Balcones Forge Dispatch

President's Corner

May 2023

Greetings,

Wow! We had a great turnout for the April meeting. I was equally pleased to see some folks we hadn't seen in quite some time as well as all the new members. Mr. Bellows drew a good crowd and put on a good demo.

The May meeting is coming right up. It will be at the Old Settlers Association in Round Rock on the 6th for their Pioneer Days. The address is 3300 East Palm Valley Blvd, Round Rock, TX, 78665. This will be a demo for the public. We will have some members bringing forges and anvils. If you have a portable coal forge and anvil, you are welcome to bring them or just help with set up.

We had some really nice coal rakes entered for the April trade item; 6 in total. I was grateful to be voted the winner. To keep the forge tool theme going, the May trade item is a watering can for the forge. Remember you have to make one to take one.

Aaron

Arron Tilton
Balcones Forge President

Meeting is on May 6

Start time is 9:30

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Jerry Achterberg (left) models the trivet made by Roy Bellows (right).

photos by Tim Tellander

Upcoming Meetings

May: 6 Old Settlers Park, Round Rock, TX
June 24: Pioneer Farms in Austin

More info in the two Balcones Forge Facebook pages. (You can check out the posts without having a Facebook account.)

https://www.facebook.com/BFCTB/
https://www.facebook.com/groups/688735415468063

Substitute Secretary's April Meeting notes

Our Balcones Forge meeting was held at The Museum of Handmade Texas Furniture April 15 – 16, and our guest demonstrator was Mr. Roy Bellows from Buda, Texas. Roy studied drawing and painting with Warren Hunter at La Villita in San Antonio, and completed his formal education with a Bachelor of Arts degree from University of Chicago. Turley Forge School of Blacksmithing in Santa Fe, New Mexico was the next step in rounding off formalities in 1974. Roy is a member of ABANA & Balcones Forge.

An interesting highlight in his career was filmed and aired by Texas Country Reporter in 2022 as he made a bed of nails, then promptly proved it a bed by getting on top of it. Today he was going to demonstrate the mortise & tenon method of blacksmithing utilizing one inch square steel. This method is stronger than welding or riveting and related to the group how well a chair he had done with this method, complete with woven steel seat survived the fall of a huge hackberry tree during a storm.

Shane Tilton cut 22 inch lengths of the square stock while Aaron and Randy got the forge hot along with the help of Caleb Berry & Thomas Dagett. In the photos on page 2 is a round 3 legged stove trivet that Roy built utilizing the mortise & tenon joinery method. Roy stressed that blacksmith demonstrations are a perfect opportunity for education but demand total awareness and constant visualization by the instructor.

By showing and explaining to the crowd each step of the process, it soon became evident how it was all coming together. The sun, however, soon started thinning the crowd and the lack of any shade made it very difficult and unnecessary for Roy to continue to swing the hammer so Joe Session & Brandon Rodgers took that part over & Roy talked them through the remaining joinery process (see photo).

I counted about 28 Balcones and their was a constant flow of onlookers from the general crowd. We were also graced with a host of occasional and seldom seen members which confirmed Roy Bellow's impressive status in the blacksmithing community.

Thank you Lance, for asking me to take notes in your absence.

Tim Tellander

Trade Item Details

For May, the trade item is a watering can to use at the forge! To participate, simply make the item chosen for the month. Sometimes there are detailed instructions and sometimes you get to make what ever your imagination tells you. Bring it to the meeting, participate in the trade and you will walk away with another smith's version of the item.

Remember, you gotta make one to take one!

Museum of Texas Handmade Furniture
April 15, 2023
Demonstration by Roy Bellows
www.BalconesForge.org

