

THE MOSTLY MONTHLY NEWSLETTER OF THE

∞ EUGENE 5160 CLUB ~ SEPTEMBER 2014 ∞
DOUBLE FEATURE EDITION



DOUBLE FEATURE

Yezzir yezzir – step right up! 2 for the price of 1:

ABSOLUTELY FREE!!

Since I was too lazy and/or busy last month (your choice) this month's newsletter has notes and photos from both the July and August 5160 Club meetings.

In July **CHUCK RICHARDS** of Woodchuck Forge: <http://acrichardscustomknives.com/> dropped in to share some of his work – and remind folks that Knife Rights was looking for a qualified bladesmith to lead a forging session at the November NASC conference near Bend. I understand from Doug Ritter that they now have it covered.

In August **RAY RICHARD** of Hawk'n'Knives/Off Beat Forge: <http://www.hawknknives.com/> shared his work and insights.

So welcome to the Richards/Richard edition - we had a couple of **GREAT** meetings!



SEPTEMBER MEETING

The 5160 Club will meet at Woodcraft of Eugene in the Delta Oaks shopping center – Beltline & Delta Hwy. Thursday September 4th at 6:00 pm. On top of the usual pass-arounds and show-n-tell we'll have Cody – from Darex – here to demo their Work Sharp Ken Onion Knife & Tool sharpener. It'll be fun to see him put it through its paces – and Joe Essen let me know that Woodcraft will have a special going on the sharpeners for club night only!



JULY MEETING

I (Michael Kemp) kicked off the meeting by sharing a recent failure. I made my 2nd attempt at a “jester's shoe” chef knife from cable – but neglected to TEST the cable for hardenability first. So I have a nice metal template for the 3rd attempt – made from mild steel cable Damascus – with heat treat scale:



CHUCK RICHARDS was our special guest at the July meeting. “About 10 years ago I went to the scrap yard – asked the guy if he had any springs laying around. He hauled this thing out. It's a D9 Cat spring – weighed 350 pounds.” Chuck cut it up and has been lugging it around – that's a chunk of it in his hand. He's made some pieces from it but it has a lot of micro cracks in it. He uses that steel mainly for hammers and tools. He's also got about 200 pounds of D8 Cat spring (slightly smaller diameter) that's in good shape. This hatchet is from the D8 spring:



Chuck sent a sample of each spring to Fastenal (in Winona, Minnesota) for analysis - \$40 apiece – so for \$80 he knows exactly what he's got in the 500

pounds of steel. They are very close to 5160 steel with some more trace elements.

Chuck talked some about discovering the micro-cracks in the D9 spring. He made a knife in it and only in the final polish did the spiderweb of crack lines appear. So now he uses that steel when he needs to make a set of tongs or some such.

“That's the problem with found steel. You just don't know what it's been through.” Another junkyard find was a 6' bin full of 52100 (marked as such by a foundry sticker) in bars 4-1/2” to 6-1/2” in diameter 3' to 4' long. So he bought two bars of each. Chuck cuts them down to manageable pieces before forging.

Chuck mentioned that higher alloy steel is prone to cracking during forging if you get out of it's heat zone – that's happened to him with both O1 and L6.

In response to questions from the floor he said he uses a power hammer and a press, and it takes about 4 hours to turn a chunk of the spring steel into a hatchet. Mainly using the press.

The press is a 4 post, 50 ton job – modified to suit his style of forging. Weighing in at 3,600 pounds. That allows him to work Damascus billets weighing 20 to 30 pounds.

Chuck does most of his Damascus dry welding in a steel box or he'll weld on sides. With the cable he adds powdered steel in the box to fill the voids. That gets the first weld, then grind off the box and if it's getting re-stacked and re-welded, weld the seams.

He doesn't worry about putting anything in the box to burn off the atmosphere: “there's enough oil and grease just from handling it to burn off any atmosphere in the box.”

