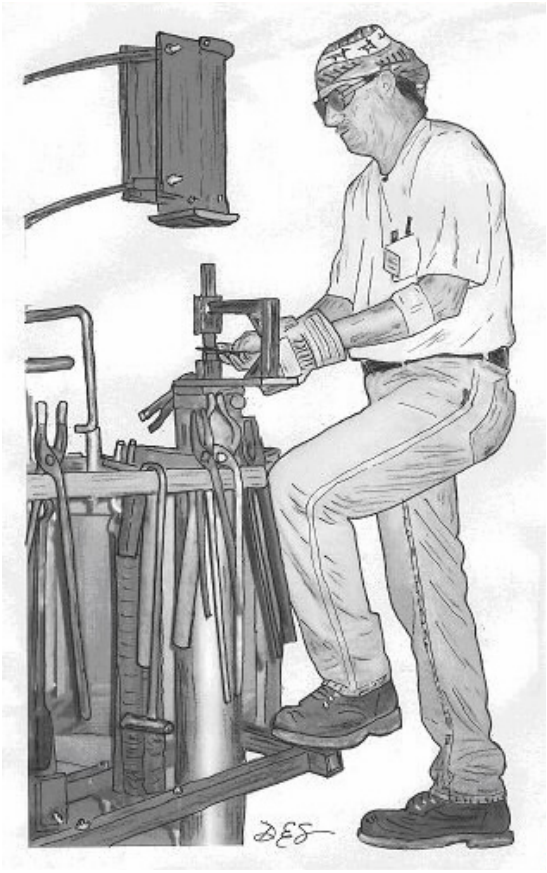


Forging for a Living

the methods and tools of

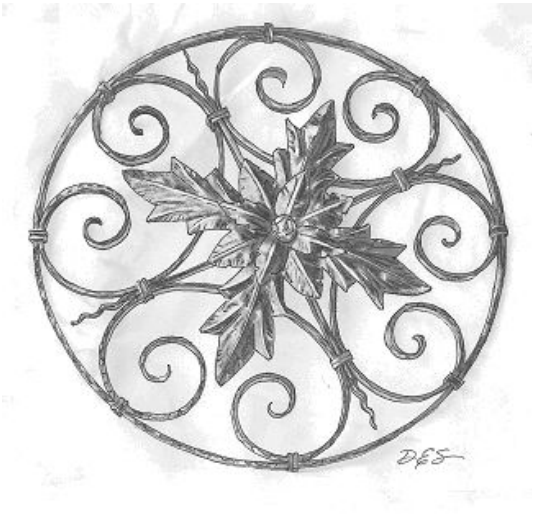
Ray Spiller

article and illustrations by
Dave Smucker

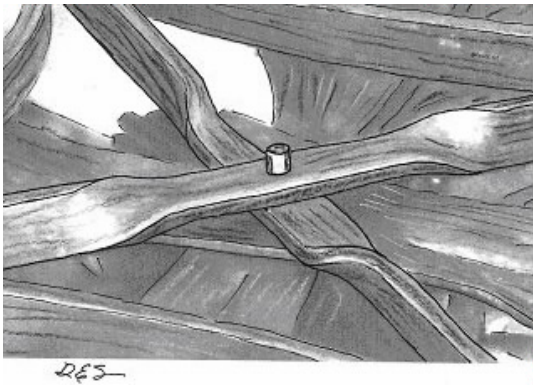
Part II

In Part I of Forging for a Living - we left off with the forging of the end wiggles or end flames of the center cross of the architectural element Ray demonstrated. Now this center cross has the appearance of two vertical elements that pass through each other at the center of the circle under the acanthus leaves. If this were the case, it would require a rather complex center joint that also has to contain the "rivet" that joins the acanthus leaves to the total piece. Instead of a complex design, Ray uses a neat little trick to make the assembly.

He puts a simple double twist in each element of the center cross, making the center of each a flat bar rather than a vertical bar. These two flat bars can now pass over each other and easily accept a hole for the master rivet that attaches the acanthus leaves and the center cross itself.

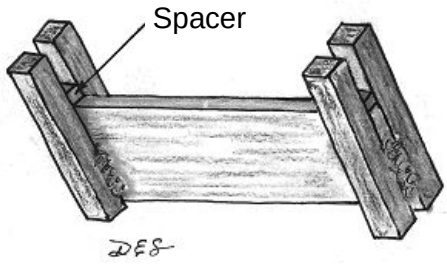


This view of the total piece shows the center cross behind the leaves where the cross members appear to go straight through each other.



