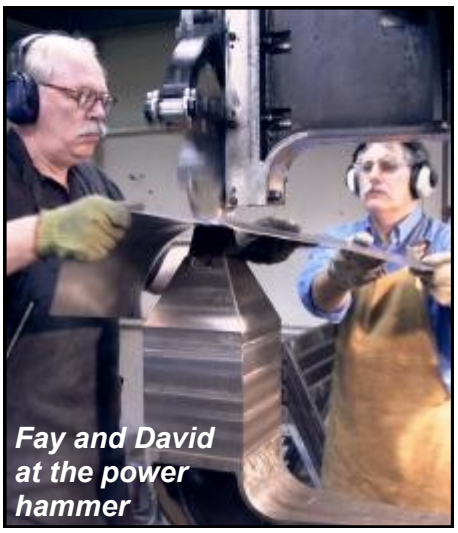

Fay and David at the power hammer

Metal Shaping Taught by a World Renowned Master: Fay Butler

By David E. Tyminski

I had the privilege to attend and participate in a metal shaping seminar taught by Fay Butler, a master metal shaper and champion of the power hammer. This experience was a wonderful birthday gift from my wife!

This three day course included:

- Fundamental discussions about the properties of steel and aluminum metals.
- Identification of metals to make the appropriate selection and communicate with a supplier.
- The shrinking or stretching of metal and what occurs on an atomic level.
- What occurs when welding and the attention to cleaning and details during oxy-acetylene torch hammer or TIG (tungsten inert gas) welding.
- The difference between “form and shape”.

There were multiple hands on demonstrations that included sheet metal shaping with an English wheel, planishing hammer, Pullmax machine and a power hammer.

The class was held September 26 - 28 at Times Welding shop south of Dayton, OH, a very well equipped machine, welding and metal shaping shop that accommodated the twenty plus students in the class and two assistants helping Fay. Doug and Jim Times have expanded the shop space and handle custom welding, metal repair and fabrication. Doug is a machinist by training and Jim has focused on

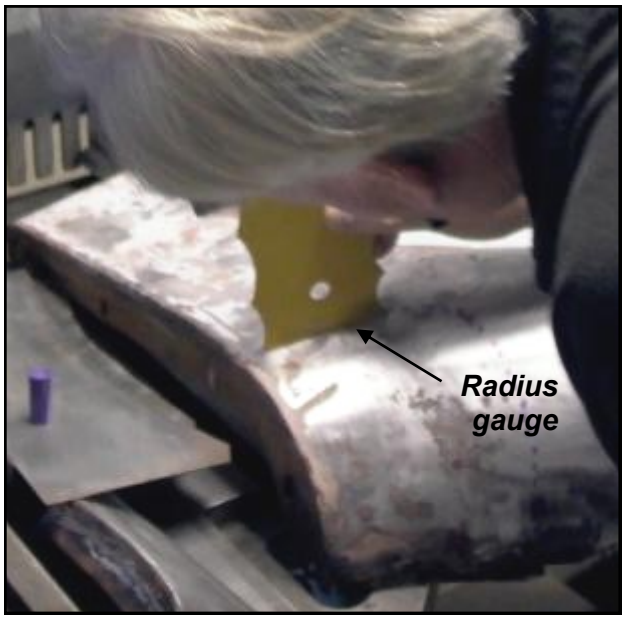
At immediate right -the power hammer built by Doug Times extends almost from floor to ceiling of the shop.

Far upper right- working at the Planishing hammer with other dies shapes available

Far lower right- Working at an English Wheeling machine

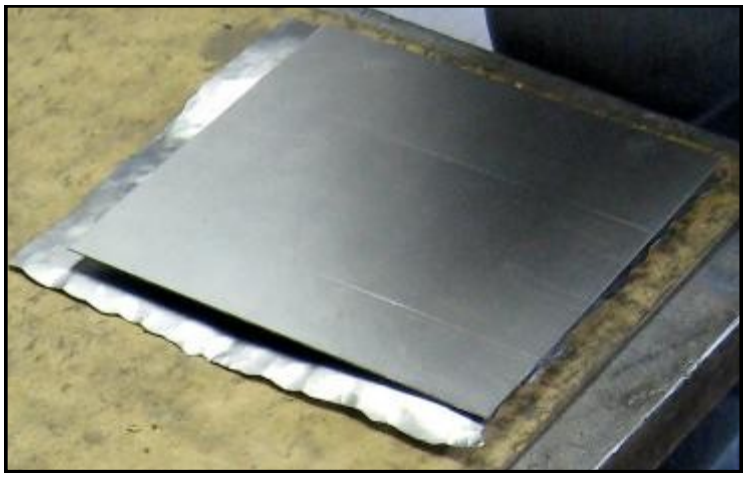
welding as his avocation. Doug has fabricated an English Wheeling machine and a double arm power hammer, similar to a Yoder design. With the focus on metal shaping, the class used 19 gauge sheet steel and 2 planishing hammers, two Pullmax hammers, body hammers and dollies, a manual metal shrinker, 2 English wheels and a power hammer while working on projects in the Times shop.

