September 2016
Newsletter

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

This newsletter is available as an electronic subscription from the front page of our website. We currently have over 1027 subscribers located all over the world.

About the Upcoming 08 October 2016 Meeting

The next general meeting will be held on 08 October at 12:00 P.M. (Noon) at the Parker Williams Library, 10851 Scarsdale Blvd., Suite 510, Houston, TX 77089. Two presentations are scheduled. Member Jan Rowland will give a presentation on "Stuff I Have Built Over the Ages". Member Norm Berls will give a presentation on "Little Hand Powered Jig for Polishing Metal Parts".

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.

Reminder: Yearly club dues were due at the September meeting. Dues are fifteen dollars ($15.00) and payable to Treasurer Emmett Carstens. He will accept cash or a check made payable to him.

Recap of the 10 September 2016 General Meeting

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

Twenty-one (21) members attended the 12:00 P.M. (Noon) meeting at the South Houston Branch County Library, 607 Avenue A, Houston, TX 77587. Two visitors, Richard Douglas and Matthew Arntzsen, attended the meeting. There are forty-seven (47) members in good standing with the club.

President *Brian Alley* led the meeting.

Presentation

Club President, Brian Alley, gave a presentation on using the CAD/CAM software Fusion 360. Fusion 360 is a relatively new 3D software design package combining the tasks of drawing a design, creating a tool path for the manufacture of the design, and generating the G-code necessary for the tool of choice to carry out the making of the design. For non commercial production use and for commercial shop production use under certain limits a subscription to use Fusion 360 is free. Details are available at the AutoDesk website.

Among the tasks available with Fusion 360 are:

Concept and design with sculpting
Parametric and mechanical drawings
Rendering and animation
Simulation
Compatibility with both PC and MAC platforms
Collaboration to access and update designs to the cloud

Brian showed the user interface, toolbars, browsers, navigation settings, timeline, and context menus. He demonstrated the use of primitive shapes such as the circle and rectangle to make complex parts in 3D. He then showed how one can place holes within a 3D shape. The holes may be placed randomly or in an array, either rectangular or polar. As one develops a design, one can view the design from six different views, front, back, left side, right side, top and bottom. As with many computer aided drawing software packages, Brian demonstrated how one may add dimensions to a design and use an assortment of tools to create the design of interest.

One unique feature of Fusion 360 is the ability to access revision history of a design. This feature is handy if design changes are required. Another useful feature is the ability to add to a design parts from the McMaster-Carr tool catalog. This feature saves time drawing standard off the shelf parts to place in a design. Another useful feature is the ability to send one's design to registered vendors to build it. This feature could obviate the need to maintain a home shop and the attendant maintenance issues. One could design a part, send the design to a vendor with the latest machines to make it and, presto, one is off to another design creation, all from the convenience of one's computer work station.

Lastly, Brian ranks as outstanding the customer support for Fusion 360. As a new user of the product, whenever he has had difficulty with using one of the tools, he will either post an inquiry on the help forum or call the helpline. In both instances he has been extremely satisfied with the solutions offered. Given the convenience in one software package of drawing design, tool path creation, and G-code generation, Fusion 360 deserves consideration for one's next design project.

Safety Moment

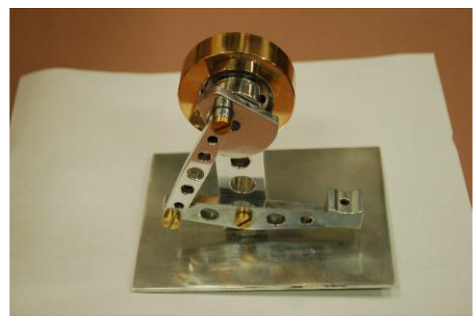
A member cautioned those present to be extremely careful when using compressed MAPP gas. Recently, while using MAPP gas to heat metal, the entire nozzle of the MAPP gas torch became engulfed in flames. A flame should appear at the end of the torch not the entire torch. It is likely the member held the MAPP gas cylinder too close to horizontal. Therefore, liquid in the small cylinder flowed to the nozzle and ignited.

