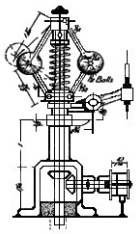

The NEMES Gazette

NEW ENGLAND MODEL ENGINEERING SOCIETY INC.

No. 219 July 2014

Presidents Corner

Victor Kozakevich

There will be no meeting for July. We will have our poster session in August.

Thanks to everyone who attended the June meeting for the Charles River documentary. For anyone who missed it, or if you care to share with a friend, the film is available for streaming on your computer. Go to newtv.org and in the search window at upper right type “Charles”. The film: *Charles River: Headwaters of Invention*, should be the first title.

Have a happy 4th of July everyone, and see you in August.

Thursday, August 7th, 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 Richard 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
AUG	JUL 22, 2014
SEP	AUG 21, 2014
OCT	SEP 18, 2014

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Shop Talk

Max benAaron

INNOVATIONS THAT CHANGED THE WORLD

According to legend, one day Pythagoras passed blacksmiths at work at their forges. The sounds, as they struck their anvils were beautiful and harmonious. Examining the anvils more closely, he realized that the anvils were "simple ratios of each other, one was half the size of the first, another was 2/3 the size, and so on." In a great leap of imagination, he realized that the relation between the size of the anvil and the musical note produced was mathematical in nature and so discovered the relationship between the length of a string and the note produced when it was plucked. This was the first application of mathematics to physics. These observations lay within the framework of the Pythagorean tradition of music, well-known to instrument makers, that subdividing a string by a whole number produces a harmonious scale.

Aristotle defined an *a priori* argument as one which proceeds from law, or cause, to effect, as opposed to an *a posteriori* argument, which goes from effect to cause. In modern language, *a priori* refers to deductive logic and *a posterior* refers to statistical or scientific inference.

> "It is frequently stated that sciences are constructed by first making inductions on the basis of large numbers of observations and experiments and then testing deductions derived from these inductions. Although one could find examples of research that follow this narrow and schematic pattern of reasoning, I think that most of the important and far-reaching scientific theories were not obtained in this fashion. Galileo and Newton did not induce the concepts of force, momentum, and acceleration, nor did Einstein reach his two theories of relativity by generalizations based on series of uniform observations.
>
> From these examples we may conclude that the logic of science transcends the norms suggested by traditional logic. All the theories mentioned were created by their propounders. ... they were "retroduced" and (that) retroduction is the most fertile logical method employed by scientists".

On July 19, 1595, Johannes Kepler was teaching at the Protestant School in Graz, demonstrating the periodic conjunction of Saturn and Jupiter in the zodiac. In a transcendent epiphany Kepler thought he had revealed God's geometrical plan for the universe; he realized that regular polygons bound one inscribed and one circumscribed circle at definite ratios. He thought that this could be the basis for mathematical correspondences between the relative radii of the orbits of the six known planets –– Mercury, Venus, Earth, Mars, Jupiter, and Saturn. He failed to find a unique arrangement of polygons that fit known astronomical observations.

Kepler, a mathematician, knew that each of the five Platonic solids could be uniquely inscribed and circumscribed by spheres. Nesting these solids, each encased in a sphere, within one another would produce six layers, with well-defined ratios between the radii of the spheres. By ordering the solids correctly –– octahedron, icosahedron, dodecahedron, tetrahedron, cube –– Kepler found that the spheres could be placed at intervals corresponding (within the accuracy limits of available astronomical observations) to the relative sizes of each planet's path, assuming the planets circle the Sun. He also found a formula relating the size of each planet's orb to the length of its orbital period: from inner to outer planets, the ratio of increase in orbital period is twice the difference in orbital radius. However, Kepler later rejected this formula, because it was not precise enough, in itself an enormously innovative action.

In his first major astronomical work, *Mysterium Cosmographicum* (The Cosmographic Mystery) Kepler leaped over the boundary separating the medieval world and modern science. In *Astronomia Nova* of 1605 he was the first to look for a universal physical law based on terrestrial mechanics to comprehend the whole universe in its quantitative details. In retrospect, what he achieved was to resuscitate an ancient *a posteriori* idea: *physical laws are mathematical in nature.* After almost two millenia, his flash of insight revived theoretical physics and prepared the ground for the great new scientific era we now enjoy.

