Controlled Hand Forging Lesson 21

Forging a Square Punch and Drift

Text by Tal Harris
Drawings by Doug Wilson
Lesson #21.
Unit: Forging a Square Punch and Drift

Intent: The student will learn to forge a square punch and square drift. Heat treating the punch will be covered in a future lesson. These tools will be used in a to produce a 3/8" square hole in a piece of 3/8" x 1" flat stock.

Tools: Basic tools, including tongs to hold the piece being forged.

Materials:

For the punch- 3/4" square W-1 Tool Steel, six inches long. W-1 is a water hardening tool steel that is suitable for tools that come in contact with hot metal such as the subject application. W-1 is readily available in small quantities shippable by UPS. A tool properly made from this steel will last for many years.

For the drift- 3/8" square hot-rolled mild steel stock 2-3/4 inches long.

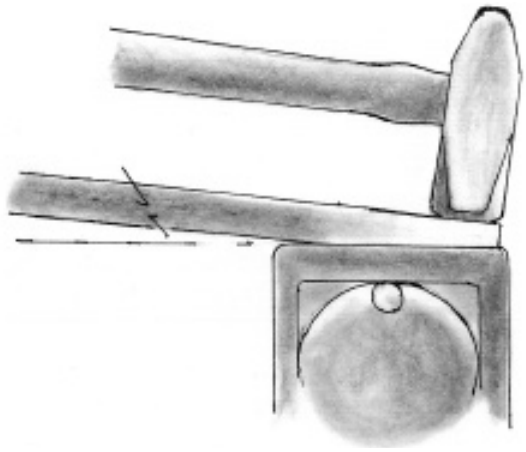
Forging a Punch Step 1

Forging the end of the punch that will be used to produce a hole.

To forge the end of the tool that will be used to punch a hole (hereafter called the "working end" of the tool), heat the end of the punch material to an orange-yellow heat and forge a taper three inches long.

Note: Tool steels typically are not forged as hot as mild steel. The alloying elements found in tool steels lower the melting point, thus the forging range. Overheated tool steel will generally fracture when forged, sometimes falling apart like cornbread. Ideally, tools should be forged in as few heats as possible to minimize decarburization or "decarb" for short. Decarb is the loss of carbon at the surface of the material due to carbon migrating from the high-carbon tool to the lesser-carbon atmosphere. Carbon is the key alloying element in W-1 that allows it to be hardened. Loss of carbon lessens the degree or surface hardness the material can attain. A coal fire minimizes this affect as the coal provides a carbon-rich atmosphere.

To forge the three-inch taper start at the tip and forge back up the bar. Start forging the taper at the end of the bar, holding the end of the material being forged near the far edge of the anvil. This will allow the taper to be forged without hitting the face of the anvil with the hammer.



1. Holding the material at an angle to produce the desired taper

To forge a taper that is centered, the material should be held at a 4-degree angle to the face of the anvil as represented in the drawing, with hammer blows being struck with the hammer face at an angle of 8 degrees to the hammer face. Forge to a square cross-section, rotating the bar 90 degrees back and forth between hammer blows. If the proper holding and hammer angle has been maintained, the taper should be centered. Once the end of the bar has

been reduced to 5/16" square, continue to forge up the bar three inches to complete the transition to the parent material. If more than one heat is required, be careful not to burn the material as the reduced section will heat quickly (you can tell you are burning the material because it will spark while in the fire).

The taper should make a smooth transition from the parent material to the end of the piece without any twist. W-1 is a tough material. With experience this taper should be able to be forged in three to four heats.

Step 2

To forge the striking end of the punch, follow the same directions for the working end, but the taper should be short, 1 inch long, tapering from the parent material to 5/8" square. The angle of the taper will be almost identical to the working end of the tool. As this taper is short, it can be forged entirely over the face of the anvil and should be able to be forged in one or two heats. Occasional hammer blows directed at the end of the punch, as if striking it during actual use, will keep the end flat so no filing is necessary to achieve the properly shaped tool.

