Blacksmithing Workshops and Classes:

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pv@warwick.net www.pvcrafts.org

Academy of Traditional Arts
Carrol County Farm Museum
500 South Center St. Westminster, MD 21157
(410)848-7775 (410)876-2667

Touchstone Center for Crafts
R.D.#1, Box 60, Farmington, PA 15437
(724)329-1370 Fax: (724)329-1371

John C Campbell Folk School
One Folk School Rd.
Brasstown, NC 28902
1-800-365-5724 www.folkschool.com

Open Forges

If any members have a forge at home and work in the evenings or weekends and want to open it up to help a few local guys, let me know, Larry Brown, editor, as we get requests from members who have a hard time traveling to some of the open forge locations.
Please contact, Larry Brown, Editor.
We want to encourage all to join us at:

Monday Night Open Forge in N.J.

Marshall Bienstock is hosting an open forge in his shop at 7 pm almost every Monday night (Please call ahead on holidays to make sure , (732-221-3015)

Open Forge in Long Island

Sunday from 10:00 am to 6pm.
Starting the 1st Sunday in November until the end of April. Please call ahead to confirm and get directions. Ron Grabowski, 110 Burlington Blvd. Smithtown, NY (631) 265-1564
Ronsforge@aol.com

In Southern NJ contact
Joshua Kuehne, 543 Amos Ave.
Vineland, NJ 08360
(856) 503-5297 iforgeiron88@yahoo.com

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jlfmib@optonline.net

John Chobrda, Dragon Run Forge
P.O. Box 315 Delaware City, DE, 19706
302-838-1960 jchob@verizon.net

Eric Cuper Artist Blacksmith
109 Lehman Lane, Neshanic Station, NJ 08853
908 642-6420 ericuper@msn.com

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In Northern Delaware and Southern NJ, contact Kerry Rhoades or John Chobrda
Kerry (302) 832-1631 John (302) 838-1960
(609) 610-3501 (cell)

Blacksmith Vise Improvement

by John Emmerling Gearhart Oregon

This great idea originated with Al Bakke of Saskatoon, Saskatchewan Canada. George Dunajski, of Los Gatos, saw it at CanIron this year and told us about it at Gary Gloyne's hammer-in at Mt. Shasta this August.

To make your blacksmith vise work 100% better (George says, "1000%"), simply replace the curved friction disc between the outboard vise jaw (1) and handle with a throw-out bearing (2 & 3). This improvement not only allows the lead screw to operate more smoothly, but also grips the work much tighter and releases easier.

To obtain the proper size bearing, take the friction disc to a bearing supply store and match the inside and outside diameter to that of a throw-out bearing. If your vise is like mine and does not have a friction disc, you may need to take the screw itself. (What I now miss is jumping up and putting my full weight on the screw handle to tighten the vise. -Ed.)

For more about John Emmerling, visit his website: www.gearhartironwerks.com. +

Major Alloying Elements in Steel

by Paul Mills, Victoria, Australia

While most of the work we do as decorative or artistic smiths is done in what we term mild steel, there are times when you need material with a special characteristic like hot hardness, increased tensile strength or toughness, such as when forging your own anvil or chasing tools. Generally speaking from that point on, you enter the world of alloy steels.

Alloy steels are those which contain appreciable quantities of one or more alloying element in addition to carbon. For instance, 1021 (mild steel) is a plain carbon steel; it is defined as such because it contains no significant amount of alloying elements other than carbon. One method of identifying steel is using S.A.E. codes. The S.A.E. (1021) number of the material shows the elements and their percentages. The first digit gives the controlling element. The second gives the percentage of the controlling element if an alloy steel and the last two digits give the percentage of carbon.

Therefore, 1021 is a plain carbon steel with 0.21% carbon. This is commonly referred to as mild steel.

Steel defined as S.A.E. 9172 contains silicon manganese at 1% with 0.72% carbon. This is an example of an alloy steel and is typically used as railhead.

