

By Drake Ambagis

Blacksmithing

Blacksmithing is an ancient art form. It's the art of taking a piece of unbreakable metal and bending and shaping it to your will. It can be used to make beautiful pieces of sculpture or art but it can also be used to make deadly weapons of war. Blacksmithing has a lot of techniques for shaping metal; the main branches are welding, casting, and forging. Each of these techniques requires special skills and different tools. I decided to study the branch of blacksmithing called forging, specifically bladesmithing. I did this because I needed those skills to make a wakizashi for my artistic piece of the project which was my focus.

In history, civilization depended on blacksmiths for many different reasons. At one time blacksmiths created everything metal that people used in their daily lives. As time moved on, new technologies were invented that took away the tasks that the blacksmiths did. Blacksmiths appeared less and less in the history books. More recently, they have started to come back but they are doing different jobs. According to Will Kalif in his essay "An Article About the History of Blacksmithing", blacksmithing was believed to have been invented in 1500 B.C. in Syria, which was the start of the iron age. Some of the first iron was discovered in meteorites, which was then sent to be melted down. When blacksmithing was first invented, people thought of it as black magic because before that no one even considered bending and shaping iron ore. Blacksmiths were considered to be the "kings of trade" well into the Renaissance. They were called

this because they created the tools and equipment that every person in any trade needed. The blacksmiths had their own shops for business. They sold everything, they made armor, weapons, all the tools, basically anything that required metal at all. They also fixed the things that broke, they were the dentists and surgeons, and they shod all the horses.

Different blacksmiths and guilds experimented with making stronger and better metal. Lorelei Sims states that early blacksmiths invented wrought iron, pig iron, and Damascus steel. Wrought iron is an old form of metal for it is not very good at staying together because it has a grain like wood and will split like it as well. In order to create wrought iron, you have to burn out all the impurities and carbon from pig iron. Pig iron is most commonly used to make other forms of steel because it is brittle on its own due to its high carbon content. Pig iron got its name because when molten iron was poured into sand beds from a common runner, the row of molds looked like a litter of piglets. Each of the ingots were called pigs and the runner a sow. Another type of metal is damascus steel; it is still one of the strongest metals available. It is a piece of metal, but it is folded over itself hundreds of times making it flexible but still very strong. Damascus steel was invented in 700 A.D. in Damascus, Syria. Damascus steel is especially useful when making blades of any sort (45-46).

Kalif also states that blacksmiths continued to be very useful until the Industrial Revolution. The revolution brought around various new technologies that did the jobs that blacksmiths used to do. These new technologies put a majority of the blacksmiths out of business, yet some still found work as farriers, shoeing horses, and other similar jobs.

By the end of the Great Depression there were very few jobs left for blacksmiths.

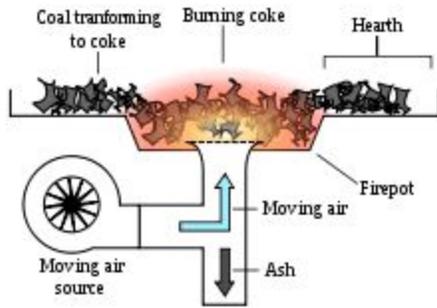
Nowadays, many blacksmiths have turned to other forms of metal working. They make beautiful pieces of art, and some people have taken it up as a hobby.

Steve Grader, the owner of the Village Blacksmith and my mentor, taught me about blacksmithing. He told me about it, showed me, and let me learn from my own experience. I learned that blacksmithing requires different tools to be able to make different things and for using different techniques. There are many tools used in blacksmithing but most of them can be grouped into different categories: forging essentials, mechanical devices, and other tools for designing different things. The tools that are included in “forging essentials” are all needed to be able to forge. You need a forge to heat the metal, an anvil to put the metal on to hit it, a quenching bucket for heat



I took this picture from my backyard forge

treatment, a hammer to hit the metal with, and tongs to hold the metal. A forge’s shape depends on the make, but the most widely known one is propane fired and either shaped like a rectangular box or a cylinder. One isn't better than the other to my knowledge. The forge can heat up to 3,500 deg F⁰. It gets up to that temperature by way of propane and forced air, thus making fire that blasts into the forge. It is connected to a propane tank with a tube and the air comes into it by various means depending on the brand.



