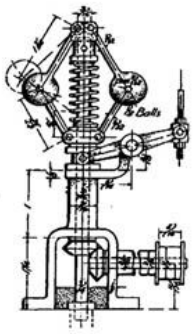
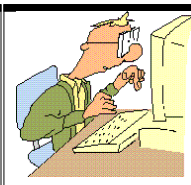


The NEMES Gazette

NEW ENGLAND MODEL ENGINEERING SOCIETY INC.

No. 195 July 2012



Editor's Desk

George Gallant

This month's issue of the Gazette was the easiest yet for me to assemble. The articles arrived on time and pasted together very nicely. Please consider writing about your pet project, tool, or procedure.

Nancy Hoggson from the American Precision in Windsor VT would like to announce that their upcoming Model Engineering show has moved to October 13, 2012.

Marty Feldman emailed that he has a Myford Super-7 lathe for sale. More information can be found on the NEMES website.

Issue	Contribution Due
SEP	AUG 23, 2012
OCT	SEP 20. 2012
NOV	OCT 18. 2012

President's Corner

Dick Boucher

The Meeting

Our speaker this month will be Ed Bellanger. Ed is with the MBTA Everett Shops, the maintenance facility for the MBTA where repairs are made for rolling stock used through the MBTA system. Some of the topics Ed will speak on are the need for repairs on some of the old equipment that parts are no longer made for and the ingenuity the maintenance crew uses to keep the equipment running.

Next Meeting

Thursday, August 2nd 2012

7:00 PM. Meetings held at:

Charles River Museum of Industry
154 Moody Street
Waltham, Massachusetts

Membership Info

New members welcome! Annual dues are $25 (mail applications and/or dues checks, made payable to "NEMES", to our Treasurer David Baker, see right) Annual dues are for the calendar year and are due by December 31st of the prior year (or with application).

Missing a Gazette? Send a US mail or email to our publisher. Contact addresses are in the left column.

Contents

Miscellaneous Ramblings

The big ramble this past month was Bea and I heading out to the Enginuity show at the Orange Airport. When we arrived, a skydiver sailing down to the airport with a huge American flag hanging below him greeted us. After registering and saying hi to the organizers of the event, many of who have joined us on the Cabin Fever bus trip over the years, we proceeded to find a place to set up our display. As luck would have it, we quickly found Norm Jones. Norm was able to pull the Ford Hilton in a little ways, making room for my truck to park. We lowered the tailgate and moved my engines out for display leaving them on the truck and not having to lift them up at the end of the day. That was great.

I had looked over my small collection and decided to bring engines that I thought were rather unique. I was wrong. I had loaded a portable water pump powered by a two cylinder two-stroke engine. It was used in both navy ships and for forest fire fighting proposes. I had used it to help pump out the cellar of the shop I used to work at during one of the floods a couple years ago. Well to make a long story short, the fellow right next to us had the same pump on display. So much for the uniqueness of that engine. I had also loaded a small four-stroke generator, which I had never seen at any engine show. Yup, you guessed it. Two displays over was the same generator, second strike out for uniqueness. Just what are the chances that the same type of engine would show up at a show not to mention that they were right next to each other?

The third unit did stay in the unique category. It is a small portable four-stroke generator in a nice watertight container. It seems to be a military unit for radio use as the ignition system is shielded like an aircraft engine.

As I have lamented in this column before, only the usual suspects were present with no new faces showing up at the event. Check out our WebPages for the pictorial report of the event filed by Errol Groff.

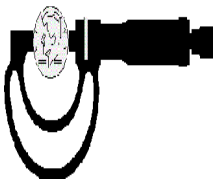
Bob Neidorff has suggested to me that the column be more of upcoming events rather than the historical nature of my reports. It is rather difficult to report on events that haven't yet occurred, but, with that acknowledgment I will remind you of the big event for August which is the Waushakum Annual Live Steam Meet on August 24th, 25th and 26th.

I can report on this event since our family has attended this event since 1972.

