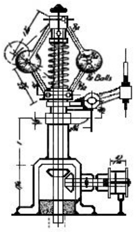

The NEMES Gazette

New England Model Engineering Society Inc.

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Presidents Corner

Victor Kozakevich

The speaker for May will be Ed Gordon representing the Old Schwamb Mill in Arlington. The mill is a living museum, carrying on the manufacture of oval wood picture frames while giving a view of a local industry as it might have operated over a hundred years ago, using the original machinery. The presentation should include some video from the museum as well as photos and discussion.

As you may have heard, our Treasurer David Baker is heading off to college this fall. First, I'd like to thank David for his service over the past several years, and wish him well as he moves on.

Secondly, this offers an opportunity for another member to step up and take over the position as Treasurer. We'll discuss this at the meeting and welcome volunteers.

We had out first meeting in the downstairs museum hall in April, and it seemed to offer adequate space for the purpose. It turns out the museum owns about 40 or so folding chairs which seemed to serve well, so any extra chair purchase seems to be a non-issue for the moment. We'll probably have to try a few different chair layouts to find the optimum arrangement for meetings, I welcome any input.

By meeting time, those who attended Cabin Fever and NAMES should be back, so we'd love to hear your stories. Please take a few minutes at the start of the meeting to tell us about your finds and experiences.

Next Meeting

Thursday, May 1st, 2014

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) 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.

Issue	Contributions Due
JUN	MAY 22, 2014
JUL	JUN 19, 2014
JUN	JUL 22, 2014

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Shop Talk

Bob Neidorff

Checking Torque Wrenches

It's amazing how much tool you can get for so little, when you are willing to accept low quality imports. I bought two torque wrenches from Harbor Freight for $10 each. One is 3/8" square drive and the other is ½" square drive. They are ratchets and "click" when the preset torque is reached. The handle is rough knurled steel, so it is not the most comfortable thing to use. The torque value is adjusted by rotating the handle, which must be tightening a spring in the tool itself.

Figure 1 – Harbor Freight ½" Torque Wrench

Figure 2 – Harbor Freight 3/8" Torque Wrench

I've used these torque wrenches a few times when working on the car and they seem to be fine. The larger one comes in handy for tightening wheel lug-nuts. The smaller one is a good size for tightening spark plugs in aluminum heads. But I really question whether these tools are accurate. The website claims 4% accuracy. This weekend, I decided to check them myself to see if they were really that good.

To check a torque wrench, you apply a gradually increasing torque to the wrench and measure the point where the wrench clicks. You can either do this with a fixed-length beam and a variable weight or with a fixed weight and a variable length beam. I decided to use a fixed weight.

For a beam, I used a 36" long piece of heavy aluminum angle. Near one end, I drilled a 3/8" hole and inserted a 5/16" bolt and long 5/16" nut. After a few minutes, I realized that this was a mistake. No matter how much I tightened the bolt, when I tried to apply high torque to the nut, it would spin.

So I removed the bolt, drilled the hole slightly larger and tapped the hole ½-13. I used a drill that was too small for that size tap, which made tapping very difficult, but it resulted in a tapped hole with slightly more thread engagement, for slightly more strength. Then I put a ½-13 bolt through it and tightened it fairly well, and put a long nut on the other end of the bolt and tightened the nut to the bolt and to the angle as tightly as I could. I gave it a test with the large torque wrench set to 80 foot pounds, and it seemed to stay put, so this worked.

When I was done, I felt really proud. Then I realized that the long nut was 7/8" across the flats, and I didn't have a 3/8" drive socket that is 7/8". So this wouldn't work for my 3/8" torque wrench.

At the other end of the beam, I drilled a letter U hole (0.368") and then carefully filed the hole square until it just barely accepted the 3/8" square drive of the ratchet. I made an extremely tight fit for best strength. This was probably unnecessary, because after 10 minutes of using the beam, my beautiful square hole was worn oversized, but still holding adequately. Now I had a place to insert the 3/8" ratchet.

As a finishing touch, I marked the beam with inch increments with a permanent marker.

