February 2011
Newsletter

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Home Metal Shop Club

http://www.homemetalshopclub.org/

Since its founding by John Korman in 1996, The Home Metal Shop Club has brought together metal workers from all over the Southeast Texas area.

Our members' interests include Model Engineering, Casting, Blacksmithing, Gunsmithing, Sheet Metal Fabrication, Robotics, CNC, Welding, Metal Art, and others. Members always like to talk about their craft and shops. Shops range from full machine shops to those limited to a bench vise and hacksaw.

If you like to make things, run metal working machines, or just talk about tools, this is your place. Meetings generally consist of a presentation with Q&A, followed by ***show and tell*** where the members can share their work and experiences.

President *Vance Burns*	Vice President *John Hoff*	Secretary *Martin Kennedy*	Treasurer *Emmett Carstens*	Librarian *Dan Harper*
Webmaster/Editor *Dick Kostelnicek*	Photographer *Jan Rowland*	CNC SIG *Dennis Cranston*	Casting SIG *Tom Moore*	Novice SIG *Rich Pichler*

About the Upcoming March 12 Meeting

General meetings are usually held on the second Saturday of each month at 12:00 noon in the meeting rooms of the Parker Williams County Library, 10851 Scarsdale Boulevard, Houston, TX 77089. Visit our website for up-to-the-minute details.

Dave Wintz, President of Robin Guitars, will speak on making guitar pickups.

Recap of the February 12 General Meeting

By Martin Kennedy, with photos by Jan Rowland

Thirty-five members and three guests, Mike Gibson, Clifford Boone, and Ron Wren attended the 12:00 noon meeting at the Parker Williams County Library. President *Vance Burns* led the meeting.

There are 51 members in good standing.

A video of the entire February meeting is available on the club's Video page.

The club website is now available at two different addresses, www.homemetalshopclub.org and www.homemetalshopclub.com

Presentation

Gary Hinds gave a presentation on Investment Casting. Gary is the owner of Texcast, located in Houston, TX.

The presentation began with a video from investmentcasting.org. Gary donated a copy of the video to the club library after the meeting. The video describes the six steps involved in making an investment casting.

Investment casting began in the mid 20th century. It is a similar process to the lost wax method of producing jewelry. It has become a $4 billion dollar industry.

The technique can be used to create parts in sizes from ounces to tons. Investment casting minimizes the cost of a part due to the short cycle time, the quality of the finish, and the ability to combine multiple parts into one piece. Since the part being made comes out of the mold nearly ready for use, little alloy is wasted in the preparation.

Step 1: A wax part pattern is produced using an aluminum die. The video only mentioned wax, but newer techniques involve the use of patterns created with 3D printers.

Step 2: The pattern is affixed to a sprue, which forms a passage through which liquid material is introduced into a mold. A running cup is added at the top. Flow channels are added to assure all areas of the part will be filled with metal when cast.

Step 3: The part and sprue are dipped into a fine coating, and then sprinkled with sand in a process called stuccoing. After the coat dries, successively coarser coats are applied until the desired thickness is built up.

Step 4: Wax is melted out of the cavity in a steam autoclave or burned out in an oven. The resultant shell is pre-heated. Molten metal is poured into the cavity in the shell. Light alloys are poured in a vacuum to assure metal reaches all portions of the shell.

Step 5: The shell is removed from the metal part using vibratory methods, waterblasting, or in a blasting cabinet. Any excess metal on the part from the sprue are removed using cut-off wheels, and then the part is ground to the final finish.

Step 6: Quality Assurance is performed on a representative sample to check for dimensional tolerances.

The pattern produced to form the mold will be larger than the final part, due to shrinkage of about 0.020 per inch. The exact shrinkage varies with different metals and with part geometry.

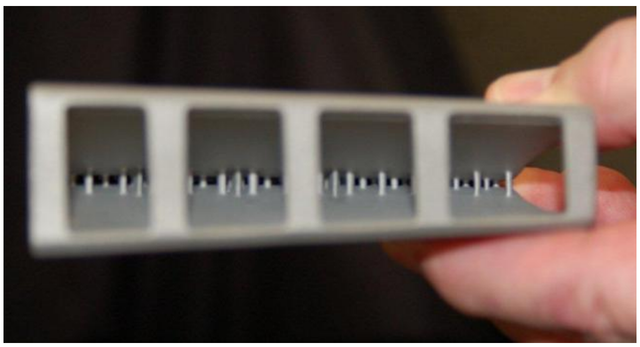
A recent revolution in the industry is rapid prototyping, accomplished using a 3D printer. This substantially reduces the cost for producing the initial pattern for the part. For example, the cost to make a 12-inch diameter turbine wheel is about $1,500 for the pattern from the 3D printer, plus about $3,000 to investment cast the part. It is an excellent way to make a single part for testing.

