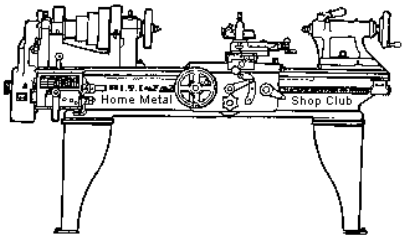
July 2016
Newsletter

Volume 21 - Number 7



http://www.homemetalshopclub.org/

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

Our members' interests include Model Engineering, Casting, Blacksmithing, Gunsmithing, Sheet Metal Fabrication, Robotics, CNC, Welding, Metal Art, and others. Members enjoy getting together and talking 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 ***general announcements***, an ***extended presentation*** with Q&A, a ***safety moment***, ***show and tell*** where attendees share their work and experiences, and ***problems and solutions*** where attendees can get answers to their questions or describe how they approached a problem. The meeting ends with ***free discussion*** and a ***novice group*** activity, where metal working techniques are demonstrated on a small lathe, grinders, and other metal shop equipment.

President	Vice President	Secretary	Treasurer	Librarian
Brian Alley	*Ray Thompson*	*Joe Sybille*	*Emmett Carstens*	*Ray Thompson*
Webmaster/Editor	Photographer	CNC SIG	Casting SIG	Novice SIG
Dick Kostelnicek	*Jan Rowland*	*Martin Kennedy*	*Tom Moore*	*John Cooper*

This newsletter is available as an electronic subscription from the front page of our website. We currently have over 1011 subscribers located all over the world.

About the Upcoming 13 August 2016 Meeting

The next general meeting will be held on 13 August at **12:30 PM (1/2 hour later than ususl)** at the Spring Branch Memorial Library, 930 Corbindale Road, Houston, TX 77024. Visit our website for up-to-the-minute details, date, location maps, and presentation topic for the next meeting.

General Announcements

Videos of recent meetings can be viewed on the HMSC website.

The HMSC has a large library of metal shop related books and videos available for members to check out at each meeting. These books can be quite costly and are not usually available at local public libraries. Access to the library is one of the many benefits of club membership. The club has funds to purchase new books for the library. If you have suggestions, contact the Librarian *Ray Thompson*.

We need more articles for the monthly newsletter! If you would like to write an article, or would like to discuss writing an article, please contact the Webmaster Dick Kostelnicek. Think about your last project. Was it a success, with perhaps a few 'uh ohs' along the way? If so, others would like to read about it. And, as a reward for providing an article, you'll receive a free year's membership the next renewal cycle!

Ideas for programs at our monthly meeting are always welcomed. If you have an idea for a meeting topic, or if you know someone that could make a presentation, please contact Vice-President Ray Thompson.

Recap of the 09 July 2016 General Meeting

By *Joe Sybille*, with photos by *Joe Sybille*

Seventeen members attended the noon meeting at the Parker Williams County Library, 10851 Scarsdale Boulevard, Houston, TX 77089. Two visitors, Larry Bartash and Philip Bartash, attended the meeting. There are forty-six members in good standing with the club. President *Vance Burns* led the meeting.

Club members Brian Alley, Ray Thompson, and John Cooper were elected to President, Vice-President and Novice SIG leader respectively. Ray is now serving as both Vice-president and Librarian. The club congratulates Brian, Ray, and John.

The club wishes to thank President Emeritus Vance Burns for his many years of dedicated service. Vance led the club through some turbulent times, and the club is stronger for it.

The club also wishes to thank Norm Berls for his recent tenure as Vice-President.

Presentation

Club member, *Brian Alley*, gave an informative presentation on 'Small Scale Anodizing in the Home Shop'. He began by stating there are three common types of anodizing; namely, Type 1 – Chromic Acid, Type 2 – Sulfuric Acid, and Type 3 – Hard Anodize. Of the three, hard anodize is the most complex. Metals that can be anodized are aluminum, magnesium, titanium, niobium, tantalum, and zinc. Aluminum alloys, however, are the most common metals anodized.

The benefits of anodizing include:

- Providing a hard surface for the anodized item
- Enhancing corrosion resistance
- Repairing of an 'mis-machined part' - typically oversized holes
- Applying a relatively thin finish to the item in assorted colors.

Brian uses a low current density (LCD) anodizing method. This method falls under the type 2 anodizing method, sulfuric acid. Features of the LCD method include:

- Easily repeatable results in the home shop
- Longer 'bath times' than commercial methods
- Weaker (also safer) chemical concentrations
- Fewer fumes
- Lower equipment costs.