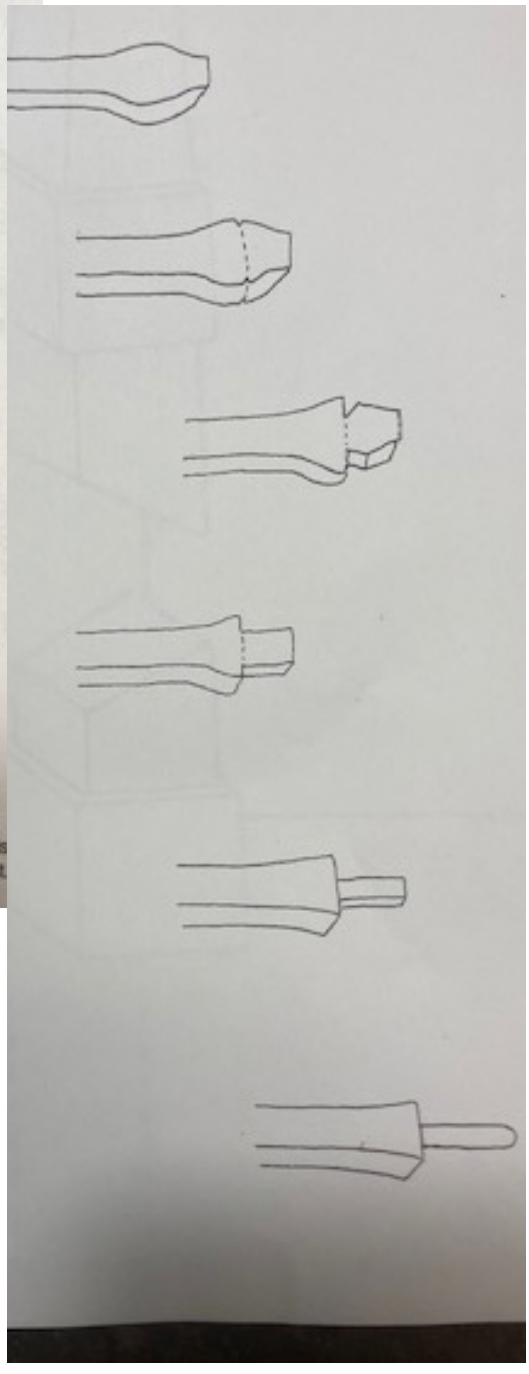
This armchair is held together with eight tenons and four collars.

The top rail to a massive garden gate I created 35 years ago. All the vertical stiles are tenoned at the top and bottom.

The handrail is at the entrance to the Vereinskirche in Fredericksburg at the center of Market Square. There are six tenoned connections holding this short rail together.

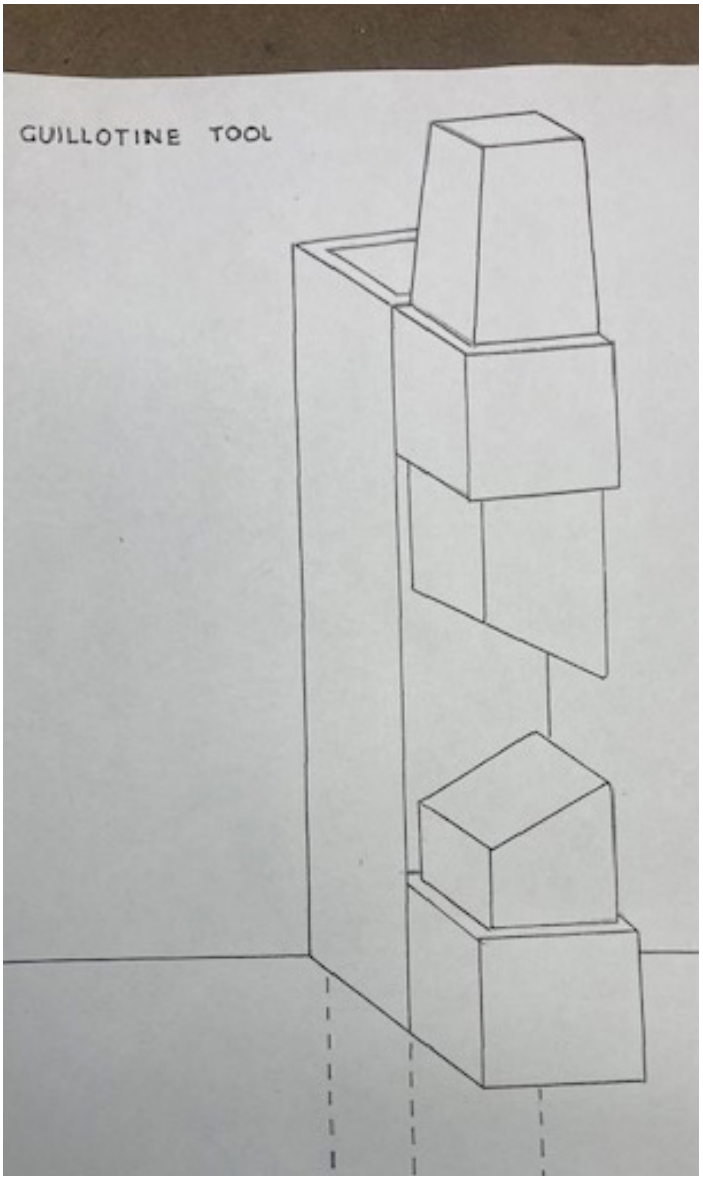
The Andiron has only one 1" tenon to hold itself together as well as all the weight of the logs, but it is stronger than any weld and is more resistant to rust.