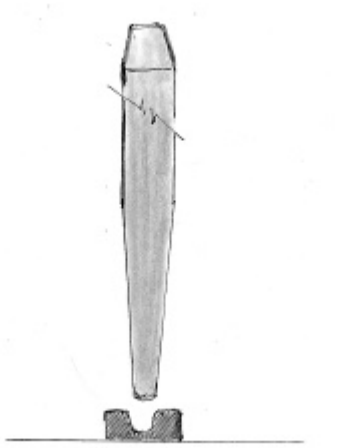
The purpose of this short taper is to delay the tendency of the striking end to "mushroom." It also helps to center the force of the blow during the hole-punching process.

Step 3

Once forged, it is best to anneal the tool to relieve forging stresses and soften it for any cold working operations such as filing. During forging, tools steels tend to get "uptight." Just as a person who gets uptight needs to relax before they "snap," the same is true for tool steel. One definition of annealing is "The heating of metal and then cooling it at a slow, consistent rate, thus reducing internal stress in the work piece and making it softer and easier to perform cold operations including filing."

In this example, to anneal the tool it should be heated uniformly to an orange heat and then buried in lime or wood ashes to allow it to cool slowly. For a tool of this size, the quantity of lime or ashes required is about a gallon. The intent is to surround the tool completely so it is thoroughly insulated. It will take several hours to cool, so don't be impatient and search for the tool with your hand as a severe burn could be experienced. If properly annealed, the tool should cut easily with a sharp file. If not, repeating the annealing process may be necessary.

Note: Forge scale can greatly reduce the life of a file. An easy way to remove this scale is to soak the piece overnight in vinegar. Vinegar contains acetic acid and will dissolve the scale.



2. "Drag" caused by a dull tool. Drag is the tendency to pull some of the surface of the steel down into the hole to be punched, rather than cutting cleanly.

Step 4

Once cooled (and only if necessary) file the ends of the tool to remove any unevenness from the forging. The working end of the tool should be square with sharp corners so it cuts its way through the material being punched. Important! Remember to file from the body of the tool towards the end to avoid getting cut on sharp edges of the tool. A tool that is not sharp

will result in a hole that has a reduced thickness around it due to the "drag" of the tool.

As W-1 is a tough steel, and mild steel heated properly to punch and drift a hole is very soft, this tool may be used successfully in the as-forged condition, i.e., not fully heat treated.

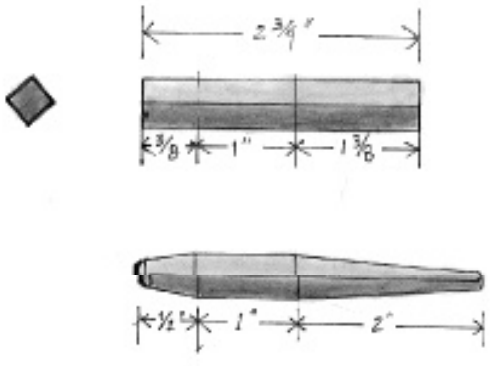
Note: The square section of the punch has several advantages. Since the tool was forged without twist, the end of the tool that produces the hole is aligned with the body of the tool. This makes placing the tool to produce a hole of desired orientation much easier, whether the tool is hand-held or held with tongs.

Also a tool forged from square stock will not roll off the anvil.

The tool described is intended to be used as a hand-held tool. As always, extreme caution should be exercised when using any hand-held tool. Remember that a misplaced blow places your hand between a hammer and a hot place. Often the material being punched will automatically lead us to whether a tool can be hand-held or should be held by some other means, such as tongs. Small-sized stock does not radiate as much heat as a larger piece and a punch can be held with a wet or Kevlar-gloved hand.

For hole punching heavier sections the use of a handled tool is required. One will also find that the force required to punch a hole in larger sections will tend to bend the punch if it is too long. A shorter punch directs more force to the working end of the tool, making the work more efficient. The short tool uses less of an expensive material and eliminates the problem of bending when using a heavy blow. Complete and proper use of the punch and drift will be covered in a future lesson.