The largest 3D printers available can make models up to 3-feet on a side. The printouts can be of varying quality and surface finish. The best quality finish can be obtained by using UV polymeric resin. The disadvantage to this particular process is that it can't make hollow patterns.

The plastic part produced in 3D printing expands when it is melted out. If it is solid, it can rupture the mold when it is burned out. To control the expansion, voids or hollow spaces are included in the center part in a honeycomb pattern.

Metal parts may warp slightly when cooling due to variance in part thickness. To combat this, parts can be molded with slight bends such that the additional bending while cooling results in them being straight. Alternately, bars can molded into the design and removed after cooling.

An example mold of a wax elbow was shown. The inside of the part had undercutting, which would prevent the mold used to form the wax from being removed. To accomplish this, a center section was created in a water soluble wax. The wax to create the pattern was formed over the water soluble center section, and then leached out to leave the final part.



Another way to create complicated internal geometries is to use a ceramic core to make the mold. After the mold is made, the ceramic core is leached out with caustic soda.

The left photo is an internal geometry created using a ceramic core.

Show & Tell

Joe Williams brought a scale extender, or union, that he had in his collection. This device was used to splice two metal scales together to make a single, longer scale.

Lee Morin passed around a Machinist Calculator Pro that he recently acquired. This $60 device facilitated calculations for speeds, feeds, and threads. Lee made a backplate for a computer monitor using his plasma cutter and mill (right photo). He had a large cutter that he had used to bevel some of the bolt holes for countersinking mounting screws.

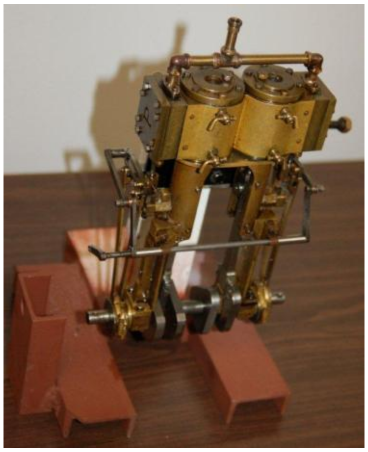
Dave Bellinger modeled a denim apron with some unusual pockets designed to keep things from falling out of the pockets when bending over.

Martin Kennedy built two pin wrenches used to remove the wheel from his surface grinder (left photo).

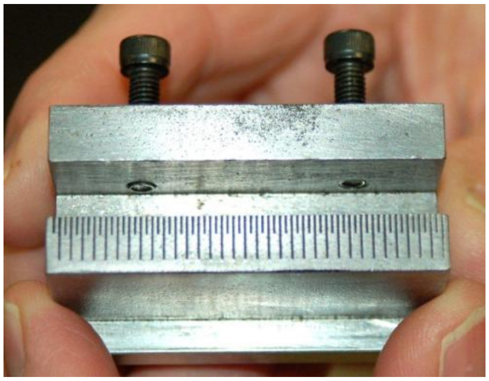
Jeff O'Malley showed an AR-15 lower receiver he built from scratch using 1/8" 6061 aluminum and plans he found online (left photo).

Dean Henning brought his 8" six-jaw chuck. Dean built a backing plate for the D1-4 mount on his lathe (right photo). He said the hardest part was making the internal 7° taper, which he accomplished using an external 7° taper and some sandpaper.

Joe Scott had two comical looking multi-wrenches that had been made by welding parts from multiple wrenches together such that one wrench would fit all the adjustment bolts on a machine. He also solved a problem to make multiple blanks from bar stock that would be used to machine a bayonet lug for a 1941 Johnston rifle by mounting two milling cutters on the same shaft. The cutters were separated by a spacer and some shims such that the blanks were exactly the correct size when cut. Joe recounted how he had been trying to make a hole that was precisely 15mm, but didn't have the slightly undersize drill and reamer needed. He found that he could chuck a drill bit deep into a collet, and the drill would make a precise hole.