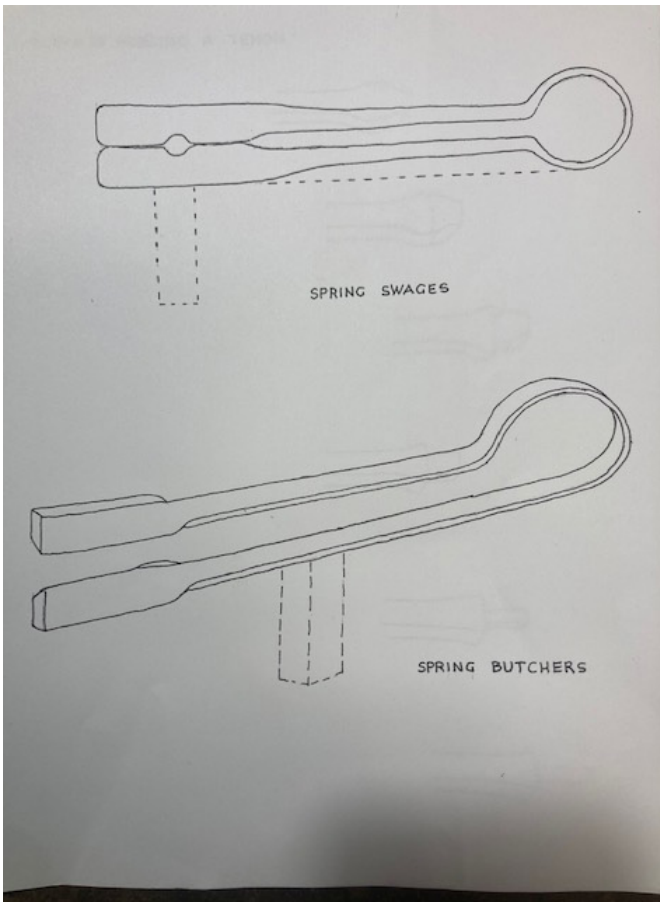
Steps in forging a tenon



The trade item entries from April

photos by Tim Tellander





A Broad Overview of Heat Treating

Heat treating is a multi-step operation, though not every step is necessary for every heat treatment. The four steps of heat treatment are:

Annealing
Normalizing
Hardening
Tempering

ANNEALING – heating to just above 'critical', or phase change temperature, the point at which the steel becomes non-magnetic, then putting the steel in an insulating material like hardwood ashes or vermiculite so that it cools slowly. This will make the steel as soft as it is possible for it to be when it cools.

It is not necessary to anneal a steel before forging, as being at forging temperatures makes all steels soft and removes all previous heat treatment. You anneal so the steel will be as soft as possible while you do cold work on it, like drilling holes or filing.

NORMALIZING – heating steel to a temperature about 100 to 150 degrees above 'critical' temperature and cooling in air to black heat, that is, until it loses all incandescent color. This allows the carbides to evenly distribute throughout the steel and normalize (make uniform) the grain size.

Since most smiths have no accurate way to measure temps to '100 to 150 degrees above critical', it is typically heated to just above non-magnetic for normalization, usually to good effect.

Normalizing is only one cycle, done once, and is followed by grain refinement cycles, which are a slightly lower temp each succeeding cycle. People refer to this whole process as normalizing, but normalizing actually grows grain slightly while evenly distributing carbides. It's then followed by 2-4 grain refinement cycles.

HARDENING – In order for a steel to be hardened, it must have enough carbon. How much is "enough" depends on what you want a tool made of that steel to do. The lower the amount of carbon in the steel, the less hard it can be made.

You achieve hardness by heating the steel to just above 'critical', or phase change temperature, then cooling it suddenly in an appropriate quench medium, which may be different from one type of steel to the next, or one cross section (shape) to the next. This causes the steel to be as hard as it can be, but for most steels it introduces a certain amount of brittleness. How much brittleness depends on the amount of carbon in the steel, the cross section of the steel, and what alloying elements are in it. Carbon is the dominant factor in deciding how hard a certain steel can get. Different cross sections of steel can have hardenability dramatically affected by other alloying elements.

Things like chrome, nickel, vanadium, etc., increase hardenability, meaning the steel will harden with a slower quench. This is important because thicker steel cools more slowly. Not just the inside, which is obvious, but also the surface because it is receiving heat from the hot interior. A steel that will fully harden in water when it is 1/8" thick won't do that if it's 4" thick - unless it is alloyed for high hardenability.

'Quench' simply means to cool rapidly. In metalwork, each steel has an optimum cooling rate for hardening, and therefore an optimum quenching medium. Oil quenches more slowly than water, water quenches more slowly than brine. Quenching is part of hardening, but the terms are not interchangeable.

TEMPERING - Tempering takes a hardened piece and reheats it to some specific temperature to reduce brittleness and increase toughness. The necessary temperature is determined by the type of steel and the specific use for the implement made of that steel. A straight razor will have a different tempering temperature than a spring made of the same steel.