Targets: -The tapered sections of the punch should be straight, centered and without twist.
-The faces of the taper should have no concavity or convexity.
-The long taper of the punch should have sharp corners as should the end of the punch that will produce a hole. This will allow the material to be sheared out cleanly when producing a hole.
-The taper on the striking end of the drift should be easily made in two heats. The opposite end should be able to be finished in three to four heats, the final heat being used to smooth and accurately center the taper.
-The length of the taper on the striking end of the punch is 1".
-The length of the taper of the working end is 3".
-The final length of the entire punch should be 7-3/8" and the working end of the tool 5/16" square.



3. Starting stock size and finished dimensions of the punch.

Forging a Drift:

Step 1

- Forging the Working End of the Drift:

Following the same steps as when forging the punch, heat the end of the drift material to a yellow heat and forge a two-inch long taper using the face of the anvil, tapering from the parent stock size to 1/4" square, with the taper

centered on the bar. 1-3/8 inches of 3/8" square material will be needed for this taper.
Note: The small end of the drift will need to be able to be placed in the hole produced by the punch. As before, if more than one heat is required, be careful not to burn the material as the reduced section will heat quickly. The taper should be even, centered and without twist. The long taper on this end of the drift, allows it to be easily driven into the hole being drifted. In actual use the end result will be a hole that has a nice bulge without the stock being reduced in thickness near the hole. Reduction in thickness near a punched hole is commonly referred to as “drag” and is affected by the taper of the end of the tool producing the effect. The shorter or more blunt the taper, the greater the drag. Alternatively, a longer and more gradual taper minimizes this effect.

Step 2

- Forging the Striking End of the Drift:

Follow the same directions for the working end. Important! The taper on the striking end must be longer than 3/8", the thickness of the material being drifted. Otherwise the drift cannot be driven through from one direction as it will get stuck in the hole being produced. A taper 1/2" long produced from 3/8" long of the starting stock will be correct for this tool.

As the drift is intended to be used only on hot material, it is not necessary that it be made from anything other than mild steel. If forged carefully, little or no filing will be necessary. Quenching mild steel from an orange heat will stiffen the drift and provide better service.

Note: The drift forged in this example will result in a hole that is slightly less than 3/8" square when the workpiece cooled. This is due to shrinkage that occurs between the time the hole is drifted and the piece cools. If a 3/8" square bar is to pass through the hole, then the drift material would need to be upset slightly prior to Step 1. To accomplish this, take a yellow heat on the starting material, stand it on end (vertically) on the anvil, holding it from the side with a pair of tongs. Strike a few light blows on the end of the material to increase its cross-section. Usually when the material has moved sufficiently to cause the scale to fall off, it is upset enough to allow a bar to pass through the hole.

Targets:

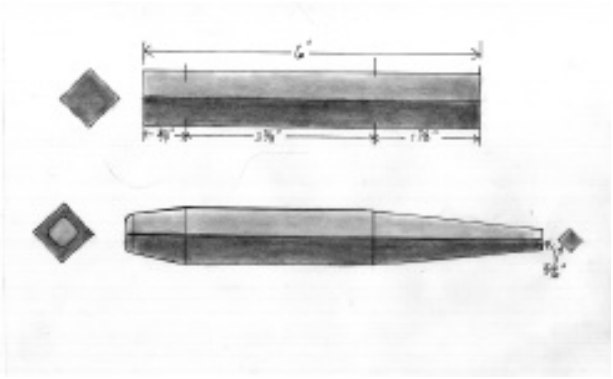
-The tapered sections of the drift should be straight, centered and without twist.

-The faces of the taper should have no concavity or convexity.

-The long taper of the drift should have sharp corners but the end geometry is not critical as long as it extends through the 3/8" thick bar when inserted into the hole. The aim dimension for this end of the drift is 1/4" square.

-The taper on the striking end of the drift should be easily made in one heat. The opposite end should be able to be finished in two heats, the second heat being used to smooth and accurately center the taper.