“I tried the kerosene soak – a couple of pinholes. I had 4' flames coming out my forge! Like a jet engine going off in my forge. So I don't do the kerosene soak anymore.” *Just so you folks that weren't there know: Chuck has a great deadpan delivery!*

Wayne Goddard asked about people not using borax flux anymore – just soaking in kerosene.

“I've seen somebody do it. Not with cable. Just

kerosene. They call it hydrocarbon flux.” Said Chuck. “Now there doing it with no flux. Just controlling the atmosphere. As long as you don't take any shortcuts. With me I've gone from about a 90% success rate to 99% [with no flux welding]. It takes a little longer but it makes a big difference in the end.”

Someone asked what the shortcuts are that need to be avoided for dry welding.

“Make sure you've got good clean mating surfaces. Not a lot of bumps and things like that. I actually mill off the edges, and if I really want a perfect weld I surface grind. It's a lot of extra work, but I've got a billet that weighs 30 pounds. By the time I'm done it'll probably weigh 15, but I've got 100% in there rather than getting a 90% where I've got to throw away a 15 pound billet.”

“With a Damascus knife you can't tell you've got a flaw sometimes until you're finishing... I've got a box full of that stuff.”

The question was posed about press dies with detailed shapes getting overheated and deforming. Chuck said he doesn't try to do that type of work on the press. He may broach a hole (enlarge or shape a hole that was pre-drilled in the steel) on the press, but not use detail dies.

“Most of my regular dies are just mild steel.”

Chuck then put in a plug for someone to lead a forging workshop at the NASC conference. He had agreed to do it, but then figured out that this is when his daughter is due so had to decline. *As I noted above, Doug Ritter has notified me that they have this covered.*

For a look at Chuck Richards' work, look here: <http://acrichardscustomknives.com/gallery.html>

MARTIN BRANDT was next up.

“The main gist of what I want to talk about is edge geometry.” He said – holding up a hot cut and cold cut chisel. The hot cut being a narrower angle. “I've been seeing a fair amount of knives come through here lately that look more



like this one [the cold cut, wider angle chisel]... and not to knock anyone's first time efforts... I will bear my wretched soul...” with which he shared the first knife he put a set of scales on, and a couple of other pieces that he feels could have more refined fit and finish.

Here's a couple of the pieces Martin shared:



“I took a jewelry class with a really good instructor. He'd come over to me and say 'That's nice Martin but when are you going to finish it?’”

Craig Morgan chimed in “You'd walk through a show with Bob Lum... pick up a knife and ask 'What do you think of this?' and Bob would say 'Not bad, another couple of hours and it'll be finished.’”

Martin took a little ribbing about this style. “That was one of the ones I did after reading an article in Outdoor Life on Randall knives...” Martin chipped in “... so you can see the similarities in the guard – big



ol' 1/4” piece of brass ... OK ... then you start learning a little about contour – shaping things – ya know – it's all in steps.”

Then Martin returned to his original point: edge geometry – noting that folks that make chef's knives

often make a knife that's 1/16" thick. "These guys [chefs] are not going to use it to stop themselves sliding down a hillside like Lewis & Clark but their using them hard – cutting a lot of stuff – go to YouTube sometime and type in '**professional chefs cutting**' and watch these guys."

Scribe's note: I put in my 2 cents - that chefs like thin blades to get clean cuts and keep food from "wedging" and splitting in the cut ... so a thin blade is great for precision & presentation of fine food ... while a thick blade is great for hard use – like a camp knife or a knife to pry stuff apart with.

"There is a happy medium in there somewhere, if you think that someday you may have to stick that knife in a crack in a rock to keep yourself from falling into the Missouri River then you want a little more thickness in the back – but you still want your edges to be fairly thin."

Here's just such a knife that Martin made for general use – with a thin edge, but enough thickness at the spine to hold up to serious outdoor use: "If you can't grind 'em that thin, use a draw file. Or a sen, a scraper."



There was some general discussion of knives breaking – presumably from poor heat treat or skipping the tempering step.