<http://www.mooseforge.com/Forges/forges.html>

There are also coal forges, which were the original forges. Coal forges are essentially just a bed of burning hot coals with bellows to superheat the coals that you put the metal on. It doesn't work better or worse than a propane forge; it just takes a little bit more effort. The anvil is a weird shape: it has a flat rectangular top and one of the short sides has a horn-shaped piece attached to it. The sides of the anvil curve in a little bit but widen back out at the bottom, which is the stand. The whole anvil is made out of very hard steel. The quenching bucket is a metal bucket, usually pretty sizable, with cold water in it. Its main use is to cool down pieces of metal very quickly, mainly for heat treatment. A hammer is a very important part of forging; the head is rectangular with one side shaped like a triangle. It is used to hit the metal on the anvil. The handle is made out of wood so that if the hammer heated up the handle will not change temperature. The head is made of steel. The tongs are shaped like scissors but the handles are long and straight and the head is shaped differently because it is made to hold things. There are a lot of different types of tongs because of the variety of shapes metal can take.

Steve Grater also taught me that another group of modern tools is “mechanical devices”. The tools in this group are the drill press, angle grinder, belt sander, and the power hammer. A drill press is a big machine that has a drill attached to it. It is used to

drill through things faster and more easily. An angle grinder is a device that has a grinding wheel attached to the end of it and it has a handle made from hard plastic. It is used to cut metal quickly. A belt sander is a medium-sized machine that has a sandpaper strip that spins around in a circle very quickly. It is used to take away metal and wood and polish up them up as well. A power hammer is a big machine that hammers metal very hard and is a faster and easier way to pound metal. Other tools that don't fit into any of these categories are wire brushes, vises, and punches. Wire brushes are like horse brushes except they have metal bristles; they are made to take off sludge and rust from metal. Vices are metal tools that are made to hold objects in place. Vices can vary in size so they can hold all sizes of material, and they all have hand cranks as the way to tighten them or loosen them. Lastly, punches are small cylindrical pieces of metal with a pointed end. They are used to make holes in metal or carvings in metal (Grater).

Throughout the world, there are many different types of metal, but certain metals got used more than others in history. The common metals are copper, iron, gold, bronze, silver, tin, and steel. All of these metals were not valued equally and some were used more than others. According to Lorelei Sims, there are also different terms used for describing metal in the world of smithing. These terms are brittleness, carbon content, compressive strength, corrosion resistance, ductility, hardness, elasticity, machinability, and malleability. Some of these terms are normal everyday words, but they have a slightly different meaning. Brittleness equates to how easily it breaks from bending; it is the opposite of ductility. Ductility is the ability to bend without breaking. Elasticity is the ability for metal to bend, then bend back to where it was before. Compressive strength is

the ability not to break under pressure. Corrosion resistance is the ability of a metal not to rust or corrode. Machinability is the ability to be shaped and molded by way of machines. Carbon content states how much carbon is in the metal. More carbon makes it harder and more brittle; less makes it softer and less brittle and affects how fast it rusts. Last, malleability is the ability to be molded, shaped, and moved generally (45). All of these terms can be used for any type of metal.

I learned from conversations with my dad that the metals that were used mainly in history are still used frequently today, but some were used much more in history. Copper, for instance, is used today for wire and plumbing mainly, but in ancient times it was used to make everyday items and decorations. It is still in use because it is a good conductor and is really soft. Iron is still used sometimes today but it was used much more frequently in history. It is and was used to make steel but it was also used to make some of the early weapons in history. Gold is valued more now than it was in ancient times; it was used as a unit of currency much like U.S. dollars, and was also used for decorations. It's rarely ever used to make anything mechanically important because it is extremely soft. Bronze isn't used much these days, but it was used a lot in ancient times. Its discovery started the Bronze Age where it was used for armor, weapons, tools, and household items. Silver is and was used a lot, for decoration, tableware, statues, and currency. Tin's main use today is for cans and roofing, but it is also used to make metal alloys. Steels are the most-used metal today and were also important in history. They have continued to be used to make everyday items, tools, supports for building, and in the medieval era it was used to make weapons and armor. It has been used a lot because it is easy to change the amount of

carbon content in steel, meaning it can be used for almost anything if it is changed appropriately.