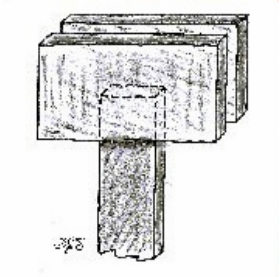
In the above sketch, we see a close up of the center cross and the master rivet from the "backside". The acanthus leaves are below the center cross and hide it when viewed from the front of the piece. Also shown are very small portions of the C scrolls.
Now that you have the idea of the bends for the center cross, how do you make them? Well, since they are really just a simple quarter twist you can make each one, one at a time with careful layout and measurement. But remember Ray is in this as a business so producing

uniform bends at a commercial pace is important to him. What does he do? He uses a simple bending jig and bending wrench to make two uniform bends at once - with correct positioning, without measuring each time.



The jig is made from a length of 1/4 by 2 inch stock and four lengths of 1/2 square stock. Plus the addition of two 1/4 x 1/4 spacers to allow free bending. Ray used the 1/4 by 2 inch stock because he is bending material that is 1/4 inch thick. This jig is easy to clamp in your vise.

Weld the 4 uprights to the center bar. Then tack weld those little spacers in the bottom of each set of uprights. They hold your hot stock off the bottom and allow free bending.



Ray's bending wrench is even simpler to make. It's just two lengths of 1/4 x 2 inch stock with a 1/4 x 1 inch bar welded between them. You should make the length of the 1/4 x 2 inch stock enough shorter than the distance between the uprights in the bending jig to allow for the two twists to take place.

Since in this case we are bending 1/4 x 3/4 stock used for the center cross, we need to leave about 3/4 of an inch for each twist. I would make the wrench about 1 - 1/2 inches shorter than the space between the uprights on you jig. If you want a tighter twist that make the wrench somewhat longer.

To make the double twist just heat your cross piece, drop it centered in the bending jig and place the wrench down from the top. Now give it a 90- degree bend and you are done. Follow up by making the same double twist on the other cross member. You do not have to worry about offsetting these two cross members at assembly. They will move enough to allow assembly without problems if you make your bending jig long enough so that the double twists are not too close together.
We have now finished the 4 C scrolls, the center cross and all of the collars.

If you have not made the outside ring to fit the pattern you developed up front you need to complete that ring. Ray did not show the making of this ring in his demo but a few comments about making rings might be in order. It is also made from 1/4 x 3/4 stock and Ray hammer textured the edges before forming into a ring. I calculate the length of stock I need for making a ring based on the diameter times Pi. What diameter to use? Measure the inside diameter of your pattern and add one thickness of your ring stock, 1/4 inch in this case. (1/8 inch for each side) This gives you the diameter to the center-line of the ring. Now form the ring or hoop. There are many ways to do this from using a ring roller (who has one of those?) to hot bending around a large round object such as a tire rim, section of large pipe etc. The method I like to use is to hot bend around a form. If I don't have the right size in my "junk" I make a section of the circular arc just as I would make a scrolling jig. I then tack weld it to my welding table and form around this jig.

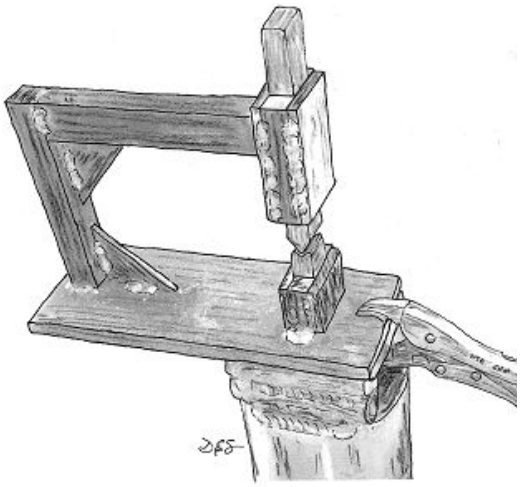
To make corrections to a large ring I hammer between two fixed bars to make the radius smaller and on the flat of the tail of the anvil to make the radius larger. I have several short lengths of channel (3, 4 and 5 inch) that have a hardie stem welded on the bottom so that the legs of the channel face up when placed on my anvil. Then, using your hammer, work your stock over the gap between the channel legs to correct your ring. Some smiths just set an open gap on their vise and use that as the two fixed bars.

Now that you have the ring formed, weld the ends together. For this piece I would arc weld them and I am sure that is what Ray did. Ground down, the weld can be hidden behind one of the collars.

Now it comes time to make the acanthus leaves themselves. Before we cut them out and start shaping them, let's look at some of the tools Ray has developed for this kind of work.