The meet brings live steam and diesel model locomotives from all over the East Coast and Canada in three gauges and scales. The club is a premier facility with the 7-1/4-gauge track meandering through a pine forest going over trestles and through a tunnel on a ride that takes at least 10 minutes. The club members always have a number of trains available offering rides to visitors all day long. The highline is also a great ride with two covered bridges to ride through. Rides are not always available on the highline, as it is not as easy to ride on as the ground level track.

There is also a cook tent providing coffee and donuts in the morning and hot dogs and hamburgers for lunch. On Saturday evening there is a Ham and Bean Supper. They do take reservations for this but is to ensure that they have enough food and not a limiting factor. There is also a breakfast for the real early risers on Saturday and Sunday morning.

So if you have never visited this great event, pack your significant other and your children or grand children or even one of the neighbor's kids or even come out by yourself and head out to Arthur Street in Holliston Massachusetts. There is signage leading to the track from Route 16 in Holliston or plug Arthur Street into your satellite navigation system and join in on a great weekend.



Tool Corner

Frank Dorion

Last time we were looking at levels, particularly precision levels, and their accuracy or sensitivity. We were using arc minutes and arc seconds to gage their relative accuracy. Another way to express the sensitivity of a level vial is by giving the radius of the vial's curvature. You may be surprised by how long that radius can be. Take the Starrett Model 199 Master Precision level as an example. Remember that its sensitivity was 8.6 arc seconds per graduation. In his article (Model Engineers' Workshop, Issue No. 77) Bill Morris calculates that a vial bubble which moves a tenth of an inch per 10 arc seconds is curved to a radius of 169 feet! And the Starrett Model 199 is a bit more sensitive yet, meaning it has an even larger radius.

As an aside, Bill Morris' article cited above gives complete instructions for making your own high-precision level vial. He provides the necessary calculations, then goes on to describe the required equipment and its use. His methods, if followed faithfully, will yield a truly high-precision level vial that would be equal or superior to most commercial high precision level vials. Something to think about for your next project?

Now let's have a look at using these high precision levels. There are a few issues to be dealt with before one can use them successfully. One major problem is thermal expansion. The cast iron frames are very easily distorted by temperature changes. Let's say you are going to level a mill table. So, you get your Starrett Model 198 out of the bottom drawer of your bench where it is kept safe and out of the way. Right away you have an issue since the temperature near the floor is likely to be a few degrees lower than the temperature at mill table height. When you put the level on the slightly warmer mill table, the bottom of the level will quickly absorb heat from the table causing it to expand and warping the level's frame. Maybe it only bends the frame a tenth or two, but you won't have a precision level again until the level's entire frame stabilizes at the new higher temperature. And did you notice that little bit of sunlight coming through the window and falling on the level? Bad news! Better draw the curtain and wait a couple of hours before trying to do anything with that level. Keep work lamps well away from it too.

Of course, don't even think about touching the level except by its insulated plastic handle. And if you bend down close to the level to take a look at the bubble, hold your breath. Think I'm kidding? One puff of your warm breath on the vial of a Model 199 will move the bubble a full graduation. The point here is that if you hope to use a high precision level successfully, controlling the temperature of it and its environment is an absolutely necessary condition.

And what about the surface you are leveling? Hopefully it is a precision ground or scraped surface. If it isn't, a precision level is the wrong tool. Even on a precision surface, the tiniest chip fragment or a raised surface around a ding you can't even see will interfere with accurately leveling the surface. Good practice calls for lightly stoning a table surface to remove small dings before using the level, and of course the surface has to be impeccably clean.

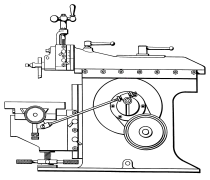
It goes without saying that the level has to be adjusted accurately. Let's assume that you have achieved and maintained thermal stability and that you are working on a clean precision surface. The classic test for determining a level's accuracy is to take a reading, then swap the level end for end and take a second reading. Make sure you put the level down in exactly the same place on the surface for both readings. The surface may not be level, but the level should read the same in both positions. If it doesn't, the level requires adjustment. When doing this test, make sure that both ends of the bubble are visible. The ends of the vial are not visible and the bubble is rather long. If you are getting the same reading in both positions but can only see one end of the bubble, most likely the other end of the bubble is up against the end of the vial so the readings are meaningless. Silly mistake, you say, but it does happen. Because of the precision level's limited range, you may have to bring your surface to a more level condition using a less accurate level before you can take a reading with the precision level.