You can use the S.A.E. Code Element Key below to establish the material specification, but from the blacksmiths point of view, the best way to identify the material is to use its chemical composition.

1 = Carbon; 2 = Nickel; 3 = Nickel Chromium; 4 = Molybdenum; 5 = Chromium; 6 = Chromium Vanadium; 7 = Tungsten; 8 = Nickel Chromium Molybdenum; 9 = Silicon Manganese.

To many, alloy steels are a mystery, but it's not really that hard once you know what you're dealing with.

If you have a specific requirement the job must fulfill, the easy way to get the correct material is to ring your local specialist steel supplier and talk to the experts. Tell them what you are making, how you intend to make it, and they'll be sure to send you in the right direction and give you a spec sheet for the steel supplied. That sheet will cover all manner of information about the material from typical application, chemical composition, temperatures for forging and heat treatment, machining, right down to its coefficient of thermal expansion.

While you may not think all of these things are important to you, they are important to the performance of steel. To get the most out of the material, you need to know these specifications; otherwise you're just playing with fire.

Carbon (C). Although it is not generally regarded as an alloying element, the effect it has on steel must be illustrated. It is the most important constituent of steel and as such has the strongest influence on its properties of hardness, strength and ductility. The progressive increasing addition of carbon to steel raises the hardness and wear resistance and lowers the melting point, ductility and weldability.

Nickel (Ni). Pure nickel is used as a corrosion resistant protective coating on wrought iron and steel and can be highly polished (nickel plating). When added to steel, nickel imparts strength and toughness without the loss of ductility and also increases resistance to shock and fatigue. Nickel is commonly found in case hardening steels, stainless and heat resisting steels.

Chromium (Cr). Pure chromium is a soft and ductile material, and can be used as a protective corrosion resistant coating on wrought iron and steel (chrome plating).
Chromium forms a carbide mixing with carbon and iron in the steel and imparts hardness and toughness. It greatly increases the resistance to wear and corrosion when present in amounts greater than 13%. It can be added to steel in varying percentages up to 35%.
A major effect of chromium is its ability to harden the steel to a greater depth than ordinary carbon steel. Chromium is the basic element in stainless, heat resisting and high speed steels.
Tungsten (W). Like chromium, tungsten is also a carbide forming element. It adds great strength, hardness and toughness to the steel. Tungsten is found in high speed steels.
Perhaps its best feature is the fact that it gives the steel greater stability at high temperature. This property is known as red-hardness, meaning that it does not lose its hardness even when red hot. Steels containing tungsten should never be quenched on water as it will cause them to split or break. Hardening is done with an air blast or in oil bath.

Alloying Elements

Molybdenum (Mo). The effect of molybdenum on steel can be characterized in much the same way as chromium (gives deep hardening properties) and tungsten (gives strength at high temperatures) it also improves hardenability, strength, toughness and corrosion resistance. Molybdenum when combined with chromium, nickel and vanadium is found in various hot die steels.
Vanadium (V). Added to alloy steels as a purifier and de-oxidizer to assist in the production of high quality steels, vanadium imparts great tensile strength and refines the grain structure of steel while increasing its resistance to fatigue. It is often found in high speed steels and high temperature steels. Vanadium is also found in spanners, springs and gears.
Manganese (Mn). Able to combine with sulphur to form manganese-sulphides, this element reduces the harmful effects of iron-sulphides in the steel, thus reducing red-shortness (brittleness) while increasing free cutting (machinability). When present in amounts from 7 to 15%, the steel will be very hard and very tough. In this range, steels with elevated carbon content are austenitic and as such are noted for their ability to work harden on the surface while the core remains tough. Manganese is found in work hardening steels such as train and tram line.
Silicon (Si). This non-metallic element is the main constituent of sand, quartz, opal, etc. Practically all steels contain silicon in some percentage. It is added as a de-oxidizer, and as an alloying element, is rarely used alone, being combined with other alloying elements such as chromium, manganese, molybdenum, etc. In combination with these elements, it adds strength and toughness. The addition of silicon greatly increases steel's elastic limit. When combined with manganese in amounts from 0.5 to 2%, they are generally referred to as spring steels which are used in all shapes and sizes of springs, from tiny volute springs to large leaf springs.