One of the major tools that Ray showed and demonstrated at Tannehill was his "veining tool setup" for using under the treadle hammer. Ray is shown using this tool on the cover of this issue and lead drawing of this article.

I have seen some drawing of similar tools before but Ray's design is straight forward and easy to build. It can also be mounted in the hardie hole of your anvil and you can use a hand hammer to strike. This limits you to holding and positioning the leaf with one hand unless you are using a striker.

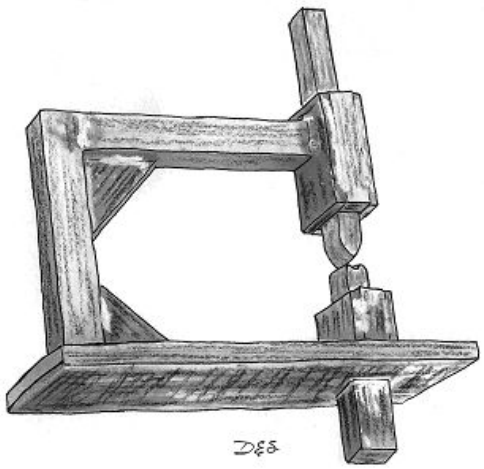


In the view above, we see the veining tool set up clamped to the anvil of the treadle hammer.

I am going to give you general dimensions for building this tool - but leave exact dimensions up to you, as many of you will be able to make a similar tool out of material you have on hand.

The tools themselves are made from 1/2 x 1 inch stock so we will be building around this size. The base or bottom of the "C-frame" is made from 1/2 x 4-inch stock about 8 to 9 inches long. Both the vertical portion and top leg of the C-frame are made from solid 1 x 1 inch stock about 6 inches in length. Both the top and bottom guides are made using 1/4 x 2 inch material for the front and back with 1/2 x 1/2 inch bar stock used for the "spacing". The 45 degree gussets at the back of the C-frame are made from 1/4 material. The bottom guide is about 1 and 1/2 inches tall and the top guide is about 3 inches tall. The open area between these two guides is 2 to 2 - 1/2 inches. It is nice if this open area is tall enough that you can remove the bottom tool without taking it through the top guide.

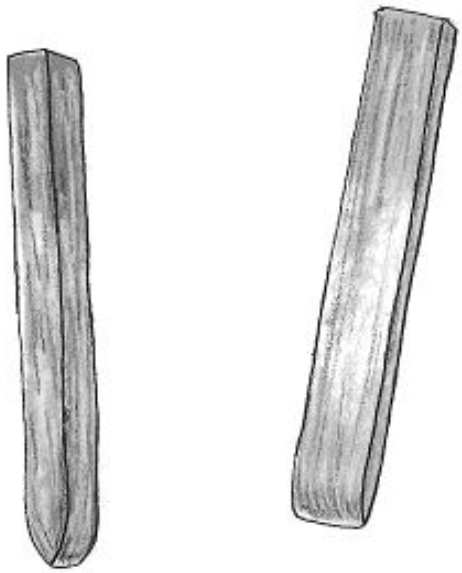
OK, what is the best way to jig and weld up this tooling? First, cut and position all of your pieces to make the C-frame without the top and bottom guide. Tack weld these parts, then check for general squareness and position before finish welding the basic C-frame (still without the top and bottom guides).



Another view of the veining tool set up - this time showing it out of the treadle hammer where you can see the hardie hole stem welded to the bottom.

Take this whole assembly and position it on the base and against the top of the C-frame. Having a solid piece of the tooling stock - 7 to 8 inches long is very helpful here because it insures the top and bottom guides are aligned with each other. The top guide may want to slide down the tooling stock but you can put in a simple spacer to maintain the distance between the top and bottom guides. Now weld it in place - leaving that tooling stock in place while you do the welding. Let it cool, then remove the length of tooling stock - if it is tight, (unlikely) heat it with the torch and burn out all of the paper.

To make the working tools we use the same 1/2 x 1 inch stock for both the bottom female tool and the top male tool. I would use cold rolled mild steel for this but hot rolled will also work well if you take a little time to clean it up. Since hot rolled stock tends to vary in exact size from run to run I would set some of the bar aside to use for making future tools. With cold rolled material it will be the same size within a few thousandths from bar to bar. This is an example of a tool that you could make out of tool steel if you are going to make miles and miles of leaf veins - but for most of us mild steel will work just fine and you can dress your tools when necessary.