Figure 3 – Beam with 3/8" square drive on one end

Figure 4 – Beam with 7/8” Long Nut on the other end

For precision weights, I used two scraps of steel that I had left over. One weighed 10.6 pounds and the other weighed 24.6 pounds.The lighter weight was better for lower torques and the larger weight was required for higher torques.

I drilled a hole in the scraps and inserted a screw eye, allowing me to hang the scraps from a hook around the beam. With the torque wrench held in a bench vice and the beam on the wrench, protruding horizontally, I can slide the scrap (weight) until the torque wrench clicks, similar to the way that you would use a sliding weight on a physician’s scale, then record the position of the weight.

Figure 5 – Torque wrench being checked

I recorded the weight and length for each torque wrench, varying the wrench setting from 20 foot-pounds to 80 foot-pounds.

The math for torque calculation is very simple.

Torque = Weight x Distance.

As an example, with the torque wrench set to 60 foot-pounds, I positioned the 24.6 pound weight along the beam and had the wrench click when the weight was 24¼” from the pivot point. I added a slight amount to the weight value to include the weight of the beam and calculated

T = 25 * 24¼ = 606 inch-pounds or 50.5 foot pounds

roughly 16% less than expected.

The other results were similar to that example. Every measurement on my 3/8” and ½” torque wrench was lower than expected. The ½” torque wrench was 16% to 20% low and the 3/8” torque wrench was 20% to 40% low, with the worst accuracy at lower torques.

But that’s not the end of the story. I shared my results with a discussion group and got a reply saying that my test method was flawed. The person who replied didn’t tell me why it was flawed, but he said that you must test the wrench by applying force to a specific part of the wrench – the smooth groove in the knurled handle. If you put pressure anywhere else, the results won’t be accurate.

That sounded like hogwash to me, but I had to try before judging. So I changed my setup. I clamped the square end of the ½” torque wrench in a vice and held the wrench body horizontal. I hung my 24.5 pound weight on the smooth part of the wrench handle and turned the handle until the wrench clicked.

The wrench itself weighs 2.6 pounds, so I figure that the wrench is adding roughly 1.3 pounds of additional force on the handle, so I did my math with 25.8 pounds of force. The weight hung 14.5” from the center of the square drive. So I calculate a torque of 25.8 pounds * 14.5/12 feet = 31.2 foot-pounds. Would you believe me if I told you that the wrench just clicked when set to 32 foot-pounds? That’s within 2.5% of perfect, which is well within the 4% specification. Wow.

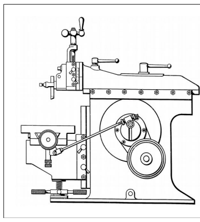
I repeated this test with my 3/8” torque wrench, but the results were not as satisfying. The wrench just clicked when set to 29 foot-pounds. The wrench weighs 2 pounds and the smooth section of this wrench is 11.5” from the square drive. So I calculate a torque of 25.5 * 11.5 / 12 = 24.5 foot-pounds. That’s still too little torque.

But…is it possible that the torque wrench is really good and I’m just reading the handle wrong? If I were off by 5 pounds (one full step) it would be accurate. The 3/8” wrench has graduations spaced very close together. I looked again, and it is clearly set to 29 foot-pounds, not 24 foot-pounds. So I wonder if this wrench is good, but the handle is just misassembled so it reads one graduation high.

Figure 6 –Graduations On My 3/8” Torque Wrench
Showing 29 Foot Pounds

So I’m not ready to condemn Harbor Freight tools yet. My larger torque wrench is probably good and my smaller one is useful now that I know to subtract 5 from the reading on the handle.

And I don’t know why my old test method was bad, but there is a difference between the old method and the new method. Fortunately, nothing that I do requires 4% accurate torques.



Metal Shapers

Kay Fisher

R. G. Sparber’s Gingery Shaper - Part 48

The Cross Slide and Cross Feed Assembly (2 of 5)

The Cross Feed Screw Bearings

I love to do casting but this part just does not justify the effort. I milled these supports out of ¾” square aluminum bar stock instead.

Bearing Supports Photo by R. G. Sparber

After layout, I used a bandsaw to remove most of the excess. I then milled down to the marked surface. This thickness is not critical but I did take care to make both supports identical.

