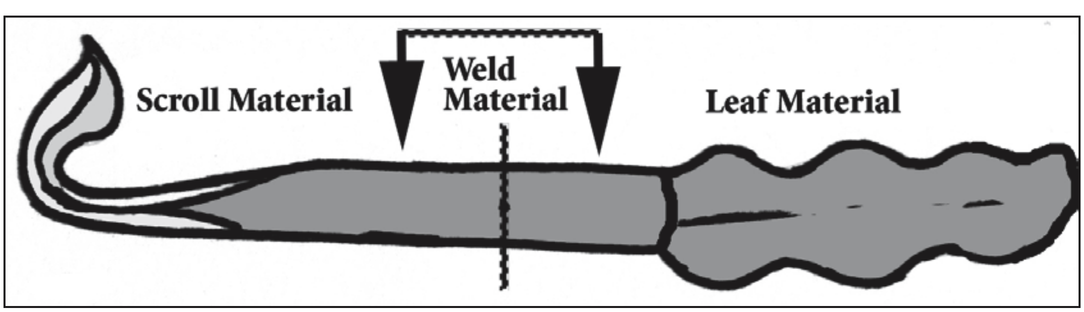
As you can see from the drawing, I have indicated a weld point mid way along the scroll. Also shown is the point where the base of the leaf will start branching from the scroll stock. Utilizing the weld point will allow for the end of the scroll and the water-leaf to be made from the same bar -which is my preferred method of construction with this particular grill. This negates the forming of the leaf from other stock and forge welding it on in an appliqué method.

Using string, I find that the leaf, from base to tip, measures 3 inches long. The scroll from weld-point to scroll tip measures 7 ¼ inches long and from weld-point to the base of the leaf is 1 ¼ inches long.

The variable is the amount of material needed to make the leaf. Having conducted a test, I know that 2 ¾ inches of material will yield a leaf of 3 inches long that fits with the drawing. Change the character of the leaf in the drawing and the stock required changes. I did a very rudimentary article on this subject in the CBA magazine Sept/Oct 2001

Once I have formed the end of the scroll, I can measure down to the weld point (7¼ inches) and then add the 1 ¼ inches from the weld point to the base of the leaf and then add another 2 ¾ inches for the leaf itself. I can now cut the bar off at that point and make the water-leaf.

The Leaf / scroll combination will be nicked at the weld point, folded in two and welded from the weld point back to the base of the leaf as a faggot weld. The cup of the leaf and the bevel of the scroll are on the same side of the bar, with the chisel nick on the opposite side. The 'blow-over' to the tip of the leaf has to point in the same direction as the scroll tip.

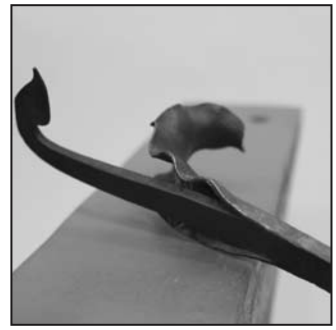


I like to make this weld over the bick with my farriers rounding hammer. By welding over the bick with the rounding hammer, I am assured that the transition from the weld to the leaf will be curved, thus helping it read better when finished.

Welding over the bick also allows me to leave a mass of material at the end of the weld that will be used to form the next scarf. The excess material will be needed to form a scarf for the weld onto the remainder of the scroll stock that comes from the upset square corners.

Nick and fold over the leaf and scroll assembly. Weld over the bick

Correct orientation of scarf. This keep the leaf up and the scroll down making a more stable arrangement



Leaf and scroll tip forge-welded onto the reminder of the scroll stock

The orientation of the scarf is important, as the leaf has to be on the outside of the scroll when finished. I like to keep the leaf up and the scroll tip stock down on the anvil as I forge weld as it is more stable – so that gives me the orientation of the scarf on both sides of the weld.

The main body of the scroll tapers from the center-punch mark of the upset square corner on (½ by ¾ inch stock) through the weld point and down to the base of the leaf. The leaf and scroll are to be made from ¼ by ¾ stock. I have the thickness of the scroll on the drawing, at the weld point, as $^5\!/_{16}$ inch by ¾.