There is a host of other elements that are added to steel to impart this property or that or to control other elements, but this overview gives you a basic idea of the major elements and their effects on steel.

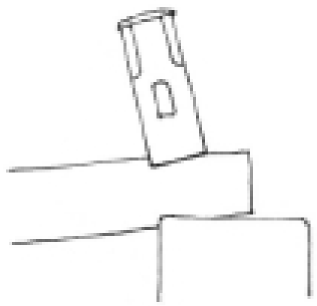
Anvil Bridge

by Tom Latane

An anvil bridge provides the acutely angled edge backed up by the mass of the anvil. I designed mine to have one edge beveled like the hatchet stake, one square edge, and a small spur with a longer taper. I considered making the spur a small square horn but thought that the thinner edge might be handier when this tool was in use.

We began with a piece of leaf spring three inches wide and a half-inch thick.

1. Using a set hammer over the edge of the anvil, we created shoulders establishing the top of the tenon.



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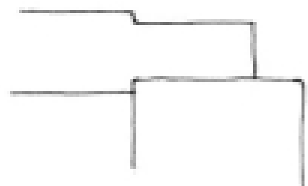

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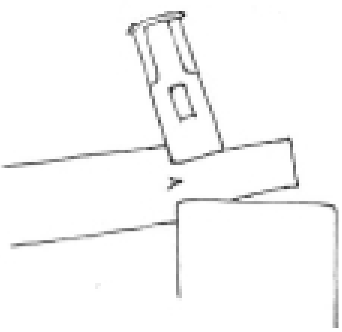

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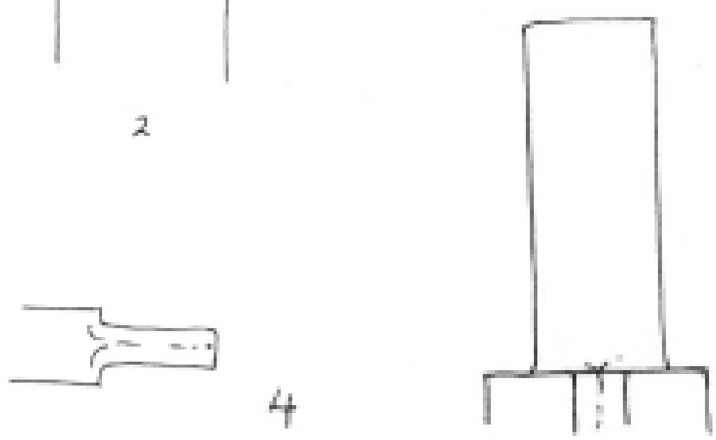

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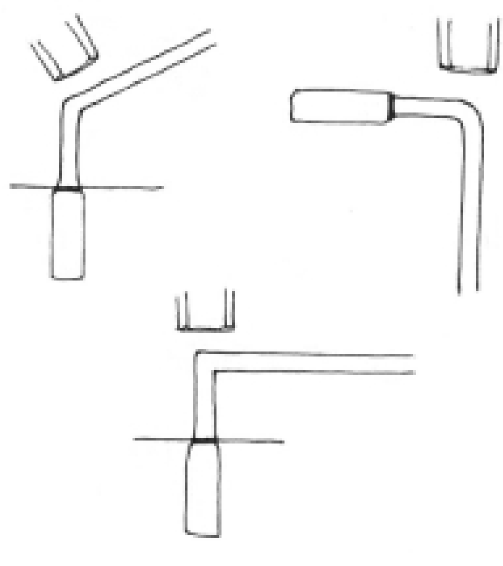
With the help of Louie Fisher, who works in my shop one afternoon a week, I recently made a tool for which I have felt a need for some time. The forging of hinges and other scrollwork with chisel- split branches has always been difficult. Using the edge of the anvil has meant spreading the split members ninety degrees apart for dressing, then working them back together at the desired angle. Working over a tinsmith's hatchet stake held horizontally in the vise always involved a lot of repositioning the stake after hammering.