Drilling for Bearing Photo by R. G. Sparber

The stop on the left side plus the steps in the soft jaws enabled me to put both $^3/_8$” holes in the same place. I first drilled $^{23}/_{64}$" and then followed with a $^{3}/_{8}$" reamer.

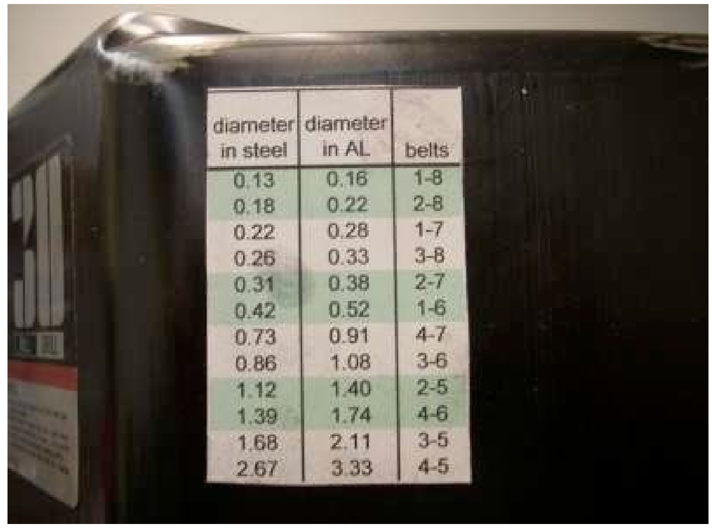
Contrary to Gingery's suggestion to next mount the bearings on the cross slide support casting, I put the assembly aside until the cross slide was done.

Cross Slide Photo by R. G. Sparber

This is the second casting done with my new Petrobond. The result has nice crisp corners.

After Cleanup Photo by R. G. Sparber

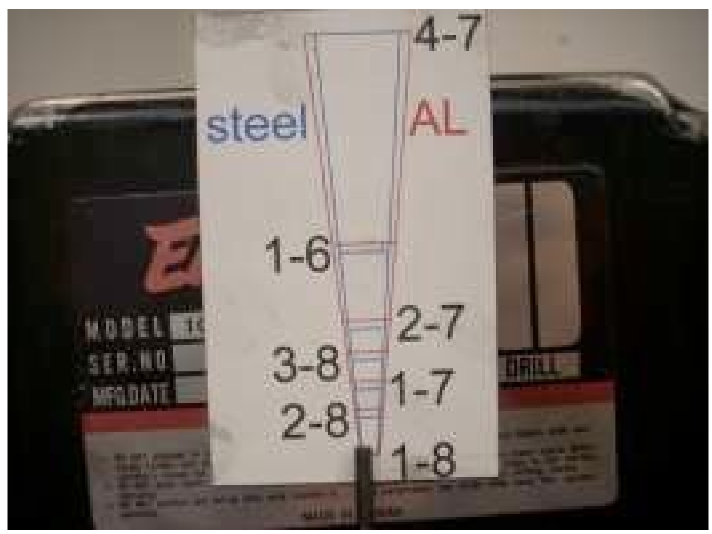
It only required a few minutes with a bandsaw and belt sander to transform the casting into a much more attractive raw part.



diameter in steel	diameter in AL	belts
0.13	0.16	1-8
0.18	0.22	2-8
0.22	0.28	1-7
0.26	0.33	3-8
0.31	0.38	2-7
0.42	0.52	1-6
0.73	0.91	4-7
0.86	1.08	3-6
1.12	1.40	2-5
1.39	1.74	4-6
1.68	2.11	3-5
2.67	3.33	4-5