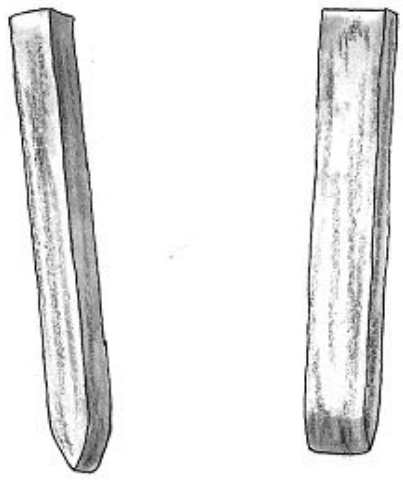
Top and bottom cold work tools

Ray showed and used two different sets of top and bottom tools at Tannehill. He had one set of tools for working thinner material cold and another set of tools for working heavier material hot. In general, he uses the cold tools to work material about 0.060 inches (16 gauge) and thinner at room temperature. Above this thickness, he uses the hot tools to work the material hot. He demonstrated working on 1/8 inch material hot for the large acanthus leaves.

What's the difference between the hot and cold tools? Basically, the hot tools have a smaller radius to their shape or you can think of them as having greater edge relief.

The first sketch shows two views of the cold top and bottom tools. (These are the same top and bottom tools, just sketched from different positions based on some photos I took.) The next sketch shows the hot top and bottom tools. (Again the same top and bottom tools, just sketched from different positions.)

In both sketches shown, the top tools are in their approximate working position but the bottom tools are lying on their sides (editor's artistic license).



Top and bottom hot work tools

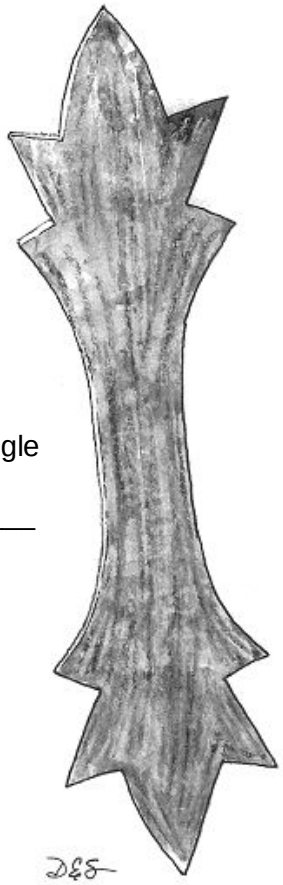
Why have the greater edge reliefs on the hot tools? It does three things: One, it keeps the edges of the tools from digging into the softer hot material. Second, it helps keep the hot material hotter longer because only the center contacts the tooling and third, it concentrates the force on a smaller area in the case of the thicker (hot worked) material.

How do you make these tools? Here is one way and it assumes you are using mild steel. First, cut your stock to the lengths required for both the top and bottom tool. Make sure you can install the bottom tool without dropping it down through the top guide. Then shape the top tool (male) by grinding and filling to the desired form. (You could forge the nose down some but this tool is so blunt you might as well just use a grinder and file.) Now heat the blank for the bottom tool (female) to a good forging heat. Place it in the bottom guide, drop the top tool in the top guide and give it several strong blows.

This will forge a V slot in bottom tool that is the reverse shape of the top tool. Let it slow cool. Do Not Quench. If you followed the advice to make sure you could remove the bottom tool without taking it through the top guide you will be happy J if you didn't L you will not be happy because you will have to file and grind the mushrooming to get it out of the veining setup. Now take the bottom tool (after it is cool) and file / grind

both edge and end relief. The idea is to have no sharp edges on the top surfaces of the bottom tool that will mark the stock you are working on. Remember that for the set of tools used for hot working you want a smaller radius to the tool itself and greater edge and end relief. One other suggestion - match mark your top and bottom tools - that way if the shape of the top tool is not perfectly symmetrical it will still be OK because it matches the shape of the bottom tool.

Try your tools out on some scrap and see how they do. If necessary, you can dress both the top and bottom tools to refine their operation. Note that none of these tools has a sharp edge - you want them to form, not cut.



Note right angle cuts define shape _____

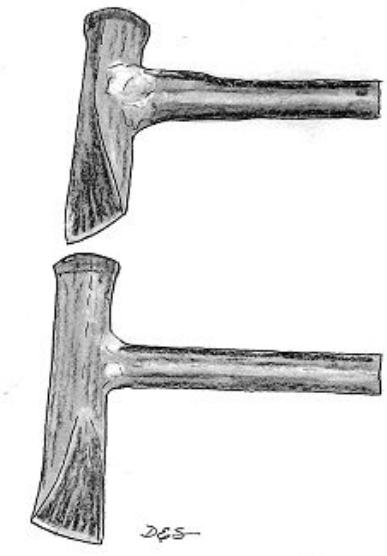
We now have our completed veining tools and set up so let's look at how Ray Spilling makes acanthus leaves. What are acanthus leaves anyway? Acanthus spinosus, common name bear's breech, is a small shrub native to the Mediterranean. It has a lobed leaf with spiny edges with spikes of white or purplish flowers. The Greeks first used it in architecture as a design pattern on the Capitals (tops) of the Corinthian columns. In the Greek form, the design had pointed leaf edges. Also widely used by the Romans in their architecture, they widened and broadened the leaf with vigorous curves.