Adjusting a precision level takes a whole lot of patience most of the time. Precision levels typically have an adjusting screw that raises and lowers one end of the vial, and often a second screw to lock the setting. Make adjustments in the tiniest possible increments and be sure the bubble has stabilized before making further adjustments. And even after you think you finally got it right, leave it overnight and come back to check it again the next day. If you are lucky it may still read the same.

So, what do you need all this accuracy for anyway? Most of us are familiar with using a level on a lathe bed to find out whether or not there is any twist in the bed, so I won't go into that application. The value of leveling a mill, like a Bridgeport, may not be as widely appreciated. Unlike a lathe, most small vertical mills (up to about Bridgeport size) don't require being leveled to do accurate work. Their configuration and inherent stiffness is such that they will do accurate work, level or not. However, there is another reason for leveling your mill, namely, to have its table become a known reference surface. If you know your table is dead level, you can seat a work piece on it and use an inclinometer or a level with confidence to gage an angle on the work piece that may be very difficult to measure otherwise.

Other uses for a level mill table are also possible. For example, I had a project where I had to bend two round bars to identical right angles. To make a bending jig, I clamped a chunk of aluminum in the mill vise and bored a hole in it the same diameter as the bars and to a depth that would locate the bend properly. The bars to be bent were not very long, so I made a "cheater" handle with a hole in its end that fit snugly over the bar diameter. To set up for the bend, the bar was inserted into the jig and the cheater handle was slid over the end of the bar, so both bar and handle were in a vertical position. Sideways pressure on the cheater handle provided force for the bend, but the problem was how to tell when the bend reached 90°. Easy! Since the table was level to begin with, the bar and cheater handle were reliably plumb when held in the bending jig's bored hole at the start of the bend. To determine when the bend had reached 90°, I just had to put a level on the cheater handle to see when the handle had reached a level position, indicating a 90° bend.

So, precision levels are neat tools, but do you really need one? The answer is a resounding "Maybe!" Without question, many thousands of machinists over the years have used lesser equipment to check their machines. The great majority no doubt went on to produce very acceptable work, in spite of not having had the last word in precision for leveling equipment. Most of our home shop equipment is well aged and is inevitably worn as a result. Also, most of us seldom work to "tenths" tolerances. We can all benefit to some degree from using a level to set up our equipment properly, but there is a real question as to what degree of refinement is worthwhile. I doubt one could set a hard and fast rule. Perhaps the best advice I have seen on this point was given by John Garner in one of his posts on the Practical Machinist board. Regarding precision levels, he wrote, "Do you need the extra sensitivity when setting up or rebuilding machine tools?. You do if you do and you don't if you don't."



Metal Shapers

Kay Fisher

R. G. Sparber's Gingery Shaper - Part 27

Making the Down Feed, Clapper Box, Cross Slide Support, and Cross Slide Patterns

I don't really enjoy woodworking but having the right tools certainly makes these jobs easier to tolerate. About 5 years ago I bought a very nice Bosch portable table saw. It permits me to make very precise cuts with minimal fuss. I also have a disk sander and 1" wide belt sander. They are handy for adding draft to my patterns. Originally I thought I would use the table saw to cut the draft on all pieces but in some cases it is better to do it after assembly by sanding.

1st Down Feed Patterns Photo by R. G. Sparber

One thing I had to rediscover is that written procedures are needed when cutting wood, just as they are needed for cutting metal.

Here you see my first two tries at cutting the down feed pattern base. They are very simple yet I screwed both of them up. Once I returned to my standard operating procedure of writing down the steps before starting to cut, all went well.

3rd Down Feed Pattern - Photo by R. G. Sparber

The down feed pattern came out fine. For ease of molding, I made the gate too. I later glued on a small block to the gate to provide a land for the sprue.