When making sheet metal patch panels previously, I have made templates or patterns with cardboard (2 dimensional) or pattern paper with glue on one side. A better way of pattern making is to use paper and introduce tucks or cut slits in the paper to make a replicate skin on the original piece. In areas of changing shape, the radius of curvature changes and can be observed and measured with a radius gauge.



Above left: Tucks following the curvature of a fender. Magnets hold the thin paper sheet to the metal fender allowing the identification of areas of changing shape/ curvature. At right: A radius gauge used to determine the radius of curvature of changes in the shape of the fender.

These areas are highlighted with a marker on the pattern. This pattern information is transferred to the flat sheet metal. The highlighted area is transferred to sheet metal that requires shaping (changing the metal thickness) to achieve curvature. Metal shaping equipment, like a Pullmax, power hammer or English wheel, are used to manipulate the thickness of the metal and introduce curvature into the flat stock sheet metal. The picture at right dramatically illustrates metal stretching with a power hammer, where the piece of metal on the bottom started out exactly the same size as the one on top.



The Butler approach to metal shaping: desire to be a craftsman and think about and understand what you are doing. Fay supplied some of his extensive background of the properties of metal (ex. on an atomic level) which when translated into an application of compressive forces can create the form (of the piece you are working on). Some thought about what you want to accomplish, the measurement of the part that you wish to duplicate and then marking the raw sheet metal to provide a visual reminder where the metal is changing thickness provides an overview of any project one wants to tackle.

I used power tools that I only read about or watched someone use in a video, but never have used. A planishing hammer, Pullmax machine and Yoder power hammer, each one uses a top and bottom die in combination to provide a metal forming result such as: metal stretching, finishing the surface, or making a sharp defined line (ex. belt molding).

Left: one example of a power hammer die.

Below: TIG welds and far below: Removing the metal tape on the backside of a TIG weld.

A massive power hammer is intimidating and makes ear pounding noise during operation. Watching a piece of metal change because of the compressive forces of the die impact – **priceless**.

We watched hammer welding skills attaching two sheet metal pieces together using a small oxy-acetylene torch tip. It sure helps to weld a small distance, hand the torch to someone and then level the two pieces together with a body hammer. Precleaning the metal surfaces is a requirement to minimize contamination, something that most of us had not been concerned about.

Cleaning the metal surfaces including wiping with solvent, cleaning the filler rod and the tungsten tip that has the correct shape for the welding surface are important for TIG welding. On the back side of the weld a metal tape with a separate strip of heat resistant material was applied to contain the shielding gas and therefore minimize oxygen exposure to the welding area. It is dramatic to see the improvement of the welds with virtually no oxidation. The TIG welded sheet metal, with extra preparations and cleaning before welding, provides a non-contaminated, narrow weld seam with minimal heat distortion in the metal. There is much less grinding on the welds, with substantially less than required with a MIG welded seam. The extra attention to preparation and understanding the input controls for a TIG welder make dramatic improvements.

The third day focused on a project that each of us selected to work on. The projects were varied and ranged from making a radiator shell, the ‘ apron’ underneath the radiator, a rear motorcycle fender, a motorcycle gas tank and for me replacing a portion of complex curvature of a rear fender. Fay and the assistants provided the necessary personal attention as each student worked on his project.

A pattern was made of the part to be made. The part of the rear fender I wanted to replace has a reverse curve and includes curves in different directions, a

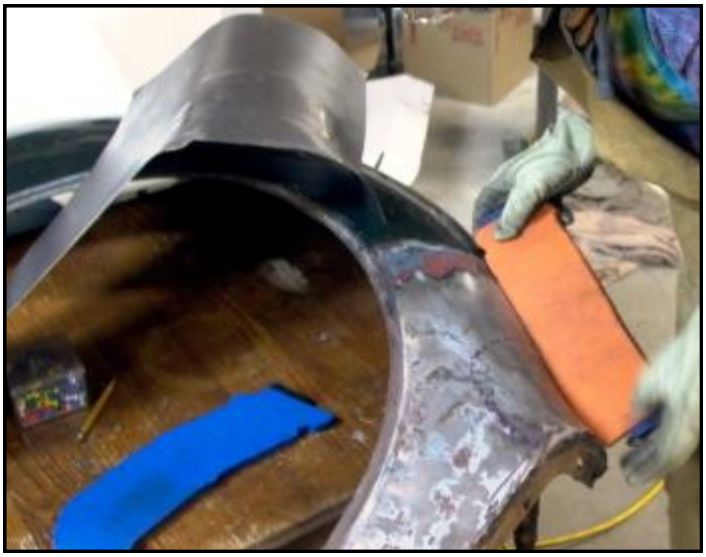
relatively flat “dog leg” and has a curved flange to receive a fender skirt. The area where different radius curves intersected was highlighted and the pattern paper was slit open to follow the metal underneath. The pattern was indexed to the part to reposition the pattern on the old and new parts. The pattern was