Drill Speed Chart Photo by R. G. Sparber

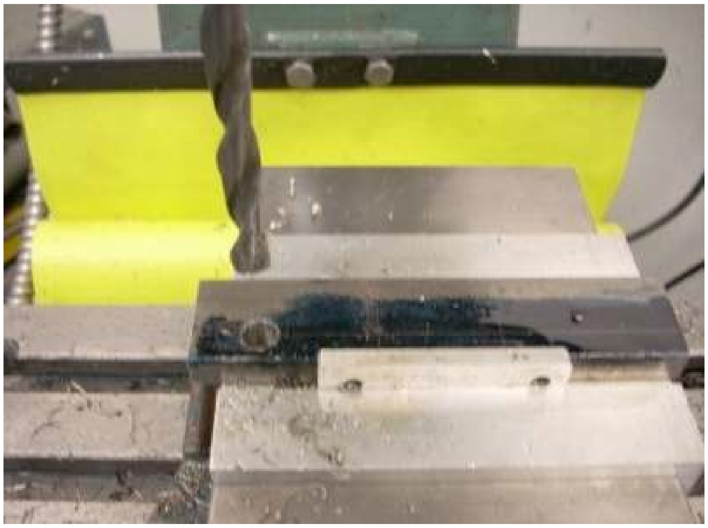
In the past, I have taken the drill diameter and used it to calculate the required RPM. The RPM was then used to pick which set of belt positions comes closest to that RPM. Today it dawned on me that there is an easier way. I took each possible RPM for my mill and worked backwards to find the drill diameter that matches it. For steel, I use 80 SFPM and 100 SFPM for aluminum. The result is the table above. For example, a $^{3}/_{8}$" drill is between 0.31" and 0.42" so for steel I should use belts 2-7 to go a little faster than ideal or 1-6 to go a bit slower. After making this table, I realized I could make the task a little easier.



Drill to Belt Chart Photo by R. G. Sparber

Now I hold the drill (or end mill) up to this figure to find the nearest set of belts. I also made 2 more copies and cut out the V for steel on one and aluminum on the other. Slide the V onto the shank and read off the belts.

Now let me describe making the clamps.



Drilling Clamps   Photo by R. G. Sparber

The clamps are drilled with a clearance drill. The packing in the front puts the movable jaw back enough to clear the drill.

Clamps Ready   Photo by R. G. Sparber

The clamps are ready to go so the next step is to machine the cross slide casting. I have labeled the wide clamp support “B” and the narrow one “C” just for backup. I have also marked the primary reference plane 1, not shown, and secondary reference plane 1 marked 1'.

Squaring Soft Pads   Photo by R. G. Sparber

My soft pads are clamped to the mill table and a light cut is made with the end mill. I now have precision X axis stops.

Letters to the Editor

Bill Brackett

From cotton to cloth.

- A production line showing the stages of changing raw cotton into final woven fabric.

Steam, early American power.

- Where does steam come from and how is it generated. Tracing the making of steam from boiler to final use, including the operator panel for control and safety.

Evolution of power.

- A history of power generation from water thru steam to electricity.

Upcoming Events

Bill Brackett

To add an event, please send a brief description, time, place and a contact person.

May 4th NHPOTP engine show
RT 113 Dunstable MA
Robt Wilkie 207-748-1092

May 1st Thursday 7PM
NEMES Monthly club meeting
Charles River Museum of Industry 781-893-5410
Waltham, MA

May 18th Spring Steam-up
Waushakum Live Steamers
Holliston MA
http://www.waushakumlivesteamers.org

May 18th 9:00am The Flea at MIT
Albany Street Garage at the corner of Albany and Main Streets in Cambridge

May 24-25th Bernardston Show
Rt 10 off Rt 91 Bernardston, MA
Vickie Ovitt 413-648-5215

May 24th American Precision Museum opens
http://www.americanprecision.org

June 5th Thursday 7PM
NEMES Monthly club meeting
Charles River Museum of Industry 781-893-5410
Waltham, MA

June14-15th call Wings and Wheels Open House

The Collings Foundation
137 Barton Road in Stow, MA
Cost at gate: $15 Adults
http://www.collingsfoundation.org/menu.htm

June 14-16th Call Father's Day Meet
Pioneer Valley Live Steamers
Southwick MA.
http://www.pioneervalleylivesteamers.org

June 22nd 11th Annual Van Brocklin Meet
Waushakum Live Steamers
Holliston MA
http://www.waushakumlivesteamers.org

June 15th 9:00am The Flea at MIT
Albany Street Garage at the corner of Albany and Main Streets in Cambridge

June 28-29th Orange Show
Orange Airport Orange MA
www.cmsgma.com