The inside edges of the blued-on thin blocks were cut with a 1 degree relieve on my table saw. The vertical block was cut square and slightly oversized. The relief angle was formed with the disk sander and included both the edge of the base and the end of the block. In this way I have a smooth surface with no discontinuity between base and block. I was able to sand the relief on the inside face of the vertical block using my 1” wide belt sander.

The large outside curved edge was rough cut on my bandsaw and then cleaned up on a disk sander. It has the relieve angle as set on the disk sander's table which is about the same as on my table saw.

The two small inside curved transitions were rough cut with my scroll saw and smoothed with a half round file. MDF sure is easy to work.

Pattern Glue Up Photo by R. G. Sparber

Here you see the pattern being glued up. You can never have too many clamps...

I put the letter “N” on all pieces to remind me which face is narrow. The pattern cannot be pulled from the sand unless all relief is in the same direction.

Clapper Box Glue Up - Photo by R. G. Sparber

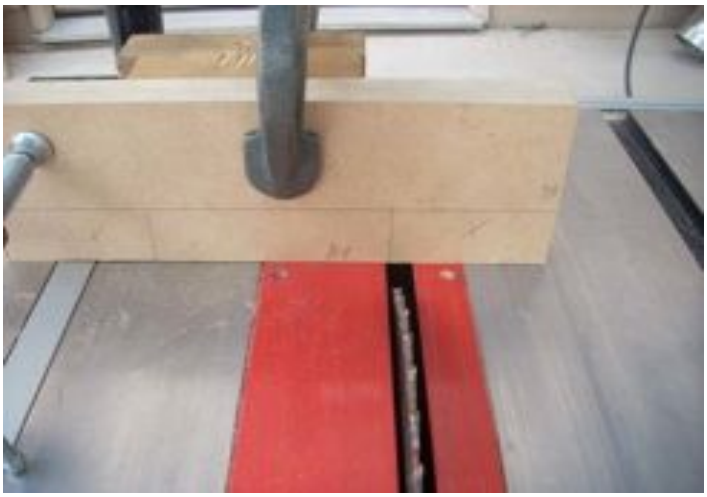
The clapper box is being glued up. I chose to do the final shaping of the curved end after assembly. In this way the curve and the draft will all be smooth over both the base plate and the two blocks. The disk sander has 60-grit paper and makes quick work of MDF yet the finish is decent.

Clapper Box Pattern - Photo by R. G. Sparber

The fillets don't look so good here but the curves came out nicely.

I was experimenting with different fillet materials. In this case I used sawdust from the table saw, Elmer's Glue, and water to make a paste. Later I used sawdust from the sander, Elmer's Glue, and water to make a much smoother paste. It worked better but I will probably run a fillet of commercial wood putty later.

I use Petrobond sand which is oil based so no water will get to my patterns. I therefore don't bother with protective coatings. I finish with 400 grit abrasive to make the surfaces smooth.



Cross Slide Pattern Parts - Photo by R. G. Sparber

The cross-slide support pattern requires matching base plates. I have clamped two pieces of ½" MDF together and will run them through my saw. I chose to go with ½" MDF rather than the $^{3}/_{8}$" specified by Gingery for two reasons. First, I like having the extra material in the casting. Second, I have ½" MDF but must build up layers to get $^{3}/_{8}$".

2nd Cut - Photo by R. G. Sparber

By placing the base on edge I am able to get square cuts with no undercut from the blade. The C- clamps and 2x4s allow me to keep my hands away from the blade plus keep the MDF stable.

Parts Laid Out - Photo by R. G. Sparber

The rest of the pieces for this pattern are rather simple. Here is the pattern dry fit.

After Glue Up - Photo by R. G. Sparber

After gluing up, I used my disk and belt sander to get a slight draft.

Note the two tiny dark dots on the top face flanking the built up section. They are the ends of cut off nails that align the cope and drag pieces.

Bottom View - Photo by R. G. Sparber

You are looking at the cope side of the pattern. The channel will form blocks of sand that must hang down into the void. It is essential that there is plenty of relief plus smooth surfaces.

Cross Slide Pattern - Photo by R. G. Sparber

I simplified the cross slide pattern by not making $^{1}/_{16}$" pads for scraping. I will mill out the center section and mill the pad area.