Doug Blogett showed an operational steam engine that had been in use for 7 years driving a scale Shay locomotive (left photo). Doug is a member and former president of the Houston Live Steamers



Ed Gladkowski brought in a compound from a early 1900 treadle lathe, and showed how he a used it with his 9" lathe and a tool he made to make precision 1/32" graduations on a part he was building (right photo).

Dick Kostelnicek bought some surplus carbide threading inserts at last month's tailgate sale and made tool holders to use them on his lathe. The inserts had an unusual canted geometry. Dick recounted how he had to research their use, and then understand the relationship between threading helix and front clearance angle for a canted cutter bit in order to design the tool holders.

Problems and Solutions

A member asked for a source of parts for a broken lathe cut-off holder. The holder was identified as a New-Style, and recommended a local supply house. He also wanted to be able to roll 3/8-inch bar stock, and another member said he had a roller that could be used.

A 3-jaw chuck had become tightly screwed to a lathe after an accidental sudden stop. The member was unable to remove the chuck. Another member had a similar problem, and was able to remove his chuck using a two-step process. First, he heated the chuck with a torch. Then, he filled the spindle with dry ice and acetone. The acetone enhances the cooling. He said to be careful with the acetone, since it's flammable. He was then able to easily remove the chuck. To prevent this from happening in the future, he made a plastic washer that fit in the chuck connection. That way, if the chuck became stuck again, he could just dissolve the plastic washer with acetone.

An attendee passed around a froe, a device to split wood along the grain or make wooden shingles. It had been made by a blacksmith using a flat bar that was wrapped around a mandrell and then welded with heat and a hammer.

Novice SIG Activities

SIG coordinator *Rich Pichler* demonstrated sharpening of drill bits

Articles

Coating Steel by Parkerizing

By *Martin Kennedy* and *Dick Kostelnicek*

Parkerizing is a process that coats and protects carbon steel from corrosion. It is often used on firearms, since the resulting finish is also wear resistant. The process is relatively easy to perform in the home shop and provides a means for protecting steel tool surfaces. It can not, however, be applied to non-ferrous metals, or chrome-nickel stainless steels. Parkerizing was developed in the late 1800's and perfected in the early 1900's. The name derives from the Parker Rust-Proof Phosphating Company *circa* 1915. Two common types of Parkerizing are: Zinc Phosphate, which creates a dark gray finish, and Manganese Phosphate, which is black.

Concentrated Parkerizing fluid can be bought from commercial sources, such as Brownell's or on eBay. It is relatively inexpensive and is mixed with water in a ratio of 1-concentrate to 4-water. A 1-quart bottle can make more than a gallon of solution. Distilled water is preferred, but tap water is OK when free from impurities. The dilute solution should be periodically passed through a Mr. Coffee type filter in order to remove the cloudy white stuff that eventually appears. The solution will last for several years of light use. If you want to make your own solution from scratch, you can find recipes on the internet. You'll need phosphoric acid (such as Jasco Prep & Primer), manganese dioxide (recovered from batteries or at pottery shops) or zinc (from shavings from contemporary pennies), and degreased steel wool. It's a messy job, so just buy the concentrate from a reputable supplier.

Be aware that the alloy content of the steel, the preparation, temperature of the solution, type of final treatment, and of course age will affect the ultimate color of the Parkerized part.

Degreasing

Be diligent in degreasing the parts to be Parkerized. Oil can both contaminate the Parkerizing bath and result in a marred finish by shielding the steel underneath. Use hot water or a solvent degreaser, such as Zep Industrial Purple Cleaner and Degreaser. For lightly oiled small parts, place them in an old sheer nylon stocking and flood spray them with Brake Cleaner. Do this out of doors and let them drip dry before Parkerizing. Wear protective gloves to keep the cleaner off of your hands, as it contains hydrocarbon solvents that will extract the oil from your skin. A good Parkerizing job starts with *good surface preparation*. Do whatever it takes to remove all the oily contamination from the surface of the parts.

Surface Preparation

For the Parkerizing process to work well, the steel surface must be freshly exposed. Sandblasting is the preferred method. Be sure you degrease the parts before blasting. You won't want to *grease up* your sandblasting cabinet! Keep your fingerprints off the parts after blasting. Use gloves, tongs, or hold the parts with a paper towel. Immediately place cleaned parts in hot Parkerizing solution before any surface rust appears on their surfaces.

