

The NEMES

NEW ENGLAND MODEL ENGINEERING SOCIETY INC.

Gazette

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Presidents Corner

Victor Kozakevich

I was unable to schedule a speaker for June, so instead, I'd like to show a DVD I borrowed, a documentary about how industry developed along the Charles River, including Waltham, Newton and beyond. It was done by a local film maker and includes some shots done at CRMI. It runs 60 minutes.(I plan to use our DVD player with the projector, patching audio to the PA- I expect a clear presentation)

According to the description of the film, **Charles River: Headwaters of Invention**, the American Industrial Revolution began in 1813 on the Charles River in Waltham, Mass., when an entrepreneur named Francis Cabot Lowell figured out how to bring all the operations of milling cotton under one roof. During the course of the 19th Century, the lower reaches of the Charles became one of the most heavily industrialized regions in the country, home to textile and paper mills, machine shops and industries of all kinds. Manufacturers were drawn first to the Charles' steady supply of water power, then to the skilled workforce created to keep the mills running.

The folks from The Old Schwamb Mill in Arlington gave a wonderful presentation in May to a full house. We appear to have enough space in the Museum to accommodate a good turnout, so it looks like the change of location has had little impact.

Thursday, June 5th, 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

JUL	JUN 19, 2014
AUG	JUL 22, 2014
SEP	AUG 21, 2014

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I'd like to thank Richard Baker for stepping up to fill the position of Treasurer after David Baker heads off to college in the fall. I believe the formal vote will be at the June meeting.

The July meeting will be our traditional Poster Session. So clean the dust off those half-finished projects, bring them along and prepare to be inspired.



HOW GPS CAME ABOUT

When the Russians lofted Sputnik I into orbit, George Weiffenbach, at Johns Hopkins Applied Physics Lab, had the essentials for receiving its signals because he was working on a Ph.D. dissertation in microwave spectroscopy. George had a good 20-MHz receiver, just 12 miles from WWV, the time standard. The Russians had set the Sputnik frequency about 1kHz from an exact 20 MHz so the receiver could produce an audio tone that varied from about 1500 Hz to about 500 Hz, never going through zero. Weiffenbach and his partner Bill Guier decided to record the signals, with an identifying time stamp and so they recorded complete passes of the satellite from horizon to horizon. Estimating the total swing in frequency and using the simplest equation for the Doppler shift proved that Sputnik was orbiting the Earth as advertised. Using the maximum slope of the Doppler shift gave an estimate of the closest approach of Sputnik.

At that time, only this APL group measured and analyzed Doppler data because every other organization in the world, with the ability to track satellites, used angle measurements based on radio interferometers. They demonstrated that, with the whole Doppler curve, from horizon to horizon, (with some corrections for ionospheric refraction and transmitter stability), a complete set of orbit parameters could be inferred, with useful accuracy, from a single set of Doppler data.

On Monday, 17 March 1958, Frank McClure, Director of APL asked Guier and Weiffenbach if the solution could be inverted: "If the orbit was known could the station position be determined?", a problem later known as the 'navigation problem'. They quickly determined that, given a 'co-operative' satellite, radiating two frequencies that are very stable and sufficiently high to effectively eliminate ionospheric

refraction errors, the station location could be determined with unbelievable accuracy.

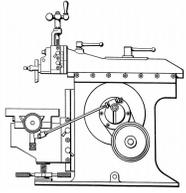
Later, they learned that the Navy wanted the answer because of concern about navigating Polaris submarines such that a launch location at sea would be accurately known, ideally within a hundred feet. Calculating accurate trajectories for a missile launch required precise knowledge of the submarine's location.

The outcome, in a remarkably short time, (just three years after Sputnik's launch) was the complete Transit system: multiple polar orbiting satellites radiating two multistable frequencies encoded with the orbit parameters (received from an injection station transmitting these parameters to the satellite), and submarine navigation receivers/computers to determine their position, about once an hour, anywhere on earth. The military would steer its ships using these artificial stars of satellite technology, just as sailors had used the stars to navigate, for thousands of years.

In 1983, when Korean Air Lines Flight 007 drifted into Russian airspace due to faulty, ground-based navigation beacons, and was shot down, Ronald Reagan declared that satellite navigation should be 'a common good', open to civilian use and the GPS system became available to the public. Now, fifty years later, the earth is blanketed with navigational signals from about thirty GPS satellites, providing navigational data for mobile phones, aircraft, ships and, even, digital cameras.

Guier WH, Weiffenbach GC. *Genesis of Satellite Navigation* Johns Hopkins APL Technical Digest V.18 #2 (1997).

Johnson, S. *Where good ideas come from: the natural history of innovation*. Riverhead Books, N.Y. 2010.