Keep sending me email with questions and interesting shaper stories.

My email address is:

KayPatFisher@gmail.com

Shop TIPS	**Drilling** Bob Neidorff	

Drilling Holes In Precisely The Right Place

This sounds like a simple task. Position the drill bit on the mark and go. But the drill doesn't bite in exactly where you want the hole. So you start the hole with a center punch or perhaps a prick punch and then a center punch. If the punch is deep enough (as wide as the drill web) and the drill is accurately ground, it will start at the center punch and drill in the right place.

Accurately center-punching the hole is a skill in itself. Some people advocate lightly scribing two intersecting lines and then feeling for the two lines to locate a prick punch, then over-punching with a center punch. If the prick mark did not come out exactly right, you may be able to move it slightly with a few more taps while holding the punch at an angle.

There are devices that allow you to position the center punch very accurately using an optical magnifier (Figure 1), from Mitutoyo, Flexbar, On Mark, and Veritas as well as some generic copies and even some articles to make your own. Starrett even makes a toolmakers' hammer with a built-in magnifier (Starrett model 815) for this job. These are handy tools, but in my opinion, not perfect. They still rely on the drill accurately following the punch.

Figure 1 – Optical Center Punch (catalog photo)

To get the drill to start precisely in location, the punch should match the angle of the drill point. If you use a 135 degree angle drill bit, for example, use a 135 degree center punch. Otherwise, the drill might remove the depression and then wander to a new location.

Even better, start drilling with a short, stubby "center drill" (Figure 2). A center drill is not engineered for quickly removing material, but instead for drilling in exactly the right spot and not wandering. Center drills are also used for making 60 degree conic depressions in the end of lathe and grinder work. Center drills are available in a few standard (thought cryptic) sizes: #1 through #5 (Table 1).

Figure 2 – Set of Center Drills (catalog photo)

Number	Overall Diameter	Nose Diameter
1	0.1250”	0.0469”
2	0.1875”	0.0781”
3	0.2500”	0.1094”
4	0.3125”	0.1250”
5	0.4375”	0.1875”

Table 1 – Dimensions of Imperial size center drills

For most jobs, starting with a center punch, following with a center drill, and then proceeding with the final-size drill bit works well. But most of us don’t have enough horsepower to push a really large drill into solid steel. So for large holes like 1”, you may want to start with a large center drill such as a #3, follow with a ¼” drill bit, then progress up to a ½” drill, a ¾” drill and finish with a 1” drill. If you need a smooth hole, you could drill 0.02” undersized and then finish with a reamer. If you need a perfectly round hole, you could drill undersized and then finish with a boring bar.

But in my experience, none of these techniques allow me to position holes exactly where I need them, quickly and repeatedly. Even when the punch is right, the drill won’t necessarily follow perfectly. I recently needed to drill 30 holes 0.272” in exact locations (clearance holes for 5/16-24 tapping) in the end of a steel plate 24” x 6” x ½”, exactly centered and precisely spaced from each other. Although not impossible, this would be very difficult to setup in the mill.

When the utmost accuracy is required, I find that the most practical method of locating a hole is to use a drill guide. A drill guide is simply a block with a hole in it exactly the same size as the desired hole. Clamp the guide in place over the work, and it will guide the drill bit into the work exactly where the guide is placed. The drill can’t walk because the guide constrains it on all sides.

For this job, I used a tool made for woodworking called a Dowl-It self-centering doweling jig (Figure 3). This drill guide uses matching left-handed and right-handed screws to clamp a drill guide block on the edge of a part. The drill guide block itself has a number of holes in it to guide standard size drills. You can make drill bushings with a metal lathe to reduce the size of one of the standard size holes to a desired size.