The idea that one could state a law and, *a posteriori*, derive the physical consequences of that law, the basis of experimental physics, also lay dormant for the next 20 centuries after Pythagoras, until Galileo Galilei's father, Vincenzo Galilei, a lutenist and music theorist, performed

experiments re-establishing perhaps the oldest known non-linear relation in physics: for a stretched string, the pitch varies as the square root of the tension.

Young Galileo Galilei could see his own father's observations expand on the tradition that a limited amount of mathematics related music and physical science. He also clearly stated that the laws of nature are mathematical. In *The Assayer* he wrote:

> "Philosophy is written in this grand book, the universe . ... It is written in the language of mathematics, and its characters are triangles, circles, and other geometric figures."

His *a priori* method pioneered the use of quantitative experiments whose results could be analyzed with mathematical precision.

In 1592, Galileo moved to the University of Padua, teaching geometry, mechanics, and astronomy until 1610. During this period he made significant discoveries in both pure science (for example, kinematics of motion, and astronomy) and applied science (for example, strength of materials, improvement of the telescope). His multiple interests included the study of astrology, which in pre-modern disciplinary practice was seen as correlated to the studies of mathematics and astronomy, and separating science from both philosophy and religion; a major development in human thought.

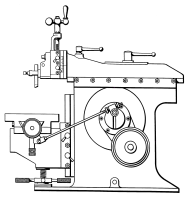
Many innovators manage to maintain a child-like vision of their world. Galileo,in 1632 said of Kepler:

> “Among the great men who have philosophized about [the action of the tides], the one who surprised me most is Kepler. He was a person of independent genius, [but he] became interested in the action of the moon on the water, and in other occult phenomena, and similar childishness.”

(I suspect an error in translation. It makes much more sense to translate the last word as ‘child-like ideas”).

The confluence of both streams, the *a posteriori* and the *a priori* methods, came to fruition when, in the opening decades of the 20th century, in a period of incredibly rapid innovation in physics, Planck, Einstein and others developed theories of a most profound and ambitious nature with no more tools than pencil, paper and their own thought. Theoretical investigations were used very effectively to direct complementary *a posteriori* experimentation. Can you imagine the state of the physical sciences today if theoreticians were disdained, as they are in contemporary neurophysical research? The progress of the physical sciences would surely have been severely curtailed.

*Rosenblueth A. *Mind and brain: A Philosophy of Science*. MIT Press Cambridge MA. 1970.



Metal Shapers

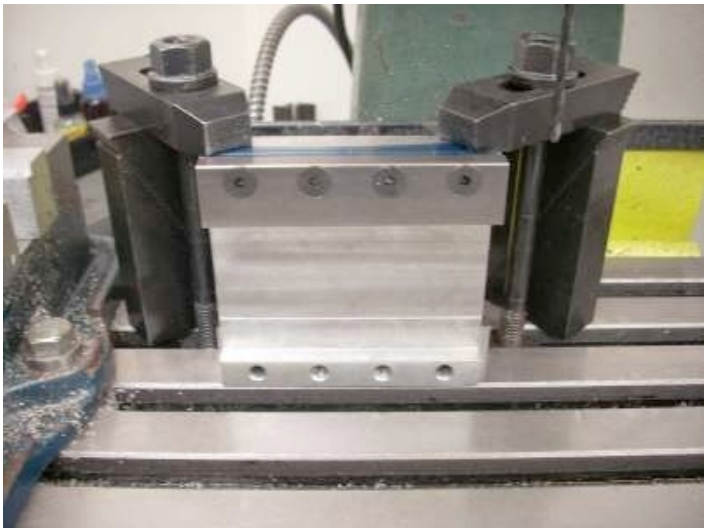
Kay Fisher

R. G. Sparber’s Gingery Shaper - Part 50

The Cross Slide and Cross Feed Assembly (4 of 5)

Drilling Casting Photo by R. G. Sparber

The clamps are match drilled to the casting. I had to be very careful not to drill too deep or I would damage the table.