Metal Shapers

Kay Fisher

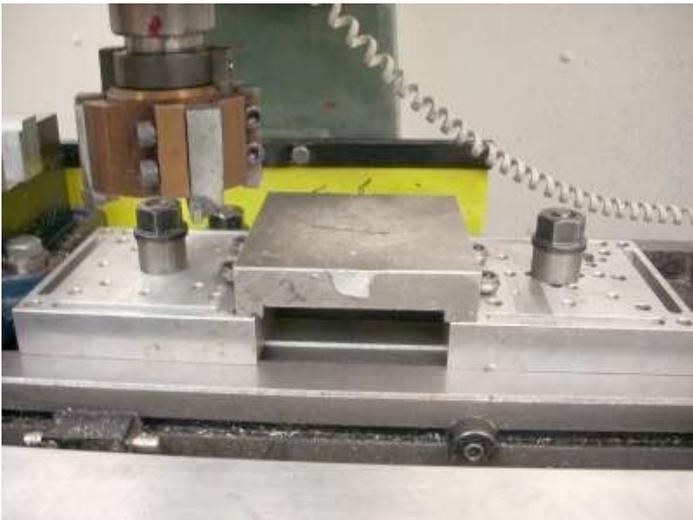
R. G. Sparber's Gingery Shaper - Part 49

The Cross Slide and Cross Feed Assembly (3 of 5)



Cross Slide Mounted Photo by R. G. Sparber

My primary reference plane 1 is down on the table and I'm ready to take a light cut on the secondary reference plane 1. The X axis pads are not needed for this cut.



Cross Slide Remounted Photo by R. G. Sparber

I now use my newly cut secondary reference plane 1 to support the casting. Eccentric screws are used to hold the casting down and give my shell mill full access to primary reference plane 1.



After 1st Pass Photo by R. G. Sparber

After the first pass of the shell mill, you can see there was some minor shrinkage. I've only gone in about 0.005" so will make another pass.



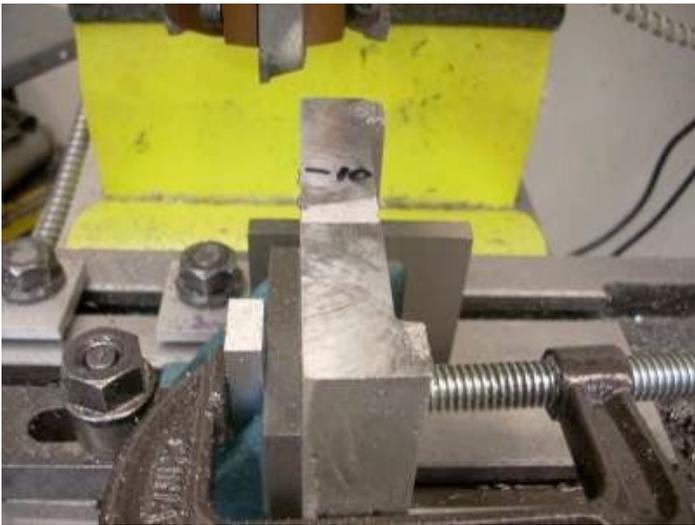
After 3rd Pass Photo by R. G. Sparber

I made two more passes for a total removal of 0.016", giving a true primary reference plane 1.



Cutting Ref 2 Photo by R. G. Sparber

Using a pair of knees, I cut secondary reference plane 2 which is the edge of the casting. Only 0.005" was removed to get a uniform surface.



Cutting Other End Photo by R. G. Sparber

Secondary reference plane 2 is now down on the table. After taking 0.010" from primary reference plane 2, I still had an area in the center that was not touched. This was from the bandsaw and about 0.02" deeper. I decided to just leave it.



Cutting Blocks Photo by R. G. Sparber

With primary reference plane 1 down on the table and primary reference plane 2 against the soft pads, it was time to cut the clamp support blocks and the wear pads. I did not bother to cast the relief depression beyond the wear pads. It is easy enough to mill that area out.