-The final length of the drift should be 2-1/2 inches

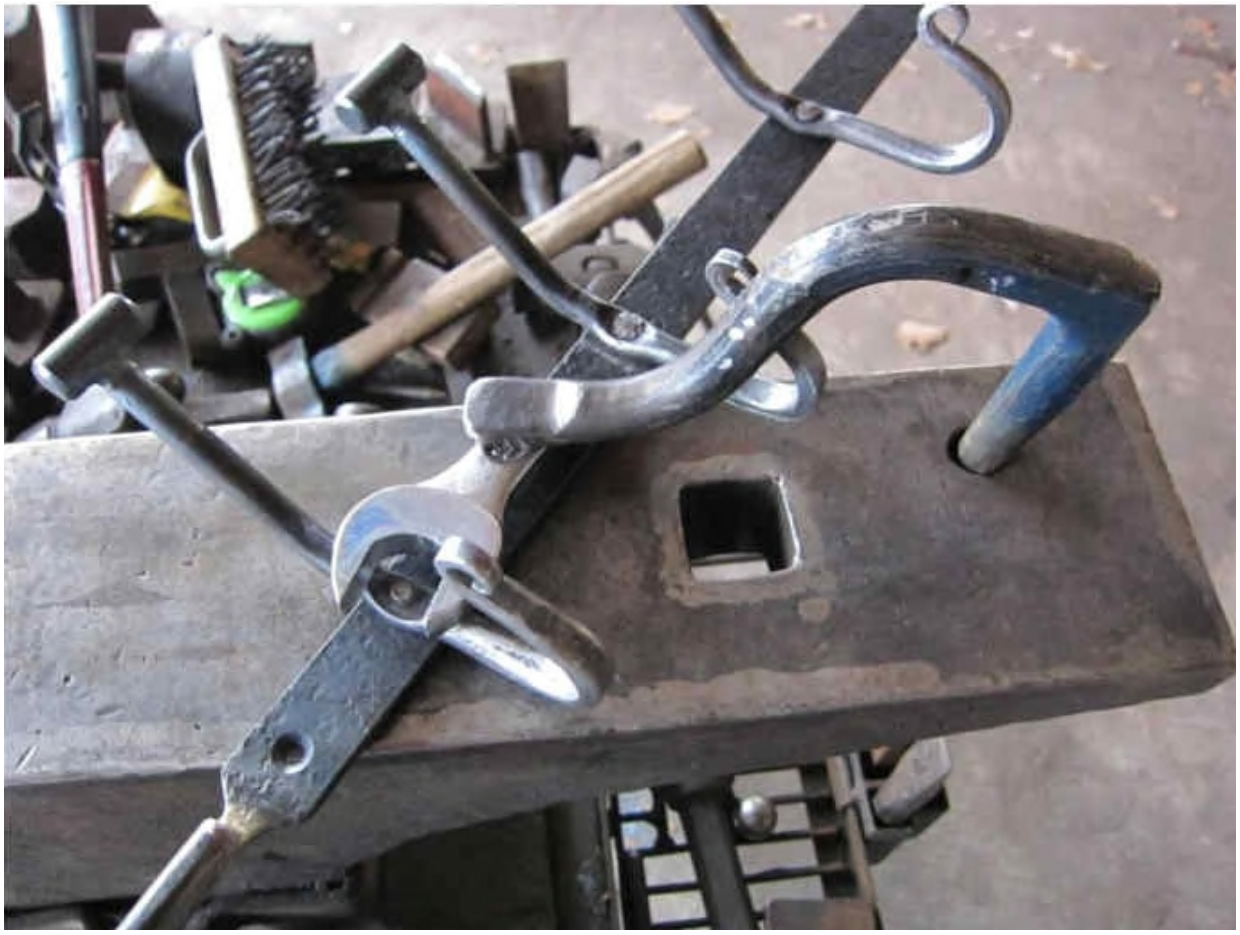


3. Starting stock size and finished dimensions of the drift.

Setting Rivets

By Jim Carothers 12/19/17

I do most of my blacksmithing by myself; some simple tools lend a third and often needed hand.
Holding pieces tightly together for riveting has been a challenge for me. In these photos you will see how an end cut off a wrench has become a tool for helping to set rivets. The open end wrench used with a hold fast keeps the joint tight while I set the rivet.