Martin turned the discussion toward general design. Looking at knives you like using – knives that work well for you – and emulating designs that work. Watch out for sharp edges on the guard – see what fits your hand – like the radius of the guard on Martin's blacksmith knife:

Make drawings of your knife before doing anything



with steel. Use pencil. Buy a decent eraser so you can experiment-and-correct your design. Including 3-D shading with a soft pencil (or shading tool from an art store) to give a feel for how a design will look in the flesh. Also you can get a template with multiple curves – or a flexible ruler that you can bend to the curve you want when tracing a curve.

It pays to keep your old drawings in a book or folder so you can go back and pull ideas from them.

I chipped in that I make full sized drawings – and when I select one to forge to I make a disposable tracing on a new sheet and use that in the forge to compare my forging to. (Disposable because the paper gets toasted in the process.)

When working on a new design Martin recommends making a quick mock-up out of softwood so that you can test the feel of the design – and modify it – before all the work of making the actual knife. "The bandsaw is your friend" in making these models.

There was some discussion of the type and method of pre-planning that different people use... from "imagine it in my mind" through to wood models.

Martin shared a Lewis-and-Clark era knife design that he photocopied and enlarged to actual dimensions as a pattern for a knife he's working on.

Martin championed the use of a "schwocking" stick to keep your blade straight while forging in the main bevel from the spine down to the edge. The back of the blade will want to sweep upwards toward the tip like a buffalo skinner. To counter that, get a heat on the blade – set its spine on the anvil so that the back of the blade makes a little arch above the anvil – and "schwock" it on the upturned edge with a piece of wood to bring the spine back flat against the anvil.

An aside: Craig Morgan mentioned that he has used one of those round artist eraser sections (chucked up in a hand drill) to spin a pizza cutter against the grinding belt so he could sharpen it w/out getting facets.



1st time attendee **FRANK BOBBIO** introduced himself – he's made knives for quite some time. There were about 10 years where life and work were too busy for it – but in the last couple of years he's gotten back into knife work and blacksmithing.

He made five cable Damascus blades in January – and brought in #5. He likes the exposed cable on the spine.

On this one it looks like it was selectively hardened, but it wasn't – so Frank asked for ideas on why it would appear like that in the etching. It's hard to tell temper line from shadow in this photo – but you can see what a handsome knife it is!



In answer to questions, Frank said that this one was quenched in canola oil. Chuck Richards noted that this might not be a fast enough oil and may have produced an actual quench line between the thinner and thicker sections of the blade. In response to a follow-up from Frank, Chuck noted that the hardened steel etches faster than the unhardened steel.

Larry Criteser asked if this was intended for hunters or for collectors. Frank confirmed that this is for collectors. Larry's point was that for a hunter, you'd get blood and tallow in all the crevices that you'd never get out.

Frank made this series of blades based a tutorial from an Argentinian bladesmith. *Scribe's note: I believe that would be #10 in Ariel Salaverria's tutorial page:* <http://www.aescustomknives.com/docs/tutorials.htm>

Frank noted that he's gotten wire rope from a couple of different suppliers. “One had much more of a black asphalt grease on it...” and to remove that Frank soaked the cable in gas for a week – then acetone, then washed them. And still after forging and heat treating - “... when I went to silver solder that guard on I still had oil oozing out!”

There was a lot of speculation about how any oil could have survived the forge welding and heat treatment.

Chuck Richards shared his process for de-greasing cable for Damascus: “I burn out the cable first – before I weld the ends. I put it in the forge. Low temp, and let it burn. When it gets up to glowing I take it out and unwrap the cable – not to the individual strands but to the major strands – and wire brush (or bead blast) it and put it back together. Then I've got a really clean piece of cable... it takes a little longer for the heavy creosote cable to burn out.”



There was some general discussion on knife design. Wayne Goddard mentioned his satisfaction that his clippit design has been so successful over the years – having the greatest number of “editions” that Spyderco has ever done.

There was more discussion about cable Damascus techniques, attaching guards to the blade, and other random aspects of blade design and construction.