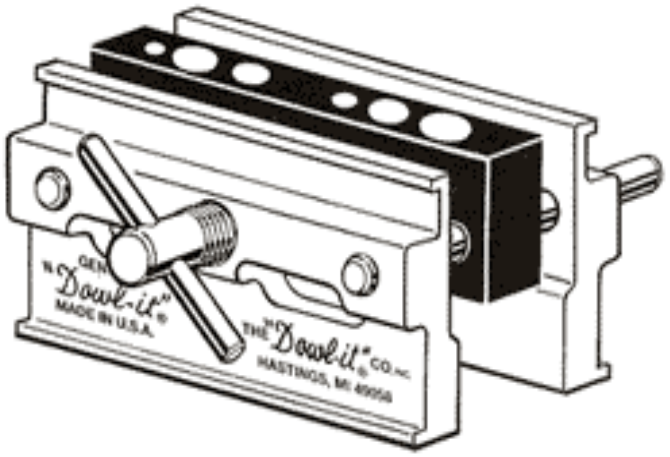


Figure 3 – Dowl-It Drill Guide (catalog drawing)

My drill guide has a 5/16” hole on the left of the screw and a 7/16” hole on the right side of the screw, 1.2” apart. Using those two holes, I get holes that are exactly 1.2” apart.

For my project, I made two drill bushings – one to reduce 7/16” to 0.272” and the other to reduce 5/16” to 0.272”. I aligned the 5/16” guide hole to the first location using a scratch mark and drilled that hole with a drill press using my smaller bushing. Then I removed the drill bushing and tapped the hole 5/16-24 using the jig to start the tap straight (Figure 4). The tap is relatively short, so once the tap had progressed 6 turns into the work, I had to remove the jig and finish tapping unguided.

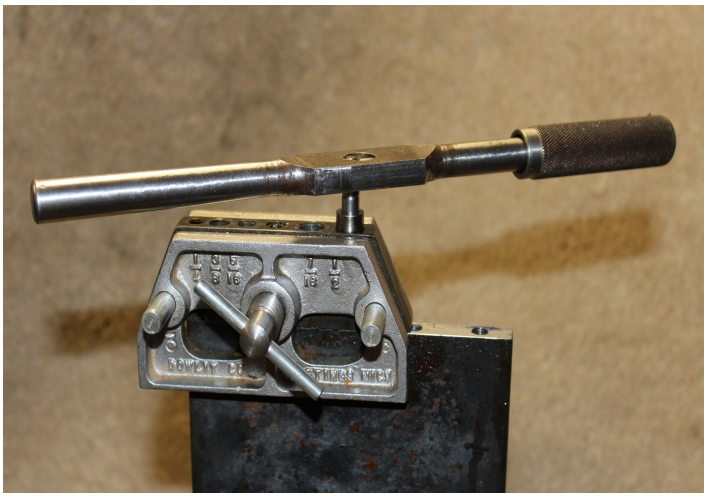


Figure 4 – Holding the Tap Perfectly Vertical

Next, I placed a 5/16” bolt in the 5/16” jig hole and used this bolt to re-align the jig to the finished hole so I could start the next hole using the 7/16” guide and larger bushing (Figure 5). This insured that I had a series of holes exactly 1.2” on centers, accurately centered on the work, perfectly perpendicular to the work. To drill these holes in a long plate, the table of the drill press must be very low on the column. When I pressed on the quill, the column flexed slightly so the drill bit wasn’t perfectly vertical. But this wasn’t a problem because the guide kept the drill straight compared to the work. As the drill column flexed, the bottom end of the work moved slightly on the drill table to compensate. Figure 6 shows that this worked very well.