I learned how to make the holdfast by watching Peter Ross and Roy Underhill on the PBS series "the Woodwright's Shop".
That video is season 37 and titled "Forging The Holdfast".

http://www.pbs.org/video/forging-the-hold-fast-ut7ymw/

(Photos by Jim Carothers)

From the newsletter of the;
Saltfork Craftsmen Artist Blacksmith Association January 2018

Blinded By the Light

Be Careful How You Look

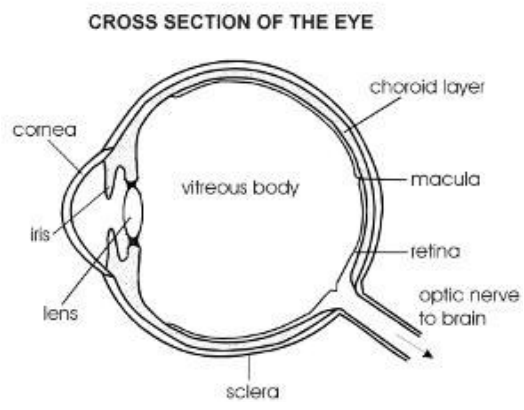
Bob Dixon Gumm

Shortly before the holidays, I was working on a welding project. The object that I was MIG welding had many prongs sticking out from it. While welding another prong, I noticed what appeared to be a weak weld. Lifting up my helmet, I poked my head in for a closer examination. What I failed to do was to move the MIG gun away from the project and rest it in the table holder. The outcome is easy to imagine. The gun was near my face, and as I got even closer to the weak spot, I accidently pushed the trigger against one of the prongs. This was followed by a bright flash, a very warm feeling against my eyes, and a wait of about five minutes before I could resume welding. Once the bright spot in my eyes had gone away, I thought everything was fine. I worked for another hour, ate a meal, and sat in front of the television to see, 'How the Grinch Stole Christmas'.

It was soon after when I felt that I had a small grain of sand in my left eye. I lifted my eyelid back, hoping that tearing would remove the grain. My eyes cried a river, but the irritant only seemed to grow larger and the pain more intense. It wasn't long before my right eye began to express its outrage over my failure to secure the MIG gun. Convinced that I had a flash burn, I went to the urgent care clinic. They confirmed this, and provided antibiotic ointment and an ophthalmologist appointment. After about a week, my eye felt as good as new. I was lucky.

Most of us have heard of flash burn. But what exactly is it? Flash burn can be thought of as sunburn in the eye. If you imagine yourself lying on a beach, you know that there are greater things to worry about than being chomped on by a shark. Sunglasses, sunblock, that bird doo looking stuff that lifeguards wear on their nose, and an umbrella all point to the greatest danger: sunlight. Sunlight is ultraviolet (UV) light, and UV risk comes to us in many different ways: sunlamps; nearby lightning flash; halogen lamps; reflection of sunlight off water and snow; and most important for us – any type of welding light, be it gas, SMAW, MIG, TIG, and forge. The latter causes are reason why the condition is known as 'welder's flash' or 'arc eye'.

A flash burn is a (painful) inflammation of the cornea. It produces a sensation similar to that of a corneal abrasion. But flash burn generally affects both eyes, though one eye usually is more irritated, whereas corneal abrasion takes usually occurs in one eye. The cornea is the clear tissue that covers the front of the eye. For our purposes, think of the cornea as the glass lens on the front of a camera. The cornea covers the iris (the colored part of the eye), focuses light on the retina, and protects deeper structures of the eye by acting like a windshield. Although the cornea is clear, it is consists of cells that are similar to those in the skin. If you've ever had sunburn that resulted in blistered or peeling skin, then imagine the damage that UV light can do to your eyes.



Bad news.
It hurts worse than it looks.