I made a lame attempt to bring up a video clip of Bob Kramer's work on the overhead screen. If you are interested, here's the link:

<http://www.youtube.com/watch?v=-OCoS81G2CY>

Check out the spring back from 90° bend at 2 minutes 20 seconds into the video.

And that was our July meeting!

... see below for the August meeting notes ...



AUGUST MEETING



RAY RICHARD qualified as our “special guest” at the August Meeting. There was quite a bit of informal banter before we all sat down.

“This is the first knife I've made in about six months now – my old body's falling apart and I'm trying to get it back in working order... I probably spent a month working on this... I like crown, so I made a tapered tang and stuck this piece of crown on it.”



Given our discussion last meeting about doing drawings and making

patterns, the question was asked – what Ray's process is when he's making a new knife.

“Ya know, I don't have a pattern. I don't draw anything. When I used to make a lot of knives I'd turn on the forge and bang on some steel and see how it went. Once it was done then I'd know what I was

working on. I just make a blade and then build the knife around the blade.”

“In the beginning I'd spend time drawing at night. Then I'd go to make it and usually I couldn't make it. I was a custom maker and I'd always screw it up. Any more I don't start with a plan unless it's an order – and I don't particularly like those...”

As usual, the guard on this one is out of wagon rim. I assume the butt loop is too.

*Scribe's note: Ray's knives just **fit** right in my hand. I think he's been making knives long enough that he can make great knives without drawings or prototypes.*

ERIK LAND our resident slip-joint and folder master, was next up to share some of his latest work.



“I just got a nice new surface grinder, so I've been in the shop playing – making more and more folders.”

First off he shared a little yellow folder he made based on his memory of a Case knife he had as a kid. The yellow G10 scales tend to pick up and show dirt – so he elicited some ideas from the gang about how to seal them.

The second knife is a “Barlow” style blade with olive wood scales from Bethlehem.

“The folders are folding much easier now that I talked to Wayne for a little about 'em. You don't have to pull your fingernail off to get 'em open...”

“... and I've got a surface grinder now and that makes fitting up blades **so** much easier. Where it used to take me a couple of hours getting everything parallel – and I use 5/1000” bronze washers and that means I've got to shrink the blade by 10/1000” ... by hand sometimes it comes out straight and sometimes it comes out wedged – now with the surface grinder you grind them both flat, pull the spring off, grind the blade, and it's done!”

Wayne noted that the Case style folder could be lighter – Erik agreed and talked about how he'll be working to make the next ones lighter.



These folders have an easy, smooth action and a satisfying snap open and closed.



Wayne talked about lightening up our blades – but not to compromise on the handle material.

Wayne invited any interested folks to give him a call and come visit his shop. “I’m 77 and I don’t know how much more I’m going to be able to do this...” and here he is – offering his help right on through.

Someone asked Erik about using “trial” pins to test the mechanics and fine-tune the filing. “Oh yah!” Erik replied “On all my folders I’ll put ‘em together and take ‘em apart a hundred times!” And yes – even the full time makers do this. Erik followed up with a description of gauges and jigs to fine tune spring and blade lock geometries.

Erik shared some details of his construction process: “All of my folders, I have a CAD file where I’ve worked out all of that stuff [*blade back, locking notches, spring geometry, pivot locations*] – and I’ve got a CNC in my shop so I’ll CNC cut a plastic pattern and I’ll drill the pivot hole in the blade, the front and back pivot hole in the spring, but I do **not** drill the pivot hole in the scale until I’m doing the final lock-up. I load the spring at that time and I’ll measure where the spring comes down and drop it down 1/16” - depending on the pattern – and clamp it down and use the spring as a drill jig to drill the scale.”

Erik noted that he uses TIG rod from welding supply stores for his pins. He under-drills the holes and carefully reams them to size.

There was some discussion of peening in the pins and things that can go wrong. “I’ve got a whole bucket load of knives that are never going to see the light of day” noted Erik “that’s just the way it is.”



JIM JORDAN got up and passed around a piece of powdered metal mokume that he’d purchased from the folks at M3 Composite:

<http://www.m3composite.com/index.php/m3-mokume-gane>

The powdered “macro molecule” metals are suspended in a matrix of binder.