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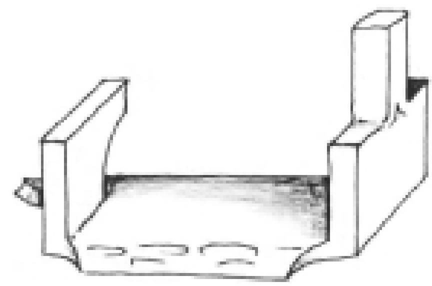
2. The remainder of the tenon was forged to the depth of the shoulder.

3. This was repeated several times until the width of the tenon had decreased to an inch and the thickness increased to an inch. Some upsetting can be done if the thickness does not increase enough. Longitudinal folds do not compromise the strength of the tenon.



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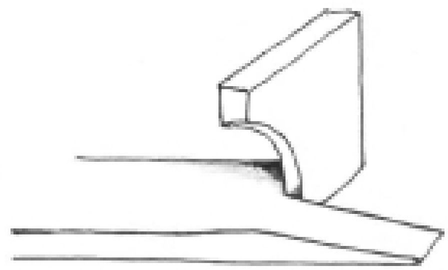
4. With the tenon fit to the hardy hole, the material was cut to a convenient length and the shoulders upset to seat well on the anvil face.

5. The next step was to forge a right angle bend, toward the horn, about 2 1/2" above the anvil surface.



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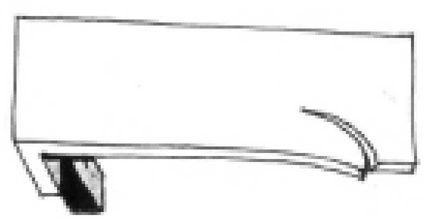
6. I marked a spot 2 1/2" from the far end and chisel cut the spur away from the side which would not be beveled. The spur was short leaving a full width at the end for the foot.

7. A second right angle bend was then formed leaving the spur material in the same plane as the bridge top. The foot was then upset or drawn out to create a level bridge top and solid contact for the foot.



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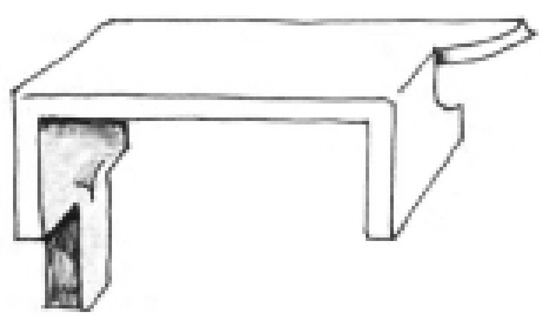
8. A cross pein hammer was used to draw out the edge of the bridge with as little gain as possible in length. A curve in the bridge top resulting from stretching of the beveled edge can be corrected by upsetting the beveled edge from the ends or drawing out the opposite edge.



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9. When the heavier forging was all done and the bridge was adjusted to sit solidly once again on the anvil face, the curved end of the spur was cut and it was forged to the desired taper. The bridge was not hardened or tempered.

METALSMITH Volume 34, No. 2, June 2010

WHY H13 IS A GREAT STEEL FOR A HOT CUT OR PUNCH

By David Brandow

To give credit where credit is due, the first time I heard this, it was at a demonstration Lloyd gave in Waldie's. At the time, while I deferred to Lloyd's experience and expertise and believed him, I didn't fully understand why it was true. As a result, I didn't try using H13 until fairly recently.

As time went by, though, I had heard other blacksmiths talk about different kinds of steel and I was lucky enough to win various pieces of 4140 and 4340 in some Iron-in-the- Hat draws, so it eventually sparked enough interest to do some reading about it. There are still a number of gaps in my knowledge but based on what I learned, I started with a thought experiment to determine what the best tool for hot work would be.