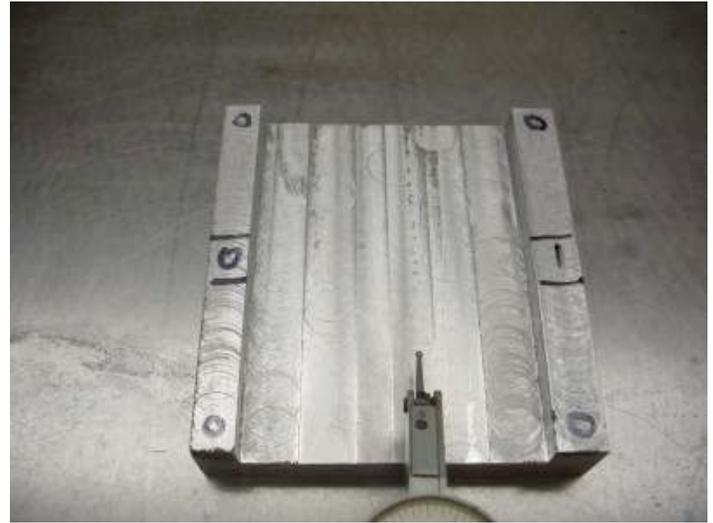
Pads Done Photo by R. G. Sparber

I cut both wear pads about $\frac{5}{8}$ " wide and then milled the relief depression 0.02" deeper.



Testing for True Photo by R. G. Sparber

I have machined castings like this many times but still check the resulting part before declaring success. In this case, the clamp supports were out of true by 0.012"! I must have missed a speck of swarf under the casting. This will be fixed the mill. At least I had the sense not to tear down the set up until the part was tested.

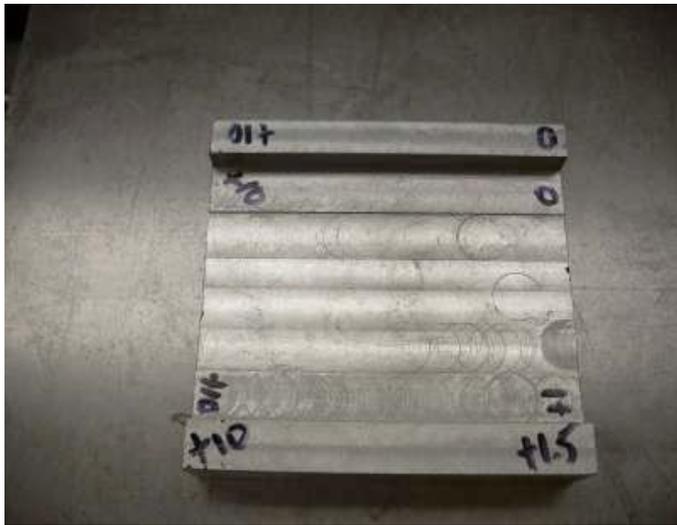


More Measuring Photo by R. G. Sparber

After remachining, I got 0 along the left clamp pad and across the right clamp pad. Zero was set at the near end of each pad. I then ran the DTI from left to right in the center and saw 0.001" difference. This says each pad is true with respect to primary reference plane 1 (the back of the casting) but the right pad is slightly higher. This is not a problem since shims are placed between the clamps and the clamp pads.

Stay Tuned for part 50 from R. G. Sparber next month.

Keep sending me email with questions and interesting shaper stories.



Identifying Error Photo by R. G. Sparber

Here are more details. The top right corner is my reference. The top right pad is high by 0.010". The wear pad is off the same amount which is no surprise. Coming across to the other pad you see that I am off by the same amount. This says that the right edge of the casting was raised, perhaps by some debris.

The lower right corner is up 0.015" so the castings also had a little twist. Fortunately I have plenty of metal here so will just re-machine this face.



Editor's Desk
George Gallant

We have discussed many times the need to assist the President in finding speakers and organizing presentations. Another year has passed and the task fell exclusively on Victor. I would like to propose that we form a speakers committee consisting of three members who serve a three moth term. Just like the draft, serving on the committee would be compulsory.

We could take the list of club members who reside in the New England area and randomly assign the dates that they would be on the committee.

Remeber, YOU could be the next president!!!



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

thebracketts@verizon.net or 508-393-6290.

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

June 14-15th 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 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

July 3rd Thursday 7PM
NEMES Monthly club meeting
Charles River Museum of Industry 781-893-5410
Waltham, MA

July 5th Antique Engine Meet & Tractor Meet
Boothbay Railway Village
Rt 27 Boothbay ME
www.railayvillage.org

July 6th Pepperell Show
RT 111 Pepperell, MA Ken Spalding 978-433-5540

July 20th 9:00am The Flea at MIT
Albany Street Garage at the corner of Albany and
Main Streets in Cambridge

July 20th antique car and motorcycle club
Waushakum Live Steamers
Holliston MA
<http://www.waushakumlivesteamers.org/>

July 26th 27th 8:30- 4:30 Race of the Century
The Collings Foundation
137 Barton Road in Stow, MA Cost at gate: \$15
Adults
<http://www.collingsfoundation.org/menu.htm>

July 25th -27th Eliot Antique Tractor & Engine Show
Raitt Homestead Farm, Rt 103
Eliot ME. Lisa Raitt 207-748-3303