Here's a couple of uses Jim has put it to:



A Kukri like D-2 blade with mokume fittings, and a couple of mokume rings out to two types of this material.



I got back up and noted that I've had a couple of folks contacting me, asking about becoming apprentices to a bladesmith.

At this time the only opportunity I'm aware of is that **JOHN EMMERLING** in Gearhart, Oregon is interested in utilizing a state grant project to cover 1/2 of the salary of an apprentice. John is an accomplished blacksmith and bladesmith – so this would be an awesome opportunity for anyone wanting to relocate to the Northern Oregon coast.

<http://www.gearhartironwerks.com/>

gearhartironwerks@gmail.com

John has brought in examples of his “wandering feather” Damascus to 5160 Club meetings in the past.

Here are a few blades he's finished lately that he emailed photos of:



MARTIN BRANDT described a project he's been working on – a beefed up post vice with a heavy base and extras like a foot-peddle hold-down other enhancements. The beast rings like a bell – and Martin solicited ideas for damping the ringing. Rubber, bags of buckshot, bed coating, horse stall mat, chain, and cutting in a figure “6” on 4 sides like on some circular saws.



MIKE JOHNSTON has been busy spending time with family and Salmon fishing in Alaska (poor guy) – but did share a piece of elk antler – “It was nasty, twisted, chalky...” but he found this section that will work great for handle material on a small Bowie. “I put a little Fiebing's Professional leather die on it – light tan. Knocked off the rough spots... and that's just what I'm looking for.”



This will be going on the Bowie blade that Mike demonstrated clay-back hardening at a couple of 5160 Club meetings early this year.



Next up was a new knifemaker with a few pieces to share and lots of questions. He made a small knife for his sister to carry – she lives at Seattle Pacific University – and after the shooting last June he wanted to give her something to carry. He made it out of railroad spike and asked about heat treating.

He also shared a couple of other pieces – a small skinner and a little small hawk head:

He left with a piece of 5160 from Walter Hardcastle and a couple of soft high temp bricks from Jim Jordan – and more advice that I'd be able to absorb in such a short period of time!



... as well as the caution that his sister should be aware of any laws regarding concealed knives in Washington or Seattle or the University. Here in Oregon it would be fine but laws vary and schools get twitchy.

And if you're carrying for self defense you should take some training.

KEITH JOHNSON talked about a Facebook “Axe Junkies” group that refurbishes old axes, and such. There was discussion there of proper treatment for axe handles to keep the head from flying off – and wood treatment in general. Keith pointed them to the 5160 newsletter archive and to the tests Eric Ochs and I have done with wood treatment effectiveness. But especially to contact Martin Brandt about his method for hafting axe heads.



There was discussion of favorite use of wood preservatives and methods of hafting axes, sledges... followed by general discussion including the New Jersey version of ban on all ivory – including fossil mammoth (Save The Mammoths!):

<http://www.blademag.com/blog/steve-shackleford-blog/new-jersey-tries-ban-fossil-ivory>

And the follies of bagpipe competition players having their instruments confiscated:

<http://www.theguardian.com/world/2014/aug/05/bagpipes-new-hampshire-canada-customs-seized-ivory>

Last up was a newcomer to the area – who introduced himself as Faulk (Falk?) - who had been working with bladesmith Chris Farrell in Austin breaking up charcoal and doing jobs around the shop. He started on a couple of stock removal knives.



Faulk moved here about three months ago – into a small apartment – and would really like to continue the knife work.

I handed Faulk a card with my email – and when he sends me a note I'll put his contact into the de-classifieds.

Anyway – at that the August meeting broke up and we wandered into the night!



Wear your safety gear – no synthetic clothing at the forge. No loose hair or clothing in the shop – and have fun!

Keep Well ~ ~ ~

Your Scribe

~ ~ ~ Michael Kemp



FREE DE-CLASSIFIEDS (IN NO PARTICULAR ORDER)

Email me a brief description of what you are selling/buying/looking for with your preferred contact (phone/email/...). Unless you let me know you want a shorter run, I'll run the note for 3 months and then send you an email to see if it's still valid.