Show and Tell

Jan Rowland showed a brass bearing that he made for a kaleidoscope (photo at right).

Dick Kostelnicek showed a radius gage (photo at left) and a single flute deburring bit that he uses with an electric screwdriver.

Joe Scott displayed a butt plate that he made for a vintage M14 rifle.



Mike Winkler exhibited a finger engine made from plans found on the World Wide Web (photo at right).

Stan Reeves exhibited a four facet drill bit sharpener that he made.

Problems and Solutions - *Ask the Blacksmith*

A member wanted to know what he could do to duplicate an asymmetrical thread screw for wood turning. Several suggestions were offered..

Another member sought options on making a spur drive for wood turning, specifically the making of a small taper using the compound without a taper adjustment tool. Several different options were offered.

Articles

Thread Dial Indicator

by Kenneth J. Miller – Valley Falls, NY

The salient features of the thread dial indicator are the gear, the dial, and the housing with two holes. Through one hole a shaft connects the gear to the dial, and in the second, a shaft about which the housing pivots to engage or disengage the lead screw. Note that the holes are at right angles but not necessarily in the same plane. Figures 1 through 3 show the various parts of my indicator for a South Bend 9” Model A lathe and the cutter to make the gear. For this 9” lathe (left photo), refer to the Department of Army’s report. (reference 1).

Figure1: Notice the sloping gear teeth matching the helix angle of the lead screw.

Figure 2: The gear and stepped holes. The small hole perpendicular to the housing accesses the set screw in the gear. The cutter is ground at 29 degrees for an Acme thread.

Figure 3: The dial and shaft. A hole along the axis leading into two perpendicular ones are for oiling the shaft, while the first depression is for a set screw.

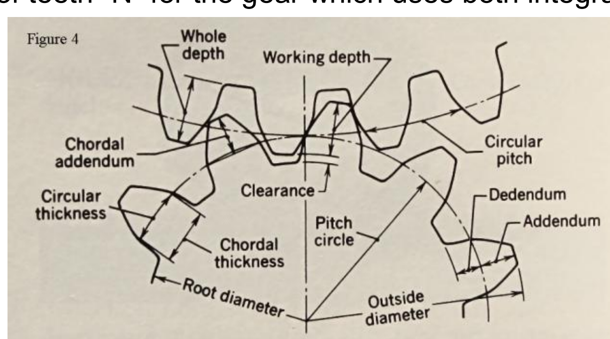
Gear

The number of gear teeth depends on whether you want to use integral and half integral or only the integral numbers (refer to reference 2 at the end of this article). I chose the former because I wanted to strive for the greatest threading flexibility. The number of teeth “N” for the gear which uses both integral and half integral numbers is:

$$N = 4 / p$$

where p is the lathe lead screw pitch.

Figure 4 shows a gear tooth profile width pitch circle, addendum, dedendum, whole depth, root diameter and outside diameter (reference 3). The working



depth + clearance, and the outside minus root diameters, are both the whole depth, which will be the cutting depth on the milling machine. There are two pairs of surfaces: One is at 29 degrees at the bottom of the gear to fit an Acme thread, and the second pair towards the tooth which is filed by hand. This profile allows smooth engagement and disengagement of the gear.

The teeth should not be hogged to fit the lead screw, which is important in this application. This allows the gear to mesh with the lead screw anywhere along the gear teeth, allowing flexibility in positioning the gear, and also as wear takes place in the lathe. The pitch circle is a circle about which N gear teeth fit whose circumference is

$$C = N \times p,$$

and its diameter is the pitch diameter,

$$D = C / \pi.$$

The top and bottom of the gear tooth is obtained by adding the addendum,

$$a = p / \pi,$$

to, and subtracting the dedendum,

$$d = 1.157 \times p / \pi,$$

from the pitch circle. These are standard mathematical formulae for an Acme thread. The whole depth of cut will be

$$a + d = 2.157 \times p / \pi.$$

The gear blank outside diameter is D + 2 x a.