What do you do when you receive a flash burn? The first step is to make arrangements to get to a doctor or care center. You should never attempt to drive yourself there. In the interim, flushing your eyes with water provides some pain relief. Once your eyes have been attended to by a doctor, you must be vigilant about applying prescribed antibiotic drops or ointment to your eyes. You may also with to use OTC artificial tears, anti-inflammatory, and pain medications. Do not wear contacts lenses and do not apply topical anesthetics. They will only prolong the condition. It is important to wear sunglasses whenever you're outside, and if the doctor determines that you need to wear a patch, ask for one of the black, pirate looking ones. They're rather dashing.

If you've followed doctor's orders carefully and have refrained from the activity that caused your flash burn, you can expect the cornea to repair itself within a few days, and all irritation or discomfort to end within a week. Typically, flash burn usually heals without leaving a scar. More severe cases may take longer. Like the time in my Navy days when our ship was is in the shipyard. A young seaman who was having second thoughts about his enlistment was assigned as fire watch to a welding crew. While maintaining vigilance, it occurred to him that flash burn might just be his ticket out of the Navy. And so he stared at welding arcs. Instead of getting a pirate looking patch, as one expect for a sailor, the corps-men taped big wads of cotton and gauze on top of his eyes. So rather than Blackbeard or Barnacle Bill, the poor guy looked like a human fly. Whenever he was led past shipmates who were standing around with nothing much to do, they would yell, "Help me!," and then bust out laughing. Far be it from the Navy to provide no opportunity for fun. Several of his bunkmates waited through the night, and when they were certain he was asleep, took magic markers and drew owl eyes on his bandages. The crew thought it was a hoot!

For blacksmiths and welders, we know that working with hot metal is fraught with danger. We all fear the black hot burn that leaves an impression on our fingers of the thing we just picked up. Skin, like eyes, is an organ, but an organ with the capacity to replenish itself and go on working as if nothing happened. What's a little scar among blacksmiths, right? It may get you bragging rights or a ! cup of coffee. The eye, unfortunately, is not so capable. A severe flash burn can produce scarring, and this can obstruct vision to some degree. If the flash burn is not treated, an infection may start. This is as serious a matter as getting a shard or miniscule piece of metal stuck in your eye. If infection sets in and goes untreated, the result may be partial vision loss or a blind eye.

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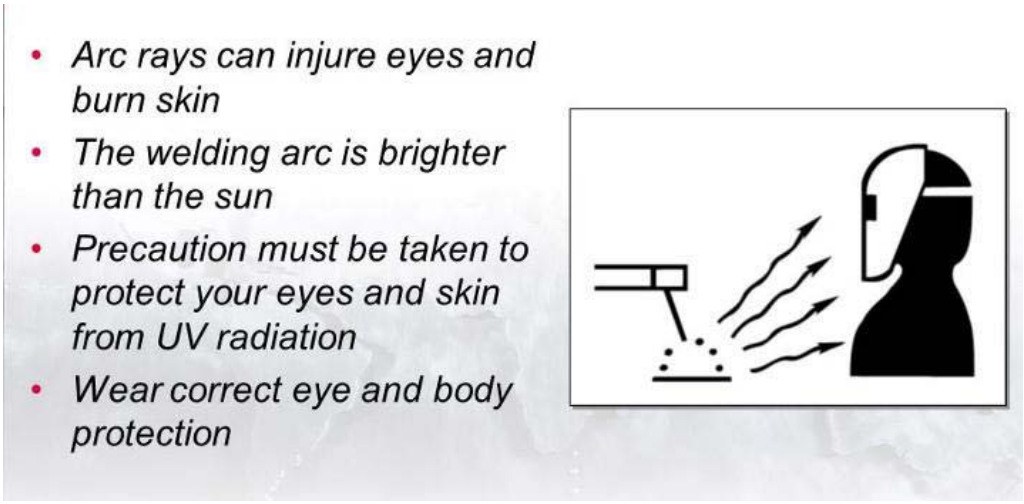

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The Ashokan campus is located in

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Contact : Tim Neu to register for hammer-ins or subscribe to the newsletter;
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For more information check the web site;
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