Help Wanted: I am looking for help here at the coast (Gearhart, OR). The job will most likely work into a full time position depending upon the individual. The state has a job training program which I hope to take advantage of as they will pay 50% of the base salary for several months. Applicants need to know how to MIG, and hopefully TIG weld. Blacksmithing knowledge would be a plus. Contact John Emmerling ironwerks@iinet.com

For Sale: I have a surface grinder I would like to sell. it's a Boyar-Schultz Challenger Deluxe 2A, 6-18 hydraulic surface grinder with magnetic chuck, in great shape, works good. \$1000.00, call Lynn at 541-554-5294.

For Sale: I live in the Riddle Oregon area and have two large squirrel cage fans - I'd take \$25 each. They would work great for making forges. This is wildernessman Dan Hines saying keep the steel hot and making those hammer blows work good. wildernessman56@yahoo.com or by phone at 541-817-6215.



WEBSITE LINKS

5160 CLUB

5160 Club Newsletters are archived at:

<http://www.elementalforge.com/5160Club/>

Hint: to Google the archive for a specific knife style or presenter name, use a search like this:

sami site:<http://www.elementalforge.com/5160Club>

or this:

ron lake site:<http://www.elementalforge.com/5160Club>

FORUMS

Knifedog Forum

<http://knifedogs.com/forum.php>

Bladesmith's Forum aka Don Fogg Forum

<http://www.bladesmithsforum.com/>

American Bladesmith Society

<http://www.americanbladesmith.com/ipboard/>

Usual Suspects Network

<http://www.usualsuspect.net/forums/forum.php>

Blade Forums

<http://www.bladeforums.com/forums/forum.php>

REFERENCES

Many of the sites linked under “Knife Maker General” have book & video sections.

Our own Wayne Goddard's books are available at Amazon:

<http://www.amazon.com/Wayne-Goddard/e/B001JS9M10>

And you can email Wayne directly for his DVD at

wgoddard44@comcast.net

Verhoeven's Metallurgy For Bladesmiths PDF

<http://www.feine-klingen.de/PDFs/verhoeven.pdf>

Verhoeven's updated book:

<http://www.amazon.com/Steel-Metallurgy-Non-Metallurgist-J-Verhoeven/dp/0871708582>

ZKnives – Knife steel composition/comparison/etc.

<http://zknives.com/knives/steels>

Kevin Cashen's Bladesmithing Info

<http://www.cashenblades.com/info.html>

Tempil Basic Guide to Ferrous Metallurgy

http://www.tempil.com/wp-content/plugins/download-monitor/download.php?id=Basic_Guide_to_Ferrous_2010.pdf

GENERAL TOOLS & SUPPLIES

Woodcraft of Eugene – special thanks to Joe & the crew! 1052 Green Acres Rd Eugene, OR 97408

(Delta Oaks Shopping Center) 541 685-0677

<http://www.woodcraft.com/stores/store.aspx?id=515>

MSC Direct

<http://www.mscdirect.com/>

McMaster-Carr

<http://www.mcmaster.com>

Grainger

<http://www.grainger.com>

Surplus Center

<http://www.surpluscenter.com/>

Victor Machinery Exchange

<http://www.victornet.com/>

OREGON KNIFE MAKING CLASSES

Gene Martin offers personal instruction at his shop south of Grants Pass for a daily rate.

<http://www.customknife.com/>

Michael and Gabriel Bell offer a constant series of small group classes in Japanese style sword forging and fittings. Located on the southern Oregon Coast.

<http://dragonflyforge.com/>

Murray Carter offers small group classes in a variety of subjects, primarily focused on traditional Japanese cutlery. Located in Hillsboro.

<http://www.cartercutlery.com/bladesmithing-courses/>

KNIFE MAKER GENERAL

Knife kits, steel, tools, machines, supplies such as handle material, fasteners, belts, glues, finishes, etc.