The acanthus leaf was reproduced in many other art forms, and became a favorite of wood carvers. It has often been used in the carved details of furniture. In made its way into ironwork in the French repoussé of the 16th century and then was widely used by others throughout the 17th century.

Ray uses a simplified form of the acanthus leaf that I find very effective. It also meets his need for something that can be produced at a commercial pace.

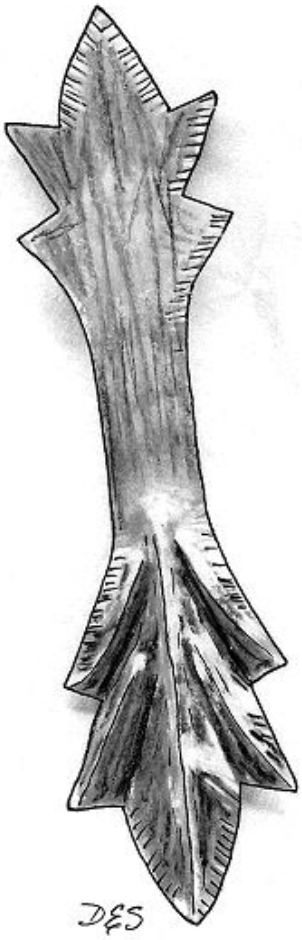
The sketch to the left shows Ray's blank for the large acanthus leaf at about 1/2 size. He cuts this leaf from 1/8 inch thick material. This is another example where Ray has defined his design and uses his shop equipment to rough out the shape quickly. He makes use of his ironworker and a notching feature it has. This lets him cut notches that have a right angle corner. He in effect uses the notcher feature to rough out the whole shape including the sharp inside corners and then cleans it up with a belt sander or grinder.

Ray's next operation is to put a large number of texture marks along the edge of the leaf using a hot cut.



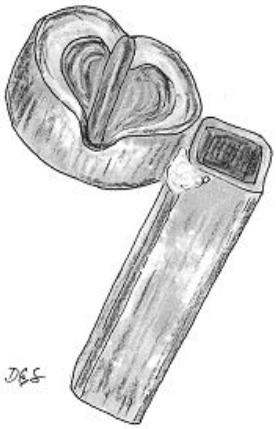
He makes these hot cuts short in height with welded steel handles to use under the treadle hammer. The handles are about 14 or 15 inches in length and have a simple hook on the end for hanging on a tool bar.

Only a portion of the handle is shown in the sketch below. Ray has both "right hand" and "left hand" hot cuts with the cutting edge turned 45 degrees from the handle. One turned right and the other turned left. This makes positioning the hot cut under the treadle hammer much easier. This is another place we see the usefulness of the treadle hammer. You have the work piece in one hand, the hot cut in the other and you control the hammer blow with your foot.

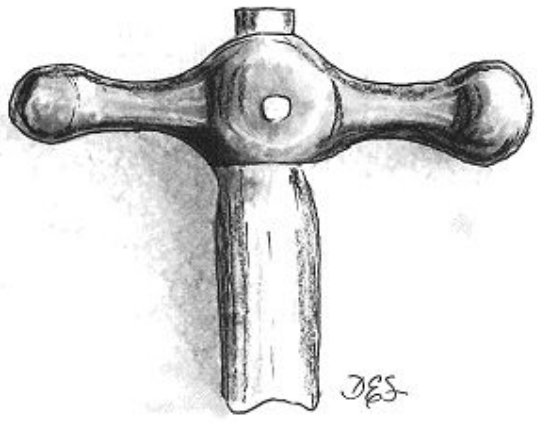


Once Ray has textured the edge, he is ready to put the vein into the leaf and does this hot (on thick stock) working from the backside of the leaf. It is a good idea to lay out the vein positions with soapstone or silver pencil on the backside before heating. It will take a number of heats to put in well defined veins as viewed from the front of the leaf. Watching Ray do this operation, he uses a vibrating or shaking motion of the work piece to advance it between the top and bottom tools while he strikes repeated blows with the treadle. Now flip your work piece over and go back and but in the valleys in the spaces between the veins you defined from the back. The following sketch shows a sample leaf that Ray had made for the demonstration with just the texture effect on part of the top of the leaf and the ridges and valleys formed on the bottom of the leaf using the veining set up.