Different grades of sand grit can be used to vary the degree of mat finish. Glass beads will leave a fine mat surface finish but also peens the surface instead of cutting it. In fact glass beads may drive surface impurities into the body of the parts, thereby yielding a poor Parkerized finish. For thin parts, peening can also warp the parts shape by expanding its surface. Blow all of the sand off the part with dry air before you immerse them in the Parkerizing solution.

Parkerizing

The Parkerizing solution should be heated between 180° and 190° F. When the solution is new, it is a transparent green color (see photo below). Monitor the bath's temperature with a long probe meat thermometer that you can obtain from a grocery store. If the solution is below 180° F, the reaction will not work well. If it's too hot, especially if it boils, the solution will leave a brown scale on the parts, thermometer, and vessel containing the solution. For large parts, weighing several pounds or more, preheat them in hot clean water. Pre-heating prevents the temperature of the Parkerizing solution from initially dropping below 180° F.

To contain and heat the solution, use an inexpensive electrically heated crockpot with a ceramic bowl, obtainable from an appliance store for around $10. You can also use a Pyrex glass or preferably a stainless steel container over a camp stove or electric hot plate. A more sophisticated system uses an immersion thermocouple and electronic controller to accurately maintain the temperature of the bath (see photo below). Depending on the ambient humidity, the hot fluid will visibly produce a light amount of fumes. This is just steam. However, always use adequate ventilation when Parkerizing. If you do your Parkerizing indoors in a vented paint spray booth, well, that is ideal. The solution is nearly PH neutral. It will not create holes, like battery acid will, if you get some of it on your clothing. Always employ eye protection during the process. In any case, you should consult the MSDS that comes with your Parkerizing solution in order to understand all the precautions and risks. And finally, don't employ pots and utensils that you'll want to use later for cooking!

Immerse your parts in the hot solution for about 5 to 15 minutes. The process is self-defeating, so that the coating thickness will not continue to increase with extended time in the bath. In fact the coating thickness is slight (less that 0.0005 inch) for 10 minutes of immersion. When first submerged, the parts may bubble vigorously. The bubbling will ease off as the reaction progresses, and should stop after several minutes. There may be some white tissue-like flakes that appear, but this is also normal. Agitate the parts periodically to make sure of not getting light spots where parts touch one another or where bubbles have formed on their surface. Make a basket from iron wire (the kind used for tying rebar) to hold small parts. For parts with through holes, hang them from iron wire. A pair of tongs or a hemostat will be helpful in removing parts from the hot solution.

With a new solution, the parts may come out lighter than expected. As the solution ages, the parts will be darker.

If there are areas that you do not want Parkerized, here's a couple of ways to keep them from being exposed to the solution. (1) Isolate internal areas with cured silicon calk or rubber stoppers. (2) Paint external surfaces with Dykem or similar Layout Fluid. When dry, this paint-like coating is insoluble in hot water. After Parkerizing, the Layout coating can be removed with acetone.

Rinse

After you remove your parts from the hot solution, rinse them with room temperature water so that they are cool and can be handled. Any white milky residue can be scrubbed off with a toothbrush. Don't leave the parts wet for long, as they may begin to rust. Evaporate excess water with a hair dryer.

Treatment

The rust resistance comes partially from the phosphate layer, but primarily from the hydrocarbon, oil or wax, treatment that you apply. The surface of a Parkerized part is microscopically porous, and will absorb the treatment. You can use oil, paste wax, bearing grease, Vasoline, or almost any hydrocarbon that you have on hand. Rub the treatment into the part and let it sit on the surface for an hour or so. Then, wipe away the excess. If you use paste wax, your part will turn a nice green in about 6 months, similar to the coveted green of old rifles that were covered with cosmoline.

<u>Equipmment</u>

Shown below is a Parkerizing bath system that employs a line-voltage thermostat ([McMaster-Car #1760K77]) with a submersible thermocouple temperature probe. The thermocouple is shielded by a ¼-in OD. SS (Stainless Steel) tube plugged at the immersed end. The container is a 1-gallon SS beaker that is heated by a 120-Volt electric hot plate. Note the deep SS bowl that has a hole in its center. The depressed bowl is used to cover the beaker with the temperature probe passing through the center hole. This bowl shaped cover condenses any vapor produced and allows it to drip back into the Parkerizing fluid. You can always make up for evaporation with distilled water or extra dilute solution.

<u>Example</u>

The following photos show two carbide-insert steel lathe tool holders that were Parkerized and subsequently treated with automobile paste wax.