Working with Steve Grader, I learned that in blacksmithing, there are three main techniques: welding, casting, and forging. Forging is the one I chose to study and research because it was the first kind of blacksmithing. The basic process of forging entails a basic set of steps. The first step is to find the metal that will be used. Then, the forge must be heated until it is a bright red to a bright orange inside. Next, put the metal in the forge until it is bright orange to yellow. Take the tongs and grab the metal with them, then put it on the anvil while still holding it with the tongs so the metal doesn't move. Then hit it on the anvil, and repeat until the right shape is made. Once finished, the metal must cool appropriately or it will become brittle and maybe break. Put it on the floor to cool. Forging can be used for many things, like sculptures, houseware, tools, and basically anything you need.

Different techniques can be used to make different things. There is tapering, spreading, twisting, punching, forge welding, and heat treatment. Tapering is used to make a side or sides come down into a point. Spreading makes metal flatten out making it wider and longer depending on where you flatten it. Scrolling makes the metal spiral in a circle. Twisting metal makes it twist but keeps the same size and general shape except it has a spiral in a certain part of it. Punching the metal with a punch makes a hole in the metal but it will only work if the metal is heated up. Forge welding is when someone takes two pieces of metal, heats them up, and hammers them together, making one piece. Lastly, heat treatment is a process where the metal gets heated to a certain temperature,

depending on what you are trying to do, then it is either left in the forge to cool or it is put in the quenching bucket. Doing this process changes the grain in the metal making it harder, softer, more brittle, or more bendable (Grater).

In the category of forging there are subclasses of smiths, including goldsmiths, coppersmiths, armorers, and lots more. I am focusing on bladesmithing. Bladesmithing is the art of making blades of any sort, like swords, knives, spearheads, and axes. Bladesmithing is ancient blacksmithing, as it was one of the original techniques. It changed war for the world. Before blades, humans only had sticks they could sharpen and rocks, but then came swords and spears. According to [“https://www.youtube.com/watch?v=VE_4zHNcieM”](https://www.youtube.com/watch?v=VE_4zHNcieM) most of the time when bladesmiths make blades, they use high carbon steel, making it harder so it can keep an edge, but in return, it makes it more brittle. The bladesmiths in Japan were experts in the art of making blades. One of the ways their blades were better than everyone else's was because they used a low carbon steel on the inside of the blade to absorb the shock of the hits. They put high carbon steel on the outside of the blade so it held an edge. They also put an excessive amount of care into making each individual blade.

For my 8th grade project, I created an artistic piece called a wakizashi. A wakizashi is a Japanese sword that is about two feet long, a little bit shorter than a katana. My father taught me that the wakizashi was made to go as a pair with the katana for the samurai. Together, the two swords were called daisho. The wakizashi was used for close combat, beheading defeated opponents and sometimes committing seppuku, which was a ritual suicide. I started working on it by practicing making knives on bad pieces of metal,

but only brought two of them to completion. I started working with better techniques and better steel, but then the coronavirus came along so I took a break from it to focus on building a forge at home. Next, we went to get materials at a place called Tucson Springs and they had some leaf spring steel than we needed to make blades easily. Leaf spring steel is a good metal to make blades out of because it is high in carbon but not very brittle. It was made this way because leaf spring steel is used for car shocks. I started it but then I saw it was starting to crack a little bit so I put it through some heat treatment. I pounded it flat, then I started to grind the blade out. After I finished the blade I worked on the tang of the blade, the part where the handle fits. Next I cut the wood out for the handle, I ground then sanded it until it was the right shape then I put it onto the tang. In the tree of blacksmithing, I have found the technique that I like best, it's the one I love, forging, specifically making blades. I have been practicing this because of the artistic project I have chosen, making a wakizashi.

Learning about the ancient art form of blacksmithing has been a great experience for me. It is fun and interesting taking a piece of solid metal and bending them to look the way I want. I now have the ability to make beautiful pieces of art, and I can make sharp lethal weapons. Now I can see the immense task that, from ancient times up to the Renaissance, blacksmiths had to accomplish. They made all the pieces of metal that everyone used in their daily life.

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Personal interview:

Grater, Steve. Blacksmith, Owner of The Village Blacksmith and Hessen Iron

Works

My mentor, meet every week since christmas break of 2020