We are not quite done with the leaf yet; Ray has one more operation that really makes the leaves look "real". For that he uses a very simple tool but one that has a neat feature.



Most of us have seen and used a "dishing" tool, but Ray's design has the special feature of a deep groove running down the center of the bowl. This groove allows Ray to place the acanthus leaf face down with the ridge of the vein in the groove and add a final curvature to the leaf giving it a true feel of depth. This makes the leaves take on a real look of nature.



Ray has a favorite hammer he uses for the repoussé operation. You should be able to make or find similar hammers. If you want to make your own, an old ball peen hammer is a good starting point.

How do you make one of Ray's "dishing" tools? Start with a round bar of mild steel, about 1- 1/2 to 2 inches in diameter and cut off a slice about 1 inch long. Find and mark the center of one side with a center punch. Now start a drill in the center (use say a 1/2 inch dia.) but you want to make only a very shallow cut using just the point of the drill. You now need a large ball bearing or a very large ball peen hammer as a top tool. Heat your "hockey puck" to a good yellow forging heat, place the ball on the center depression, and forge it down into the stock to form the center spherical depression. Do this on the treadle hammer or a power hammer. It may take several heats to get the depression you want.

You are not done forging quite yet. Now take a 1/4 to 3/8 inch rod and with your "hockey puck" back up at a good forging heat place the rod across the width of the bowl and using the treadle hammer drive the rod down into the rim of the bowl until its top surface is flush with the top of the bowl. This will give you the side lips of the "groove". To cut the groove through the rest of the bowl you can use your angle grinder. Now you know why you save those almost used up grinding disks. Dress the edge to a nice round curvature and use the grinder to carefully sink the groove in the bottom of the bowl. Clean up and round all of the remaining surfaces of the dishing tool and then weld on a hardie stem or "tang".

You will note that on this tool too, Ray welds his stem on the side rather than the bottom - works great and is easier to do. Again - no sharp corners - you want to shape with this tool, not cut or leave marks.

The smaller leaves in Ray's example piece were made from thinner material - about 0.060 inch (16 gauge). Ray cuts this thinner material on his Beverly Shear and the adds small right angle cuts to add detail. The rest of the operations are the same as the larger heavy leaves but done cold.

You should now have all of the parts to assemble the total architectural element or piece. (I leave the details of making the master rivet to your own imagination.) The assembly is straight forward but Ray has a few key suggestions. Start with the center cross and the 4 C scrolls. Use a dummy rivet or pin to position the two cross elements and then place all of the C scrolls inside the outer ring. No leaves are in place at this point.

Place your collars all in place and arrange the whole assembly on your worktable. Make sure you are happy with the arrangement of all of the parts, and remember you will be looking at the back as you make the assembly by setting the collars. Ray sets all of his collars cold. This came as somewhat of a shock to many at Tannehill but worked very well and is fast.

One important thing is making sure that you get a tight fill in the collar. Make sure it is all of the way on before setting the collar. Ray places small steel blocks under the collars being set to make sure he presses the parts full into the bottom of the collar. Ray likes to use the ball end of a ball-peen hammer for setting collars because it gives good directional control. Set the collars between the cross elements and the C scrolls first and then set the C scrolls to ring. Now use the master rivet to attach the leaves and you are done.

The example that Ray demonstrated at Tannehill is what I would call "single sided". In other words it is primarily made to be viewed from a "front" side. Ray also makes this type of architectural element in a "double sided" form. To do this you need to forge and add a second set of acanthus leaves on the "back" side. Your collars will still be lapped on this backside but the piece will look great from either side.