Example 1: For my 3/4” x 8 acme lead screw, N = 32, p = 1/8”, C = 4.0000”, D = 1.2732”, a = 0.0398”, d = 0.460”, and the gear outside diameter is 1.3528”. The whole depth, 0.0858”, is the depth of cut on the milling machine.

Cutter

A keyway cutter is ground to the shape of the tooth with a 29 degree angle for the Acme thread. Mount it in a portable drill, spin the Woodruff cutter against a grinding wheel running in the opposite direction to joint the shape to the required angle. This process prepares the tool for grinding the clearance. Then freehand grind back from or up to the cutting edge to fashion clearance. When you cut the gear, the teeth with the farthest reach will make the finishing cuts. The secondary surfaces will be filed after the gear is cut with this tool. Because this gear is not in a power train, the gear is filed so that it rolls easily along the lead screw. Play and accuracy are discussed in the final fitting. If you wish to cut both angles at the same time, you can purchase a cutter for this purpose.

The gear teeth are cut at an angle corresponding to the slope of the lead screw thread at the point of contact. Notice that the gear teeth are slanted at an angle to the rotational axis (Figure 2) matching the helix angle of the lead screw. This angle is understood by rolling out one turn of the lead screw on a flat surface which traces the thread as the hypotenuse of a right triangle with the circumference of the lead screw and the pitch, p, as sides. The formula for this angle is

Arctan[(distance between lead screw teeth) / (lead screw circumference)] =

Arctan[(p) / (pi x dia)] = A.

For example: Shaft of dia = 3/4" with 8 teeth / inch,

Arctan[(1/8") / (pi x 0.75")] = Arctan[0.0531] = 3.04 degrees.

Those who would prefer to calculate the slope in polar coordinates using calculus will find the derivation in the appendix.

Accuracy in your work is not demanding. Keep in mind that the space into which the gear must fit is slightly greater than 0.5 x (p), the tapered edge of the gear is less. It must slide into that space and fit optimally only to keep track of the position on the lead screw. So play is tolerated, and, to minimize wear on the lead screw, desirable. The dial indicator determines when to engage the split nut which determines the accuracy of the thread.

Cutting the gear

The gear can be cut on a milling machine with a three jaw chuck bolted at 90 degrees + A to the bed. A graduated chuck is desirable, but a graduated disc serves the purpose. Each tooth is cut (360/N) degrees apart. Keep in mind that an error of 0.1 degrees is less than 0.001" for my example, and this angle can be estimated easily. A 3/8" hole is reamed to size in the gear blank. A long 3/8" shaft, preferably drill rod which is more rigid than cold rolled steel, serves to hold the gear blank in and away from the chuck while being supported in a made up steady in a vice at the proper angle away from the cutting region. A graduated disc in the 3/8" shaft can be used to adjust the various angles if more elaborate indexing devices are not available. I had a chuck graduated to minutes, but that was much more than necessary. This angle, A, corresponds to a ratio of the rise of the thread pitch to the circumference of the lead screw, which is 0.531" along 10" of milling machine bed for setup in my example. Check to be sure cutting is done on the correct side, otherwise the slope will be reversed.

Housing

The housing can be made of cast iron, but aluminum serves well, especially if the hole guiding the gear is bushed with brass or steel. A rectangular solid blank is machined. Then the hole for the dial and one for the swivel can be drilled accurately in a four jaw chuck. I suggest a blank be made of wood and tried to be sure that the finished indicator rocks enough to engage and disengage the lead screw, and that the gear projects from the housing. While the blank is held in the four jaw chuck, bore holes on the lathe in each end to accommodate the gear and dial. Although not necessary, the outside can be rounded at the same time as well as by the swivel hole. The remainder of the housing can be fashioned later with a grinder by hand. I found it to be easier to drill out some of the metal, and then bore about 1/16" into each end to accommodate an end mill safely. Finally, bore it to depth with the end mill to complete the job. The end mill will bore easier if the metal in the central portion is removed. The gear and shaft may be slotted for a keyway but the dial should be fastened with a set screw in a shallow hole after the dial is engaged and tested.