One thing: redraw (temper) pretty much IMMEDIATELY after the quench, lest the internal stresses lead to cracking of the hard, but brittle steel.

Exceptions to this are if the particular steel calls for a period to "rest" prior to redraw. Not likely you will encounter such a steel, but there are some very unusual alloys that have unusual heat treat requirements.

Temper colors are caused by oxidation of clean steel surfaces at specific temperatures. What color you get is dependent on the temperature your steel reaches...IF IT GETS UP TO TEMP QUICKLY. That causes the oxide layer to form and get thicker quickly, so in SOME circumstances the color is a helpful guide to estimating tempering temperatures.

The problem with depending on that is that a number of things affect those tempering colors; any residual oil on the steel surface will change the color of the oxide, as will lengthy heating cycles. Left at a specific temperature for long enough, a steel can run through ALL the 'tempering' oxide colors, even though the steel may never reach the temperature associated with a particular tempering color from a short heat cycle. , simply because it stayed hot long enough for the oxide layer to thicken. So TEMPERING is about TEMPERATURE, not color.

The other issue is that home cooking ovens DO fluctuate in temperature. On top of that, the temp that your oven dial indicates may not accurately reflect the actual temp your oven reaches. Your oven cycles. It gets up to temp, then cycles off until the temp drops below a certain point, then it heats up again, just like your home furnace in wintertime.

What I do to address the cycling is to buy 3 oven thermometers (usually around $10 each at the grocery store) and put them in the oven and set it for 400 degrees (as an example). When the oven says it has reached 400, I check the thermometers to see if they agree with that temp. If they do, you can be fairly confident that your oven dial is accurate.

Since the oven thermometers can sometimes be inaccurate due to rough handling in the store, I look for any two that agree. If two agree, but are different from the oven dial, then calculate the difference between the dial reading and the thermometer reading so you know where to set the dial to get the actual temp that you want.

Since the oven cycles, but I want a blade, or hammer, or any other tool to remain as close to the desired temp as possible, I bury the steel in a cheap pan full of clean sand and put it in the oven. The sand will heat up with the oven, and your steel, but will cool down more slowly than the oven when it cycles, so it moderates the temperature. So long as the oven doesn't go OVER the temp it's set for, you won't ruin the temper of your steel, no matter how long it's in there.

Written by Kirk Sullens
Henry Vila
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QUENCHING
From Austin Hillrichs, with credits to Henry Vila

Rule of thumb:
Fast oil <10 seconds for Wx, 10xx, etc
Medium speed oil 10-14 seconds for 5160, 80CrV2, etc
Slow oil 14-18 seconds for O1, etc.

You need to use an oil that matches the quench speed of the steel. For example: for 10xx steels you need Parks50 to quench the steel from critical to 800F in 1 second or less, for 5160 you need an oil that does this in 5-6 seconds, and for O1 10 seconds. Too slow and you don't get maximum martensite conversion. Too fast will get you maximum martensite conversion but you'll also get either surface cracks or micro fractures in the steel or both.

And let's not forget that certain steels require air quenching, or plate quenching or salt baths, etc.

So when someone asks "what oil should I use for quenching?" you also need to tell us what steel are you quenching.

One thing to point out that might not be obvious or maybe confusing to a new smith is that steels need to be quenched to below the pearlite nose in a specific amount of time. For example:

Wx and 10xx in <1 second
5160 in 5 seconds
O1 in 10 seconds

But quenchants are measured as the time it takes to cool a nickel ball from 1625F to 670F (These numbers I pulled off the web and not all have been verified):

Brine: ~4-6 seconds
Water: ~5-6 seconds
Parks 50: 7-9 seconds
50 Quench Oil: 7-9 seconds
Houghtoquench K: 7-9 seconds
Duratherm 48: 7-9 seconds
Parks AAA: 9-11 seconds
Duratherm Superquench 70: 10 seconds
Chevron Quench 70: 10 seconds
130F canola: ~10-11 seconds
Duratherm G: 10-12 seconds
Houghton Quench G: 10-12 seconds
Gulf Super Quench 70: 10-12 seconds
Gloc Quench A: 10-12 seconds
McMaster Quench Fast: 11 seconds
Citgo Quench Oil 0510: 14.5 seconds
Citgo Quenchol 521: 16.1 seconds
Citgo Quenchol 624: 17.0 seconds
Mcmaster Quenchall: 28 seconds

May Meeting Directions

The May meeting of Balcones Forge will be at the Old Settlers Park.

3300 East Palm Valley Blvd, Round Rock, TX, 78665

To get to Old Settlers Park, go East on Highway 79 (from I-35) for approximately four miles. The park will be on the North side. Look for the Salt Lick BBQ and turn left on Harrell Parkway.

Remember, Google Maps is your friend!

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