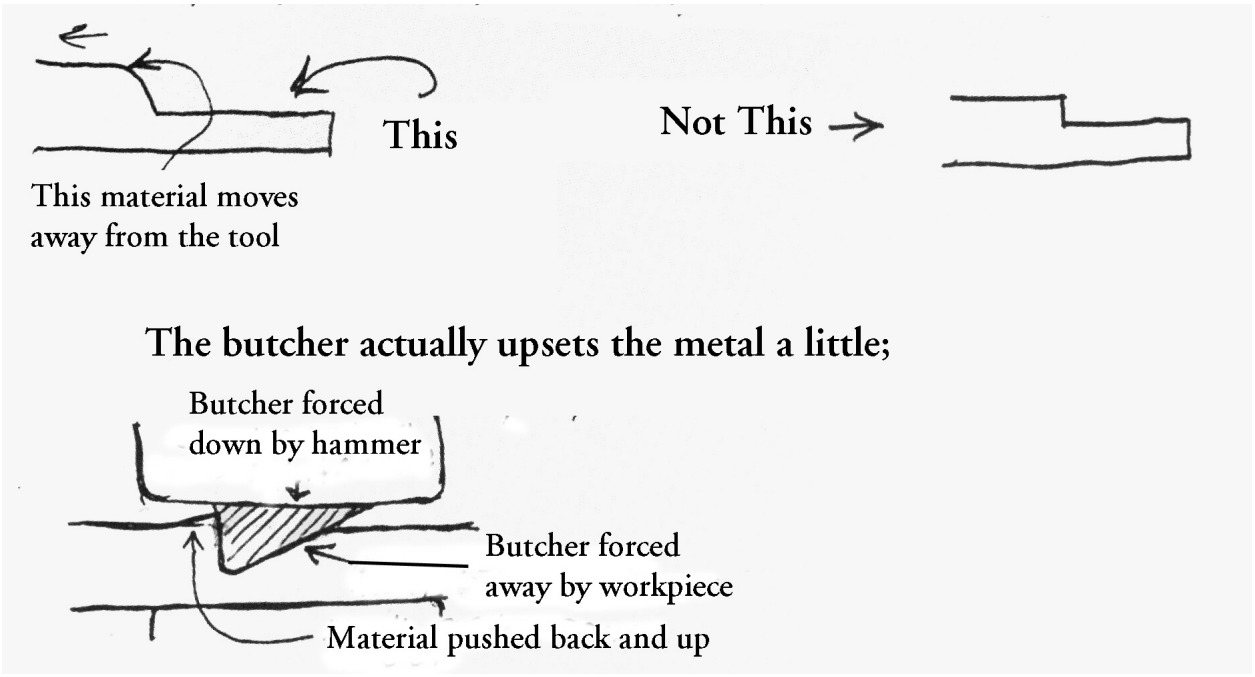
Ray showed and talked about more things at Tannehill but they will have to wait for some future articles. I would like to express a special thank you to Ray Spiller for a great job at Tannehill and for sharing his methods and tools with all of us. One of the great things about blacksmithing today is the sharing of knowledge and Ray did a great job of this.

Letter to the Blacksmith Association of Missouri Editor from Walt Hull, 7/24/04 Lawrence, Kansas

Dear Editor,

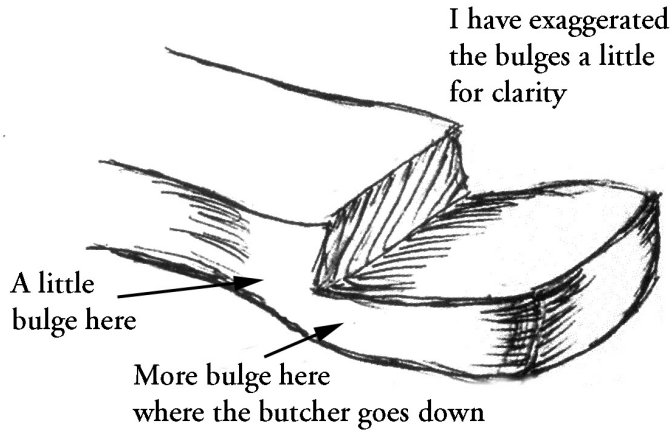
Just a quick technical note on Doug Hendrickson's scholarship report in the May- June issue:

If you use a set tool to make a lap joint, the tool might not bounce if you have a hammer with very good control, the work is very hot and you hold the tool down very tightly. But you still need to use a butcher because as the tool forges the material down it also draws it, so you will still get;

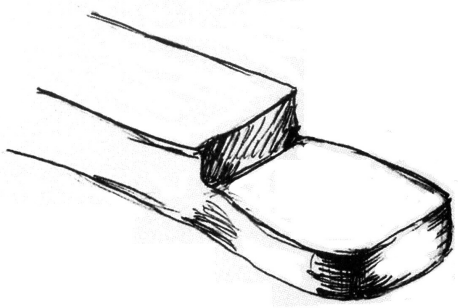


This upset is pushed back into the bar when the hammer die hits it.

