Rocky Forge News

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Next Meeting (2/14/2015)

What a winter, snow, cold, wind, illness, politicians and the groundhog saw his shadow. But remember, this is Indiana. I used to walk to and from grade school and it was uphill both ways and the snow was over the fences, so those cold winters have been around for a while.

Anyway, I sure hope you are all okay and ready to meet on Saturday, February 14th with coffee and doughnuts ready by 8:30 AM. Since that is Valentine's Day we probably should make some hearts or something for our sweethearts. Do some INTERNET research regarding blacksmith items for Valentine's Day and bring the info to the meeting to share with each other. Also, we have the unfinished sunflowers to work on. Depending on the weather we can work at the forges inside and outside. Several members have expressed excitement about getting together again and starting a new year of forging challenges.

Carol is going to buy a ham for lunch so bring pitch-in items to pass around for the lunch. Lunch is always a fun time to talk amongst ourselves and trade stories. I for one am looking forward to the time together. Bring your favorite hand tools to work with and items for the Iron-in-the-Hat.

See you on Saturday. Ted

Heat Treating an Unknown Metal

By Dominick Andrisani

On February 7, I went to the Rural Smiths of Mid-America meeting at Conner Prairie to watch Nathan Allen give several terrific demonstrations. One demonstration involved experimenting with an unknown steel to determine how best to heat-treat (temper) that metal and then heat-treating a hammerhead. What follows is my recollection of Nathan's procedure. Please note that this is a simplified blacksmith's approach to a complex metallurgical problem, and there are certainly other and perhaps better ways to do this. Also, please be careful when quenching since either flames or steam are possible, even likely. Always wear eye protection.

Question 1: What do I know about the unknown steel?

There may be something that you know (or suspect) about the metal, e.g., is it spring steel, or was it used as an automotive axle. You may be able to find some information on the INTERNET about the composition and heat-treat properties of that metal. This information might be helpful in guiding the following experiments. There is a useful chart called Junkyard Steels that is a good starting point.

Question 2: What is the heat color corresponding to the critical temperature of the steel?

The critical temperature is the temperature at which the unknown steel becomes non-magnetic. Put the unknown steel in the fire and get it uniformly yellow-hot. At a yellow heat the unknown steel should be non-magnetic. Put your magnet on a non-metallic surface like a brick. Take the unknown steel out of the fire and let it slowly cool while periodically touching it to the magnet. Observe the coolest heat color at which it remains non-magnetic. We will use this heat color often in the heat-treating process as our way of knowing that the metal is at or above the critical temperature. For the unknown steel Nathan used the heat color for non-magnetic was "red going into orange".

2000°F	Bright yellow
1900°F	Dark yellow
1800°F	Orange yellow
1700°F	Orange
1600°F	Orange red
1500°F	Bright red
1400°F	Red
1300°F	Medium red
1200°F	Dull red
1100°F	Slight red
1000°F	Very slight red, mostly grey
0800°F	Dark grey

Question 3: Does the metal require an oil quench or a water quench?

First we will assume that the unknown steel requires an oil quench so get your bucket of quenching oil with metal lid. Bring the unknown metal to critical temperature (e.g., "red going into orange"). Do this slowly so that the metal is uniformly hot throughout the piece and do not go to a temperature (or color) any hotter than needed. Quench in the oil. Make sure the oil does not catch fire. If it does, put the fire out with the lid. If you can't quench in oil without flames, you probably need an oil bath with more oil and you need to move the hot metal around vigorously in the oil so that the oil touching the hot metal does not get so hot that it burns.

With the metal quenched, take a sharp file and apply it to the unknown metal. You are hoping for the file to skate over the metal without cutting. This would indicate that the metal has been fully hardened. If the file skates over the unknown metal without cutting, then the unknown metal requires an oil quench. If the file cuts, then the unknown metal probably requires a water quench to get it harder.

For the sample piece Nathan was using the file was digging into the metal slightly and he concluded that the unknown steel probably required a water quench.

To test for the need for a water quench we repeat the process with water. Bring the unknown metal to critical temperature (e.g., "red going into orange") and quench in the water bucket. Move the unknown metal around in the water vigorously so that no steam is produced while the metal cools. When cool, take your file and see if the file skates without cutting or digs in and cuts. If the file skates without cutting, then the metal is fully hardened, and we can conclude that metal requires a water quench.

For the sample piece Nathan was using the file skated without cutting and he confirmed that the unknown steel probably required a water quench.

Question 4: What temper color should I use?

When you have a piece of steel in the quenched state (fully hardened) do not leave the metal this way for long. It is very brittle and can easily crack.

To determine the temper color to use, polish a portion of the fully hardened metal with sand paper. Slowly heat the entire piece of metal until the temper colors begin to form. When you see the straw color develop, test the metal with a file to see if the file now cuts. If not, you may have to temper to a higher temperature. High carbon steel will likely require tempering to a color hotter than straw.

0575°F	Blue
0540°F	Dark Purple
0520°F	Purple
0500°F	Brown/Purple
0480°F	Brown
0465°F	Dark Straw
0445°F	Light Straw
0390°F	Faint Straw

Question 5: How do I get the metal up to tempering temperature?

You can temper metal in a kitchen oven or toaster oven. For example you can start with the oven set at 300 degrees F and wait for an hour for the metal to get up to temperature. Or you can use a torch on the thickest part of the metal to slowly get the temperature up to tempering temperature.

Nathan tempered a hammerhead by placing a firebrick on the anvil, placing a yellow-hot block of metal on the firebrick and then placing the hammerhead on top of the yellow-hot block. He periodically rotated the hammerhead to ensure even heating. He watched the temper colors develop in the polished portion of the hammerhead. For the hammerhead, Nathan tempered to the straw color. To test the tempering, he used a file on the face of the hammer to insure that the file cut the steel. If the file skated, he would have put the hammerhead back on the yellow-hot block and made the hammerhead hotter as judged by the temper color.

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Web Site: http://www.rockyforge.org/ (previous newsletters can be found here).

Dates to Remember

February 14, 2015: Rocky Forge meeting at Ted's shop.
March 14, 2015: Rocky Forge meeting at Ted's shop.

June 5-7, 2015: IBA Conference, Tipton, IN