If I can calculate the amount of material needed to produce this taper from the center-punch mark of the square corner stock to the weld point, then I save myself the trouble of either -not having enough material or -having too much and cutting some off to get the correct length of taper to the weld point.

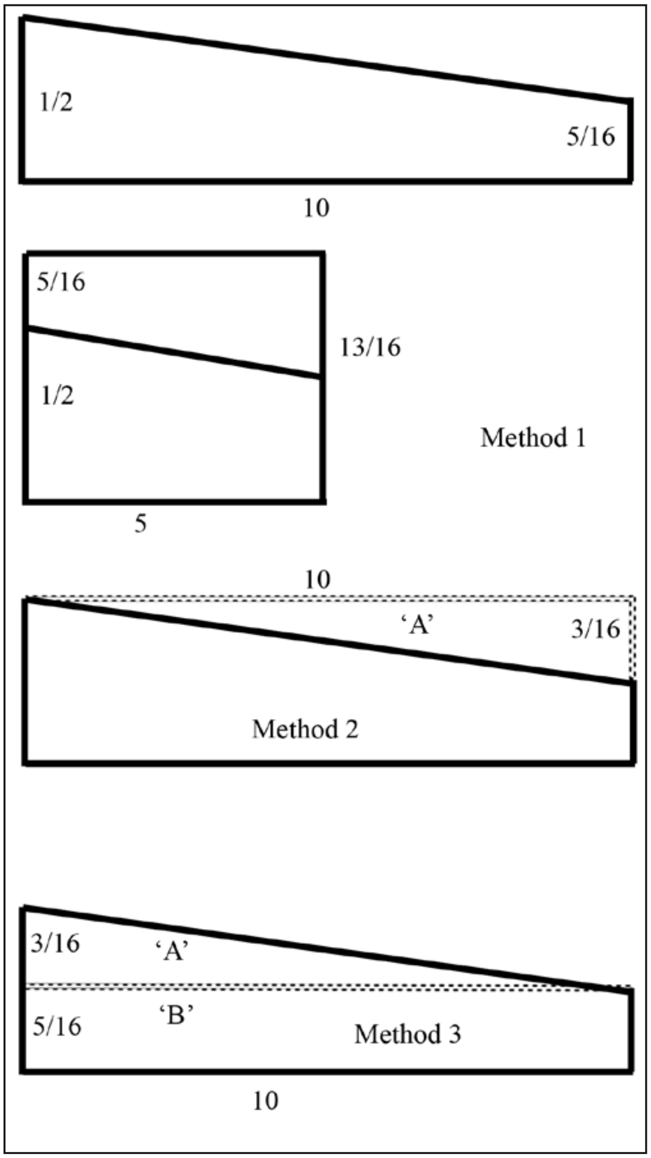
The problem associated with not calculating the amount of stock needed is one of 'not forging with certainty'. Rather than forge the end to the required thickness and draw the taper back to the square corner in one or two heats, the smith is obliged to work sparingly, constantly measuring – with the quality of taper at risk.

There are at least three ways to calculate the area of the taper. I say area instead of volume in this case, as the ¾ dimension does not change, so we are only concerned with the change on the ½ inch side. This saves an excess of math work, something for which I am extremely grateful!

The taper goes from ½ inch wide to $^5\!/_{16}$ wide over 10 inches. Our math possibilities are:

1.) Fold the taper in half to create a rectangle and calculate its area by a Length x Breadth calculation
2.) Calculate the area of the triangle that is not there, shown as 'A' in the drawing and subtracting that number from the area of the rectangle that contains the taper.
3.) Calculate the area of the taper itself by turning it into two objects, a triangle (shown as 'A') and a rectangle (shown as 'B' in the last drawing) and then adding the two areas together.

Whichever method is chosen, once the area is calculated, it has to be converted into the length of ½ by ¾ bar needed to make it.



Let's take method 1

The taper is folded at the half way mark (5 inches) to make a rectangle $\frac{13}{16}$ inch tall by 5 inches long.

Area = L x B = $\frac{13}{16}$ x 5 = $\frac{65}{16}$ or 4 $\frac{1}{16}$ sq inches.

Method 2

Area of triangle = ½ x base x height = $\frac{3}{16}$ x 10 x ½ = 30/32 or $\frac{15}{16}$ square inches.