Also the material is not simply pressed down under the butcher and then the set tool, but away in all directions,

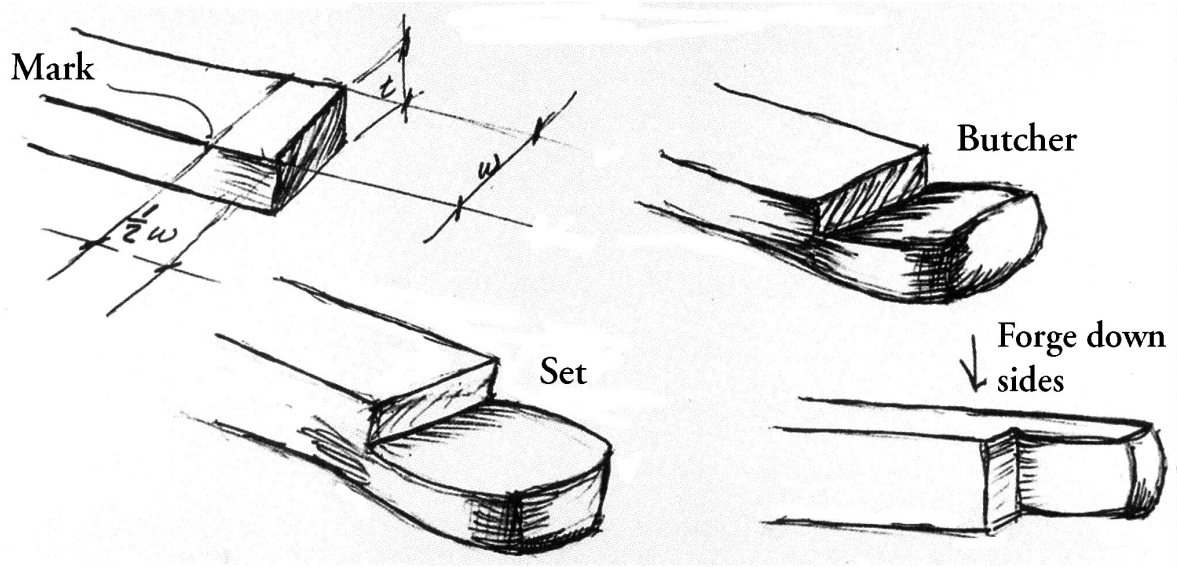


The results being something like this after butchering

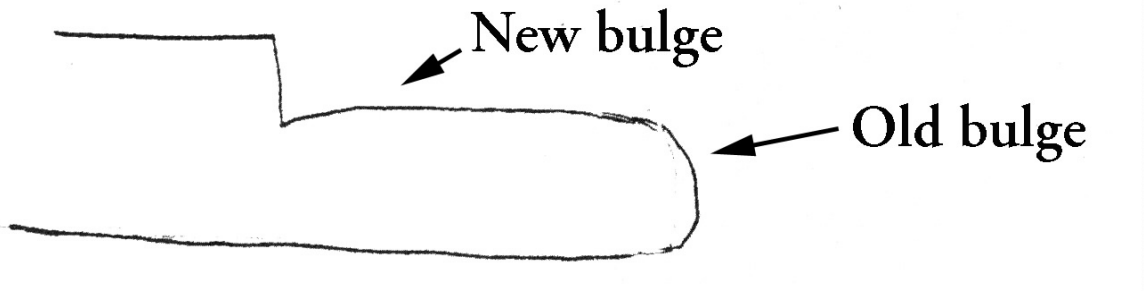


And like this after using the set tool

So the procedure is like this;



Note that after you forge down the sides, you'll need to go back in with the set tool, because some of the bulge from the sides has gone back into the area you just forged down. From the side it now looks like this;



Finally, square up the end with the hand hammer hitting first the end, then the sides, then the end till it all comes out even. Hopefully this will haqppen just as you run out of heat and you'll leave a nice smooth surface

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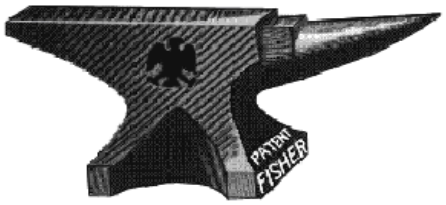
Attn: Larry Brown, Editor

New Jersey Blacksmiths Association



"EAGLE"
FISHER & NORRIS, Trenton, N. J.

How to Join or Renew your Membership in NJBA:

NJBA Dues are $18 per year (as of July 1, 2001).
Please make your check out to: "NJBA"
Please mail checks to:
NJBA, P.O. Box 761, Mt. Laurel, NJ 08054

Please include payment with the information listed below. You will receive a postcard confirmation of your membership, and will receive a newsletter within a month. NJBA's "year" runs from June to June. If you join mid-year, the postcard will offer a prorated dues option which will then allow you to extend your membership till the following June. The following information will be listed in a roster available to other members.

Name _____ Home Phone_____
Address _____ Day Phone _____
City _____
State _____ Zip _____
E-Mail _____ Skill Level (optional)_____
Comments _____