In general, the LCD method involves placing the part to be anodized into a weak sulfuric acid electrolytic solution and then passing low amperage current through the solution. The parts required for anodizing at home can be as simple as a plastic five gallon bucket, a power supply, and battery acid.

Bear in mind, anodizing enhances any imperfections in a finished item. For many items, surface imperfections may be made less noticeable by rubbing with 500 grit sandpaper.

Before an item can be anodized, it must be clean and free of oils or other surface contaminants. Household cleaners will work as long as there is no residue remaining on the surface. Using what is referred to as the 'water break' test, an item is sufficiently cleaned when water poured over the item does not form beads on the item's surface. After the item is cleaned it is ready to be anodized. Here is what happens when the item is placed in the tank for anodizing. The aluminum surface grows a layer of aluminum oxide, which transforms into aluminum hydroxide and finally into hydroxide monohydrate. The layer that ultimately forms is the equivalent to 'rust' on steel and is non-conductive.

The LCD method uses a solution of three parts distilled water to one part sulfuric acid. Battery acid from the auto parts store is a good source for the sulfuric acid. Remember to wear safety goggles, gloves, and other personal protective equipment (PPE) when mixing the solution and when placing the items in the anodizing solution. If inadvertently splashed onto skin, the sulfuric acid solution may cause

a burn. In that case, flush the affected area with cool water for at least fifteen minutes and seek medical treatment. To avoid a violent chemical reaction pour the acid into the water.

Current sent through the solution must fall within the range of three amperes per square foot to six amperes per square foot. These values represent a current density which is difficult to determine in a home shop. In practice, using a constant current within the three ampere to six ampere range will suffice. Lower amperages result in better dyeing quality and final color depth. Higher amperages result in increased surface hardness. The size of pores on the surface of the item undergoing anodizing is determined by the amount of applied current. Larger pores are easier to dye, but pores too large allow the dye to bleed out during the finishing process. Small pores create better surface hardness, but in practice make it difficult for the dye to penetrate the surface.

To determine the time in minutes that the part or parts must remain in the anodizing solution, one may use the 720 Rule; i.e., Minutes to anodize = (mils of coating desired × 720) / Amps per ft^2.
For example: if the part is 100 square inches, and you use 6amp per sq ft current density you'll get 1 mil thickness.

> Residence minutes = (1*720) / 6 = 120 minutes.
> Use 6 amps per sq ft if the part is100 sq inches (.69 sqft)
> You'll need 4.14 amps.
> So, anodize the part at 4.14 amps for 120 minutes to achieve 1 mil thickness.

The metric equivalent, 312 Rule, to the 720 Rule is it takes 3.12 ampere minutes per square decimeter to produce one micron thickness of oxide over one square decimeter.

Note: Both the 720 and 312 rules are based on the experiments of Michael Faraday which found that one gram-equivalent weight of material is discharged at each electrode for every 96,500 coulombs (amp-sec) of electricity passed through an electrolytic solution.

As mentioned earlier, a five gallon plastic bucket can be used to hold the electrolyte (or anodizing solution). In the bottom of the bucket should be a piece of aluminum or lead plate to serve as a cathode. To this plate of say, 6 inches by 6 inches, is welded a round bar, angle, or flat bar of the same material as the plate. This connector bar should extend beyond the top surface of the electrolyte and the rim of the bucket. The negative lead from the power supply is connected to this bar. A rack to hold

the part or parts undergoing anodizing is placed across the top edge of the bucket. From this rack the part or parts are suspended in the electrolyte. A means to electrically bond the part or parts to the rack must exist. The positive lead from the power supply is connected to the rack. Do not allow any part of the cathode to touch any part of the anode. If any part of the rack, other than a small diameter wire used to suspend the parts undergoing anodizing, is submerged in the electrolyte, the area of the submerged rack must be accounted for in determining the residence time in the electrolyte.

At this point the duration of the part or parts in the anodizing solution has been calculated. Before placing the part or parts in the electrolyte, the dye bath and the sealing bath must be prepared. Once the part or parts are removed from the electrolyte, the parts should be rinsed thoroughly in distilled water. Do not allow the parts to dry after removal from the anodizing solution and before rinsing. At this stage, the parts should have a gold or bronze tint. If not, anodizing did not occur and the parts should be returned to the anodizing solution.

If the gold or bronze tint is enough ‘color’ for the part or parts, then the parts should be placed in boiling water to seal them to keep out contaminants. Boiling water as a sealant is cheaper than commercial nickel acetate sealants. Again, do not allow the parts to dry before placing in the boiling water.