Normally, when you temper a tool, you bring the temperature up to the straw-purple range, which is somewhere in the 430 F to 520 F range, and lock it in by quenching in water or oil, depending on the steel (e.g. water for 1045, oil for 5160). Having done so, though, we then lay a piece of steel that's about 1900 F on it and hammer on that steel for a while, driving our carefully heattreated piece into it like a wedge. Or we might punch our carefully heat-treated tool into our very hot piece, surrounding it on all sides with that hot steel. As we do so, that 1900 F is bleeding into our tool. If our tool is well polished and we are paying attention, we might notice, from a distance, when it hits purple and have enough time to quench it. If not, it might turn blue, grey, red or even orange before we notice, ruining the temper. Knowing me, I'd probably quench it and keep using it anyway, but it's won't be very good. The edge will mush (deform) the first time I use it, and I'll have to continually grind it to reform the edge until I finally break down and heat treat it properly again.

The reason for this is that most of my tools were made out of car springs and the hardness of 5160 (car spring) when first quenched is 62, when tempered at 500 F is 57, but when brought to 1000 F it drops way down to 38. Similarly, 4140 and 4340 start at 56 and end up down at a hardness of 40 by the time you hit 800 F. So none of these tools are ideally suited for hot work, at least not unless you are scrupulous about cool them off between, and during, use.

H13, though, instead being tempering at around 500 F, is instead tempered at around 1000-1100 F, a dark red, where its hardness is still 54. Similarly, A2's hardness at 1000 F is 56 and S7's hardness at 1000 F is 51 (1000 F is where you'd want to stop with A2 and S7, though). That means that these steels can stand being brought pretty hot and still keep their temper, still be hard and resistant to deformation. You are far less likely to ruin them, although obviously you'll still want to be careful to cool the tool down between uses, particularly on the thin ends.

From this, we can see that steels like H13, A2 and S7 are the best candidates for hot tools. But heat resistance isn't the only category we want to measure. Our next consideration is toughness. A2 is only rated Fair on the toughness scale, and if I'm going to be beating on a tool with a hammer, I'm thinking it should be at least Good, so we can rule out A2. 4140 and 4340 are Good on the toughness scale, making them good for cold work, but they don't have enough temperature resistance for hot work, so we can rule them out. H13 and S7 are both rated Excellent on the toughness scale. H13 gives us better hardness at a higher temperature, so we'll give the nod to H13 as our winner.

Life rarely gives you anything for free, though, H13 does have a number of drawbacks. H13 is pretty expensive, hard to come by, and rates a Difficult on the formability scale. What is the formability scale? Again, I'm no expert, but from my experience, I think a better name would be the "you-have-to-beat-the crap- out-of-it-to-get-it-to-move" scale. H13, like S7, 1045 and 4140, only rate a Fair on the weldability scale. You can't use the magnet test when hardening H13, its hardening temperature is way up at almost yellow, at 1850 F, so you need to do that by eye or, better yet, with temple sticks (S7 hardens around orange—light orange; 4140, 4340 and 5160 are around light cherry-light red). Finally, H13, like S7, is an air hardening steel, so you can't quickly quench it when it does start to get hot.

Despite those disadvantages, though, this thought experiment turns out to be true in reality. I ran across a bar of H13, made some tools out of it, I have found H13 to be the best steel I have used for hot work. That's not to say that other steels can't be used and work just fine, it's just that H13 seems to work better. So yes, the short version of the story is that I should have just listened to Lloyd.

THE IRON TRILLIUM
FALL 2012

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Northeast Blacksmiths holds its meets twice a year at the Ashokan Field Campus in New York State.
The Ashokan campus is located in Olivebridge, N.Y., several miles west of Kingston, N.Y. The meets are held the first weekend in May and in the first weekend in October every year. The main demonstration is in the blacksmith shop and there is a "Hands On" workshop for beginners. A main demonstrator is brought in for each meet, food and bunk-house style lodging are provided as part of the cost of the weekend long meet.

Contact : Tim Neu
to register for hammer-ins
or subscribe to the newsletter;
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