DIAL

The dial is marked and numbered using an indexing device, but the final mark on the housing is left for the final touches. Assemble the indicator and align the gear teeth to mesh maximally. File secondary surfaces on the teeth so that the dial slides back and forth easily for all positions on the gear teeth. Test the fit by moving the dial indicator back and forth along the lead screw manually. Continue filing until the gear does not bind in any of the teeth positions. Mount the indicator in the lathe and determine where to file the mark on the housing. Then lightly mark the orientation of the dial to match one of the numbers. Tighten the set screw into a slightly flattened part of the shaft into which a shallow hole can be drilled. Test the indicator to adjust the position. Then, file the final mark on the housing which signals the start of a threading operation. Keep in mind that the job of the dial indicator is to signal engaging the half nut for threading which determines the accuracy of the threading operation.

Appendix

The helix angle that the lead screw thread makes at the point of contact with the gear can be calculated in polar coordinates. Let the lead screw axis be the z - axis. Imagine a cylinder of diameter dia, and a circle in the xy plane which intersects this cylinder. It is also of diameter dia. The x-axis can be oriented perpendicular to the lathe bed towards the user, and the y-axis vertical, but that doesn't matter for the derivation. The lead screw is traced out along this cylinder by

$$z = (A / 2 \times \pi) \times p,$$

the points on a circle by

$$x = r \cos(A),$$

$$y = r \sin(A),$$

as the angle, A, changes. The differential change along each dimension is

$$dz = [\, p / (2 \times \pi) \,]\, dA,$$

$$dx = -r \sin(A)\, dA,$$

$$dy = r \cos(A)\, dA.$$

Relative to the point at the intersection of the circle with the cylinder, a right triangle is formed with the differential distances forming one side of a right triangle in the plane of the circle,

$$dt = sqrt[(dx)**2 + (dy)**2] = r\,dA$$

and the other side parallel to the z - axis, dz. When the dial indicator is installed it can make contact anywhere on the thread, so this derivation is general. Then the slope required to mesh the gear anywhere along the lead screw is

$$dz / dt = \{ dz / dA] \times [dA / dt] = [p / (2 \times r \times \pi)]$$

which is 0.0531 for our example. Notice that the gear can mesh with the lead screw anywhere along its teeth, unlike a hogged gear which should mesh exactly.

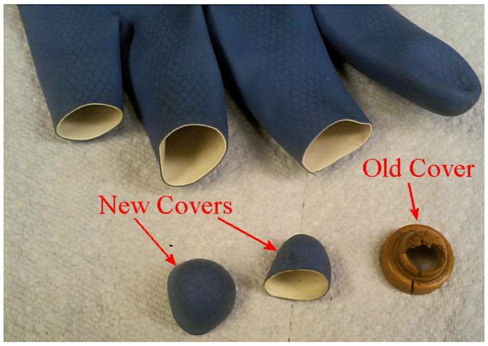
References

1. DEPARTMENT OF THE ARMY TECHNICAL MANUAL, TM 9-3416-235- 14&P, Department of the Army, 1980, page 22.
2. Imperial Lathe Threading Dials, Richard Kostelnicek
3. Machine Tool Practices, R. R. Kibbe, J. E. Neeley, R. O. Meyer, W. T. White, Prentice Hall, NJ, 5th Ed. 1995.

Push Button Cover for Power Feed

By *Dick Kostelnicek*

The original elastomeric cover for the rapid motion push button switch on two of my mill's power feeds (left photo) have disintegrated. They have deteriorated to the point that the inner stem of the push button protrudes through the top of the old cover (right photo). I couldn't find a manufacturer's replacement, so I fashioned covers of my own making. I used the finger tips from an elastic latex dishwashing glove (right photo).



A glove finger tip is fastened to the power feed button's circular retaining nut with a thin bead of silicone caulk (left photo). The finished button cover is shown in the right photo.