If a color is desired for the parts, RIT brand dye works well for anodizing in the home shop. As before, do not allow the parts to dry after removal from the anodizing solution and before soaking in the dye. Brian has discovered that liquid dyes for synthetics give a more consistent finish when compared to the powered dyes. For either of the dyes, limit residence time in the color bath to thirty minutes maximum. After removal from the color bath, quickly place the parts in boiling water to seal them.

Sealing is the last step in the anodizing process. The parts can now be placed to dry, for the abrasion resistance of the anodized parts will continue to increase for about thirty more days.

If there is an aluminum part on your work bench awaiting an opportunity to get anodized, now is the time to get busy anodizing. The technique is straightforward. The setup costs are relatively inexpensive. Battery acid makes an excellent electrolyte and costs $12.00 for one half gallon at the local auto parts store. The five gallon bucket and the aluminum alloy for the cathode are likely already on hand in the shop. Distilled water and RIT dye may be purchased for nominal costs. The power supply, if not owned already, will be the most expensive item to purchase or make. First timers should consider using aluminum alloy 6061 for those initial anodizing jobs. This aluminum alloy is ubiquitous and many household items are made from it. Brian considers 6061 one of the best aluminum alloys to anodize.

An example of anodized parts made in a home shop is shown in the photo at the right.

Brian’s presentation can be viewed at this link.

Safety Moment

Vance Burns showed a video on the safety hazards of using an angle grinder without a blade guard. As a reminder, one should not operate an angle grinder with a missing blade guard. If the grinding disc should come apart while spinning at several thousand RPM's and the guard is missing, the operator would likely suffer an injury.

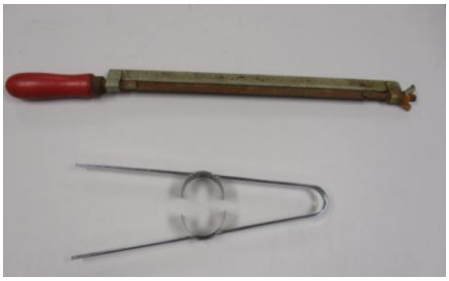
Show and Tell

Dick Kostelnicek talked about a project with his milling machine on which he is working to automate the drilling of deep holes in work. The operation is called pecking. The goal is to prevent the breakage of drill bits when drilling deeper than twice the diameter of the drill bit. Pecking is the process of drilling into work to a pre-determined depth, pausing, and then retracting the bit to remove the chips. This process is repeated each time drilling a bit deeper. Dick is using an Arduino microprocessor to automate the process via a stepping motor attached to the quill movement on a vertical mill..

Emmett Carstens showed a 1 ½" cold chisel purchased recently from a garage sale.

Dan Harper showed several work-holding devices that he made. See photo at left.

Brian Alley exhibited two tools purchased from a garage sale. One was a fret saw with a metal cutting blade attached and the other was a tool for removing the kernels from a corn cob. See photo at right.



Problems and Solutions - *Ask the Blacksmith*

A member wanted to know where he could obtain light weight expanded metal for a project. He was referred to several vendors.

Another member sought options on techniques to reduce the diameter of a four inch long by one and one eighth inch diameter cylinder. He wanted to do so without having to remove the cylinder from the chuck. One option recommended the use of epoxy to attach a sacrificial piece to the cylinder on one end and mounting the cylinder between centers. Another recommended threading a bolt into each end and mounting the cylinder between centers.

Another member wanted an opinion on the quality of ACER vertical milling machines. One member familiar with ACER said they were high quality machines.

Articles

LED Lights on a Bench Mill

By *Alan May*

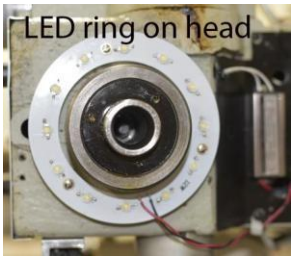
At the April meeting, I was introduced to Cree LEDs available on E-Bay. A Club member mentioned their usefulness in illumination. Because of his description of the lamps, I had a good head start. But for me, there were complications. Getting the parts wasn't much of a problem. Soldering them all together was easy. Mounting the heat-sink ring to the mill head casting was not too hard. However, I had to tilt the head over 90º to drill and tap the mounting holes. The results: a great light except where the cutter meets the work. See pictures below.

For those who may have missed the recent meeting where all was explained, the Cre LEDs are quite bright, but they get hot. Aluminum heat-sink circuit boards are available in various shapes, including good sized rings. Also, power supplies made for the purpose provide proper current from 115V - 220V AC power.

Finding the parts I wanted among the hundreds of related offerings on E-Bay took some patience. The aluminum ring-heat sink is listed as a "LED aluminum base plate" but I will call it a "Ring." Be patient! I found one on the 7th page of 50 item listings per page. I bought the largest one available with an OD of 156mm (6.1"). I planned to attach it to the mill head casting with machine screws and spacers.