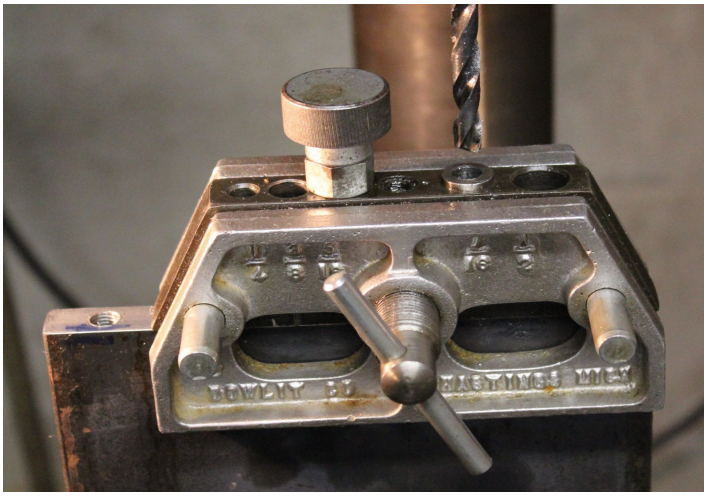


Figure 5 – Positioning the Next Hole

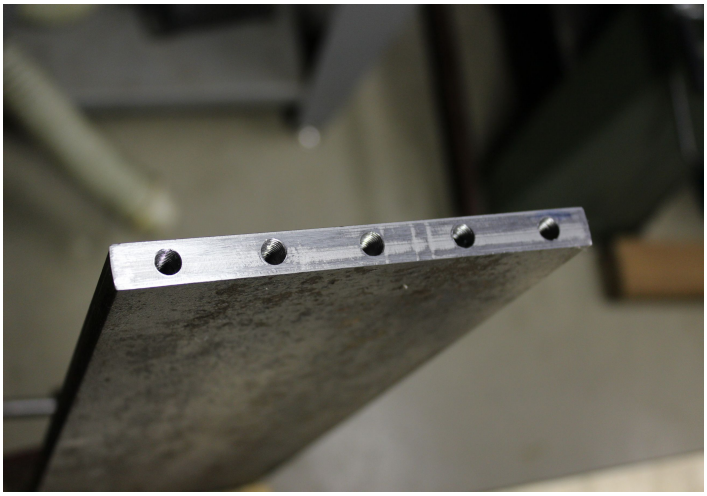


Figure 6 – One Finished Plate

You can also make your own drill guide with multiple holes drilled at precise spacings and clamp that onto your work. For most jobs, an aluminum drill guide is adequate, but a steel guide like the Dowl-It will last through hundreds of holes. The same company makes a few different jigs that sell for $35 to $80. The more expensive models handle wider parts and come with replaceable bushings. These are available retail from many woodworking suppliers and also from Amazon.

Make your own optical center punch:

www.gadgetbuilder.com/OpticalPunch.html
www.nucleus.com/~harlan/punch.html

Starrett model 815 Toolmakers' Hammer with built-in magnifying lens:

www.starrett.com/metrology/product-detail?k-815

More information on Dowl-It drill jigs:

www.dowl-it.com

Upcoming Events

Bill Brackett

To add an event, please send a brief description, time, place and a contact person to call for further information to Bill Brackett at events@neme-s.org

Aug 5th Belltown Antique Car Club
46th annual summer show
East Hampton
www.belltownantiquecarclub.org/shows/engine%20show%20main.htm

Aug 4-5th Scribner's Mill Show
Sebago Lake Region near Harrison ME
207-583-6455

Aug 11th -12th Straw Hollow Engine Show
Boylston, MA
J. A. Resseguie 508-869-2089

Aug 18th -19th Race of the Century
The Collings Foundation
137 Barton Road in Stow, MA Cost at gate: $15 Adults
www.collingsfoundation.org/cf_OpenHouseEvents12.htm

Aug 19th 9:00am The Flea at MIT
Albany Street Garage at the corner of Albany and Main Streets in Cambridge

Aug 24-26th 42nd Annual Meet
Waushakum Live Steamers
Holliston MA
www.waushakumlivesteamers.org/

Aug 30th –Sept 1st Vermont Gas & Steam Engine Assoc
Intersection Rte 100 and Rte 107 Stockbridge VT
Gail Norman 802-485-8224

Sept 6th Thursday 7PM
NEMES Monthly club meeting
Charles River Museum of Industry 781-893-5410
Waltham, MA

Sept 7th -9th Fall Meet
Pioneer Valley Live Steamers
Southwick MA.
www.pioneervalleylivesteamers.org/

Sept 8-9th Dublin Show
RT 101, Dublin, NH

Sept 7th-16th Annual Lee's Mills Steamboat meet
Lake Winnipesaukee Lees Mills NH
www.steamboating.org/

Sept 16th 9:00am The Flea at MIT
Albany Street Garage at the corner of Albany and Main Streets in Cambridge

Sept 28th-30th Connecticut Antique Machinery Museum Fall Festival
www.ctamachinery.com/