Jantz Supply

<http://www.knifemaking.com>

Texas Knifemaker's Supply

<http://www.texasknife.com>

USA Knife Maker's Supply

<http://www.usaknifemaker.com/>

Knife and Gun (K&G)

<http://www.knifeandgun.com/>

Alpha Knife Supply

<http://www.alphaknifesupply.com/>

KNIFE STEEL SOURCES

New Jersey Steel Baron

<http://newjerseysteelbaron.com/>

Niagara Specialty Metals

<http://www.nsm-ny.com> (click Products/Knife Steels)

SB Specialty Metals

<http://sb-specialty-metals.com/products/knifesteels>

Bohler Uddeholm

<http://www.bucorp.com/knives.htm>

Pacific Machinery & Tool Steel – Portland, Oregon

<http://www.pmtsco.com/tool-die-steel.php>

2X72 BELT GRINDERS

Beaumont (KMG) – the industry standard

<http://www.beaumontmetalworks.com/shop/>

Travis Wuertz – premium brand, versatile machine

http://www.twuertz.com/Home_Page.php

Pheer – affordable, satisfied customers on the forums

<http://www.2x72beltgrinder.com>

AMK – affordable, quick-change between platen & contact wheel

<http://amktactical.com/>

Coote – affordable, reliable – you supply the motor

<http://www.cootebeltgrinder.com>

Grinder-In-A-Box – low cost – assembly required

http://www.polarbearforge.com/grinder_kit.html

Wayne Coe – grinders, motors, VFDs, etc.

<http://www.waynecoeartistblacksmith.com>

Contact Rubber Corp – wheels etc.

<http://contactrubber.com/contact-wheels.asp>

Sunray – drive wheels

<http://www.sunray-inc.com/drive-wheels/>

True Grit – grinder belts

<http://www.trugrit.com>

FORGE & REFRACTORY

Chile Forge

<http://www.chileforge.com/>

Mankel Forge

<http://mankelforge.com/forges.html>

High Temp Tools (scroll down the page for the category buttons)

<http://www.hightemptools.com/supplies-mainpage.html>

Omega – thermocouples & measuring equipment

<http://www.omega.com/>

Auber – more thermocouples and controllers, etc.

<http://www.auberins.com>

Hybridburners – home of the venturi T-Rex

<http://www.hybridburners.com/>

Pine Ridge Burners – for ribbon burners and all associated fittings, blowers, valves, etc.

<http://www.pineridgeburner.com>

Zoeller Forge – low cost venturi & parts: Z Burners

<http://zoellerforge.com/>

BLACKSMITH

Blacksmith Depot

<http://www.blacksmithsdepot.com>

Pieh Tool

<http://www.piehtoolco.com>

Centaur Forge

<http://www.centaurforge.com>

LOGO/ETCHING

Ernie Grospitch – Blue Lightning Stencil

<http://www.erniesknives.com/>

IMG International Marking Group

<http://img-electromark.com/>

Electro-Chem Etch

<http://www.ecemmi.com/products.html>

OTHER GOODIES

Sally Martin Mosaic Pins – So. Oregon

<http://customknife.com/index.php?cPath=13>

Burl Source – handle blocks/scales – So. Oregon

<http://www.burlsales.com/>

Gilmer Wood – N.W. Portland

<https://www.gilmerwood.com/>

Oregon Leather – 810 Conger Eugene and 110 N.W. 2ND Portland

<http://www.oregonleatherco.com/>

Coyote Steel – misc., scrap, copper, brass, bronze – Garfield & Cross St. Eugene

<http://www.coyotesteel.com>

Cherry City Metals – Salem, Oregon – metal recycling and useful objects

<http://www.cherrycitymetals.com/>

Amtek – tool steel & cutting tools

<http://websales.amtektool.com>

Rio Grande – jewelry tools/supplies

<http://www.riogrande.com>

Otto Frei – jewelry tools/supplies

<http://www.ottofrei.com>

M3 Composite – space age mokume & other

<http://www.m3composite.com/>