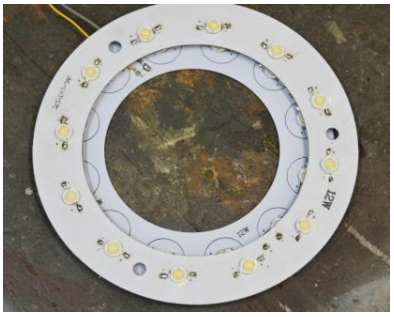
Next, I found an offer of 50 1 watt LEDs which looked like they would fit the ring for about $40. I should have looked further, but I had no idea of how much they should cost. I now know you can get 50 for about $4.00. I was surprised when the order was delivered as there was a sack of 600. There was no problem with the "LED power supply": "8-15 x 1W, $3.50," from 2012topdeal. It all was delivered in about 10 days.

I put it all together and mounted the ring to the mill head casting around the quill. I attaqched the power supply to a sheet metal shield on the underside of the mill head. You can see it as a silver out of focus rectangle on the right side in the picture. However, as you can see from the next picture the result was a failure. Really good illumination except where the cutter meets the work when the quill is extended. So, I went back to the drawing board. Apparently, the ring needs to be much-much bigger or attached to the quill. Much bigger was out, so I fastened the ring it to the quill with a clamp on the DRO bracket to see how it might work. It works fine, even with a fat drill chuck, but the LEDs can shine right in your eyes, which is unpleasant. I had worried that the large light ring added to the quill would get in the way, but I don't notice it at all when using the mill. But it needs a shade around the outside edge. And I think the thin Ring should have more substantial support.

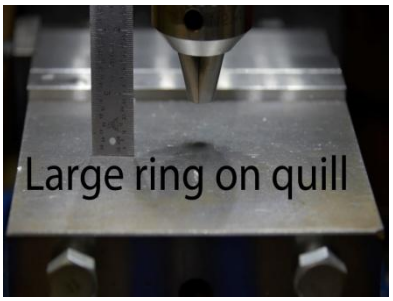


I wondered if the shade should have an outside edge angled to direct side emissions from the LEDs downward, but I could see no difference by holding reflectors up against the temporarily installed ring.

The ring vendor, “merryday168” told me that most mill customers ordered a smaller ring, 138mm (5.4”) OD. It seemed to me that smaller might be better if there is no shadow problem so I ordered 2, the minimum quantity, and soldered the LEDs in place for a test. I should point out that I always added heat sink grease to the LED center spots on the ring to make a better heat connection. Note that the bigger notches from the leg mark the positive side of the LED. Getting the plus and minus legs soldered to the proper pads is essential.



The smaller ring is not that much smaller, and it put a shadow with the chuck 1 ½” above the work, not much, but not as good as the big ring which let me get down to 1” before there is a shadow. So, I decided to stay with the larger ring. Fortunately, the factory installed X-axis DRO carrier is bolted directly to the quill. I can fasten the ring holder to it if I provide a stub projection. Absent that, I would have attached it to the quill with a squeezing clamp or a ring with set screws. Set screws would probably work better.



I found my 8” rotary table was an unfortunate size to make a holder-shade for the aluminum ring. My plan was to drill holes through inside center waste area and bolt the work directly to the table. However, the slots in the table do not go close enough to the center. The work is too big for regular hold-downs. So, I had to bolt it down by drilling holes in the corners.

I drilled a ¼” index hole in the center of a ½” thick square piece of aluminum and 4 holes in the corners to bolt it to the table. I marked both sides fairly accurately so I could turn it over using a pin in the index hole. First, I bolted it upside down and cut a round slot to fit the ring with a ¾” mill, ¼” deep. The slot is a bit over ¾” wide.

I flipped it over, bolted it down and removed the center. I then trimmed most of the OD, dodging the stub and the holding bolts. I finished the OD with a band saw, belt sander and a file.

I clamped the finished part to the DRO support, lining it up by eye using mirror. I removed the clamped DRO support plus the ring still clamped on, and match drilled and tapped the DRO support for 10-24 screws. The LED ring is attached to the holder with 6-32 machine screws.

I understand there is heat-sink double stick tape available, but it won’t

work for me as the ring must be removed to access the screws that attach the shade- holder to the DRO bracket. I considered the effect of flying chips on all the exposed connections where the LED legs were soldered to the ring. Knowing Murphy's law all too well, I invested in a bottle of white liquid tape and covered up all the bare spots.

There must be a rule about the color of workshop lights as they are all black. As I don't want to anger the workshop fashion police, I painted the top and sides of my holder-shade the proper color.