Area of rectangle = L x B = 10 x ½ = 5 sq inches

Area of taper = Area of rectangle minus area of triangle of missing material = 5 – $\frac{15}{16}$ = 4 $\frac{1}{16}$ sq inches

Method 3

Area of triangle contained within the taper added to the rectangle contained within the taper.

Area of triangle = ½ x base x height = ½ x $\frac{3}{16}$ x 10 = 30/32 or $\frac{15}{16}$ square inches

Area of rectangle = L x B = 10 x 5/16 = 50/16 or 3 $\frac{2}{16}$ square inches

Total area of taper = $\frac{15}{16}$ + 3 $\frac{2}{16}$= 4 $\frac{1}{16}$ square inches.

Calculating the length of bar needed to forge the taper.

This taper has to come out of a bar ½ wide by an unknown length (X) long

X x ½ = 4 1/16 square inches

Isolating for X means multiplying both sides by $\frac{2}{1}$

$\frac{X}{2} \times \frac{1}{1} \times \frac{2}{} = 4\frac{1}{16} \times \frac{2}{1} = 8\frac{2}{16}$ or 8 ⅛ inches long.

A bar ½ inch by ¾ inch by 8 1/8 inches long will yield a taper from ½ inch wide down to 5/16 wide over 10 inches maintaining the ¾ inch dimension.

I like to measure my bar along the center-line so that I don't have to calculate for the material movement in the upset square corners.

So why all the math? To form the square corners, you may have to grip the bar in the vice and unless you have an adjustable vice jaw insert, the stock has to be parallel sided or it will slip in the vice jaws!

Because of the math, we know to center-punch the ½ inch side of the bar 8 1/8 inches from one end and form the first upset square corner. Once both square corners have been formed, then we can draw the taper from the corner down to the weld point.

One corner can be made in the vice as per the CBA article issue Nov/Dec 2003 or CBA web site under resources then projects. The second corner, due to its close proximity to the first, will probably have to be made at the anvil or at the anvil and vice combined, but not totally at the vice unless you have a vice with small jaws and can hold the stock vertically between the jaws without fouling the lower corner or leg.

To negate the use of tongs when forging the square corners, I like to use a long bar of the required stock size so that I can split it in the middle with a pair of square corners on either end. There are 4 sets of square corners on the grill. The bar will, of course, have to forge welded back together again at some point. I find it easier to do this than to deal with turning the bevelled scroll over the bick with a very long bar attached.

To determine the length of the original bar, the amount of stock needed to create the taper to the weld in the middle of the grill will have to be known. This is just a repeat of the same sort of math we did earlier. The

Use a bottom swage to prevent the stock from creeping along the anvil as your form the upper square corner.

corners are 2 ¼ inches apart -center to center and the center of the bar does not change length along the centerline when forming upset square corners.

If you choose to use the long bar for your own square corners, completing the corner nearest to the bevelled leaf scroll first will be helpful to you. To prevent the end of the bar from slipping away as you form the square corner on the anvil, use a bottom swage in the hardy as a stop for the end of the bar.

Forming the corner by hitting directly down onto the anvil face is a very strong move and one that can over penetrate the corner and upset the bar below it. To prevent this over-penetration, quench the bar up to the bottom of the upset square corner prior to working on the anvil.

Once you have completed both square corners, you can now turn your attention to the taper. You know that you have an exact amount of material to form the taper. You also know that the end of the taper will be forge welded to the leaf and scroll tip assembly.

During the forge-weld, the taper material may be thinned somewhat. To prevent the taper from being overly thinned, draw the end of the proposed taper down to 3/8 inch thick and form a scarf to the end for a lap weld.

Once you have made and drawn down your weld, then the taper can be refined. By initially drawing the taper out to 3/8 inch thick, it will be too short. This is insurance for me. I know that the position of the leaf on the scroll is somewhat exact and won’t stand much movement. It will be easy for me to stretch the taper and get the leaf in the right position. It is much harder to shrink the taper!

I can draw out the taper until I get the base of the leaf exactly where I want it in terms of length from the center-punch of the upset square corner. The tip of the scroll can vary a little and not affect the look of the overall piece too much, not so with the leaf.