Progression of fender fabrication: from left, the original portion of fender to be remade. Middle: the pattern and fitting on the old fender and at right the finished fender panel attached to the original fender.

transferred to flat 19 gauge sheet steel and an oversize piece was cut out from a 4’ X 8’ sheet. The highlight lines were transferred to the new metal and the pattern was indexed. The replacement piece was trimmed down but remained oversize. An English wheel was used to introduce some form into the portion that would be the dogleg, by rolling the metal through the wheels across the width. The metal was introduced to the power hammer using the stretching die to begin the change the thickness of the metal. The shape was developed and compared to the original a number of times. A bead roller was used to start the shape of the flange to accept the fender skirt. There were multiple passes to bend the metal. Then a shrinking die was used to remove the buckles that were created and get the metal to lay down flat. Ultimately, hand work was completed to make a sharp recessed flange. Some touch up with a hammer and dolly was required. The Pullmax machine was used for some further shaping in the area of the maximum radius until the newly shaped piece would mirror the original specimen. The outer shape around the flange was modified slightly to match the contour of the fender skirt.

Above: David using the power hammer.

The new piece was trimmed to size, after the dog leg edges were duplicated to match the old piece. The old portion of the fender was cut off the front of the rear fender and the new and old pieces were mated together in preparation for welding. The old and new surfaces were thoroughly cleaned by abrasion and then with the acetone solvent; the filler rod was also cleaned of oxidation. A heat shielding tape and a thermal barrier were applied to the backside of the weld to cover the gap between the pieces and capture the argon gas supplied during the TIG welding process. The mated pieces were tack welded together and the surfaces were aligned with



Pictures from the top then down: David comparing the new piece to the old AND using the Pullmax machine to shape the metal AND using a contour gauge to match the curvature of the fender.

a hammer and dolly. A continuous TIG weld was applied between the tack welds of ~ 1" in length. After this weld was completed it was allowed to cool, before progressing to the next location, preferably not adjacent to the previous weld (to eliminate heat distortion). This process was continued between the spot welds until the whole seam was welded together. With the preparation work, prevention of the back side of the weld becoming oxidized and a focus on a clean surface, the weld only shows the "heat zone" color that radiates away from the weld. The weld is clean without contamination and very little finish work will be required. Pictured on the next page is the new and old attached. The photo is of the inside of the fender which is now ready for its' surfaces to be further restored and finished.

For a person that is capable and driven to shape metal, Fay Butler offers the subject background and demonstrates and guides new (or old) students in the techniques used by metal craftsman. We engaged in discussions about the industrial naming conventions (AISI American Iron and Steel Institute, ASTM (mechanical and physical properties)) which provide the information to communicate and obtain the material for a metal shaping purpose. NOT all metal is the same. Discussions about what metal is capable of doing (crystal lattice, elastic limits), on a microscopic level, provided the understanding of metal deformation. We discussed the difference in the explanation of metal form (the metal can be pushed around or folded but can be returned to the original configuration) contrasted to shape (the metal thickness is changed) and we could recognize a low crown, high crown or reverse curve. In some cases, a complex metal shape will be made in multiple pieces, which are assembled by welding them together. The background about TIG welding, metal surface preparation and adjustments of the equipment are just as important as observing and moving a molten puddle of liquid metal.

Metal can be shaped by hand with simple tools and lots of time. Power tools like a power hammer, Pullmax, planishing hammer and metal shrinker can accomplish metal shaping tasks in much less time, and the surface can be finished without the need for hammer and pick work. Finally, making progress on your own project, with the guidance of experts, using the background information learned reinforced the theme of being a craftsman, who can make or replace complex contours in the rolling sculpture we admire.

The fender, viewed from the inside, with new attached to old, ready for further restoration.

Fay Butler working on form on an Indian fender buck

Fay Butler
51 Cleveland Dr.
P. O. Box 106
Wheelwright, MA 01094
(413) 477-6449
www.faybutler.com

Times Welding
(Doug Times)
6844 Gillen Lane
Miamisburg, Ohio 45342
(937) 865-9533

Metal Craftsmen and Their Projects