

The Tools and Trade Techniques of the Blacksmith

From Henry J. Kauffman, *Metalworking Trades in Early America*, 1995.

From the Collections at [Historic Bethlehem](#) [PA]

The tools of the blacksmith varied from time to time and from place to place. They were generally divided into three groups. The first is the hearth with its bellows, water trough, shovels, tongs, rake, poker, and a water container for damping down the fire and cooling objects. The second group consists of the anvil, sledges, tongs, swages, cutters, chisels, and hammers. The third group was made up of the shoeing box, which contains knives, rasps, and files for preparing the horse's hooves for shoes, an iron stand for supporting the horse's foot while working on it, and a special hammer and nails to fasten the shoe to the hoof.

The blacksmith worked with charcoal iron, so named because charcoal was used for fuel in the furnace that produced the iron. It seems not only to have been suited to the various ways it had to be "worked;" but also because of its other desirable qualities, much of it has outlived iron of a later period that lacked these qualities.

Blacksmiths of the 18th and 19th centuries had different qualities of iron available to them. Even if a high grade of iron were used, the metal frequently needed additional attention by the smith before he used it. The limitations of the refining and rolling processes caused much of the iron to have an imperfect texture, usually referred to as fibrous. The blacksmith could improve this condition by heating the iron and vigorously hammering it on his anvil. This procedure assisted in removing certain impurities from the iron and improved its purity and resistance to disintegration. Despite the work that most smiths performed on the iron, it is not uncommon to find separations or fissures in objects such as axes, wheel tires, and fence parts.

A certain amount of improvement in the texture of the iron was inevitable, since the blacksmith, after taking the iron off his rack, usually found it necessary to reshape it for his specific need. This was particularly true in the operation most frequently performed by the blacksmith, drawing out. This process was accomplished by heating the iron bar, laying it on the anvil, and increasing its length, or width, by using a cross-pein hammer, at the same time decreasing its other dimension, as necessary.

Drawing out not only improved the quality of the iron but also its appearance as well. Certain irregularities in the surface (not pock marks) and cross-sectional variations in size are usually considered evidence of hand fabrication. Such variations can be observed by close examination. They are the underlying reason for the charm of the handmade when compared with the mechanical perfection of metal sheet or strip, which was made by a machine.

Another fundamental operation of the blacksmith was welding on the forge. An early treatise on blacksmithing described the heats, three in number, that were necessary to

the proper performance of the work. The hottest is snowball heat, which refers to white heat; this is used to weld iron. There is full-welding heat, not quite as hot as snowball, employed to weld mild steel. The last is low or light-welding heat, rarely used because of the great skill required in using it.

Welding was often preceded by scarfing, which means tapering the ends or edges of parts before welding. Such tapered parts were then reheated, and the ends overlapped the entire distance of the tapered parts. They were placed on the anvil and tapped until the two pieces were perfectly welded into one piece. If the joint were oversize, it was reheated and forged until all parts were of uniform thickness. This operation was performed on wheel tires, but the joint can rarely be found. Some blacksmiths used sand, as a flux, to keep the surface of the metal clean in the fire, but a good craftsman could work without this assistance.

Upsetting was the opposite of drawing out, for in this operation the length of the bar was decreased instead of increased. A portion of the bar was heated to welding heat and other parts cooled, so that when the end of the bar was hammered, the hot portion was made thicker and the total length of the bar was decreased. The enlarged portion was then finished with a hammer, or with swages, if a design with some specific details was desired.

Punching was quite simple, but very important for decorative purposes and for joining pieces of iron. It was the only method known by which a hole one inch in diameter could be made in a bar one inch wide. The first operation was to heat the bar and slightly increase its width by upsetting. Then, after reheating, a small punch was forced through the hot part of the bar with a hammer, until the punch was stopped by the face of the anvil. The punch was pulled out of the bar, the bar reheated, and punched from the opposite side until there was a small hole through the bar. The bar was reheated the third time and the hole placed over an opening in the anvil, where it was stretched to the desired diameter with larger punches. Such holes usually have a burr on the bottom side, and the bar was always wider at the hole than at any other part. At times, the enlarged portion was utilized to form part of the design of an object. Its use, like the other techniques described, does not guarantee great age, but it does indicate that it was hand-wrought.

Various methods were used by blacksmiths to join pieces of iron: riveting, collaring, pinning, screwing, and bolting. Riveting used rivets with round or countersunk heads. When a countersunk-head was used, the head and the riveted end were flush with the surface of the iron, making them difficult to detect if the ironwork were heavily painted. When rivets with round heads were used, the portion hammered over, or riveted, was the same size and shape as the original head. Collaring was done by wrapping a band of iron around two pieces to join them together; scrolls were frequently fastened to bars, or to each other, by this plan. There were various ways of pinning pieces of iron together; the type most frequently used resembled a mortise and tenon joint, with the tenon going completely through the mortise and held in place with a tapered wedge or pin of iron. Such a joint was used on some early andirons. Screwing and bolting were

used in the 19th century. Bolted joints are undesirable if the bolt is secured with a nut. An alternative was to tap a thread on one of the bolted parts and dispense with the nut.

Twisting was another technique widely used by craftsmen in iron. It was easily executed by heating the portion of the iron to be twisted to a blood-red heat; one end was then placed in a vise and the other end twisted with a holding device of some kind. The modern iron worker uses a monkey-wrench; the tool in its present form, however, was not available before the 19th century. The spirals could be made tight or loose and the direction of the twist could be reversed a number of times if the craftsman wished to do so. A very long twist required a number of "heats." Rarely has a craftsman had at his command such a simple but effective decorative technique.

Repoussé in iron was rarely used in America, but was widely used in Europe from the 12th into the 18th century. The work required a high degree of skill and a complete understanding of the forms used. Popular designs were human figures, masks, flowers, and the acanthus leaf. The last names were widely used as an embellishment on scrolls.

Engraving was another popular decorating technique, but it was used principally by foreign craftsmen. The pattern was cut by removing small threads of iron with a pointed tool, usually called a graver. Some engraving was done on American door and gun locks made of iron.

The finishing of iron work holds much interest for connoisseurs who try to separate the new from the old. Novices assume that the pock-marked texture often found on modern reproductions is evidence of hand production. No fact could be more distant from the truth, for there is evidence, gathered from a study of the tools and techniques used by craftsmen, that they tried to make the surface of the metal as smooth as possible. As a matter of fact, there was a tool called a flatter, which was used to make the iron flat after it was drawn-out. A careful examination of surviving old objects of iron reveals surfaces so smooth that it is almost impossible to detect hammer marks on them.

Edges and bevels were often smoothed with a file; and there is evidence of competence in the using of files when they were crudely made in comparison to the quality that is available today. It should be noted that file marks were virtually never left on objects; they are usually evidence of indifferent workmanship. Powdered abrasives were available in early times; and in the 18th century, paper coated with abrasives came into use.