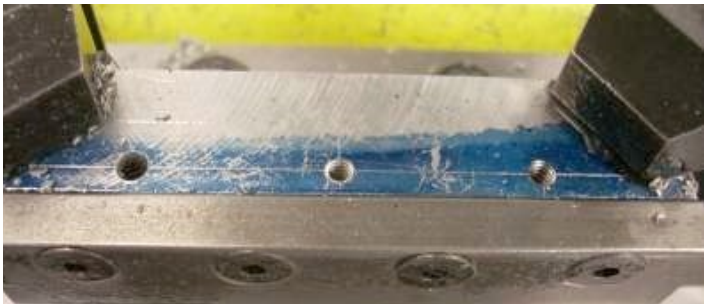


Mounting for Gib Screws Photo by R. G. Sparber

The casting is placed on primary reference plane 2 in preparation for drilling and tapping the gib screw holes. The top clamp is left in place to help support the thin wall between the hole and the top of the pad. The bottom clamp was removed to insure that the table is in full contact with the casting. The back of the casting is pressed up against the soft pads.

1st Hold Photo by R. G. Sparber

Nothing goes along smoothly for long in my shop. I misjudged the energy needed to tap this 10-24 hole. The tap went half way through the side of the pad. Fortunately, the thread that was left was not damaged. I was just too used to tapping ¼-20 and larger holes.



Gib Screw Holes Photo by R. G. Sparber

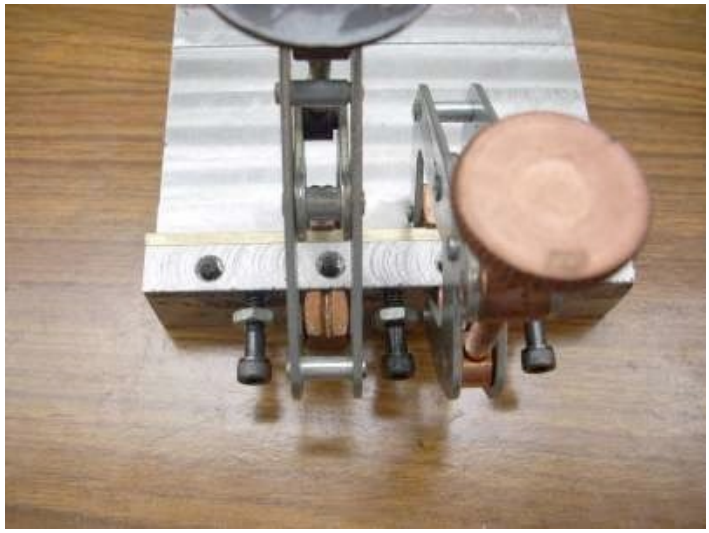
The rest of the holes came out fine.

Gib Screw Photo by R. G. Sparber

The gib screws need to be shortened and pointed. Split 10-24 nuts are fitted to each screw and the assembly clamped in the chuck on the lathe.

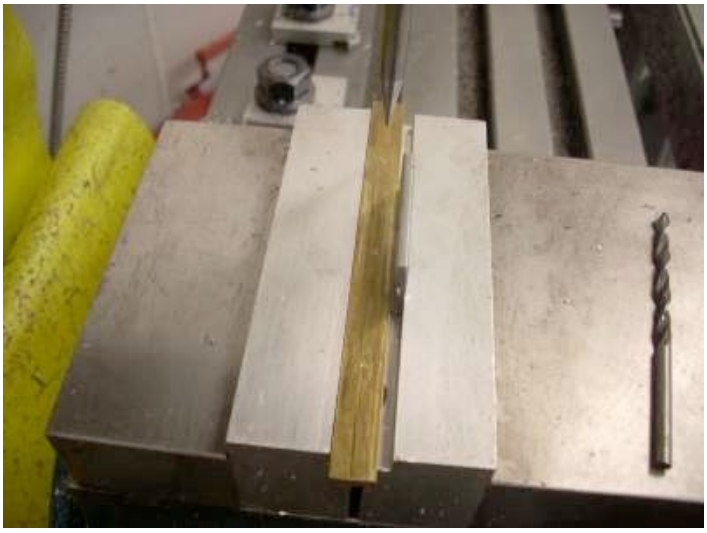
Tapering Gib Screw Photo by R. G. Sparber

Light cuts are required given that these split nuts do not grip the bolt very tightly.



Marking Gib Photo by R. G. Sparber

The gib is clamped to the pad and the gib screws fed in enough to scribe their locations.



Gib in Vise Photo by R. G. Sparber

The gib is placed in the vise and a spud used to locate the marks for drilling. A cone shaped dimple is cut half way through the gib.

Locktite Gib Photo by R. G. Sparber

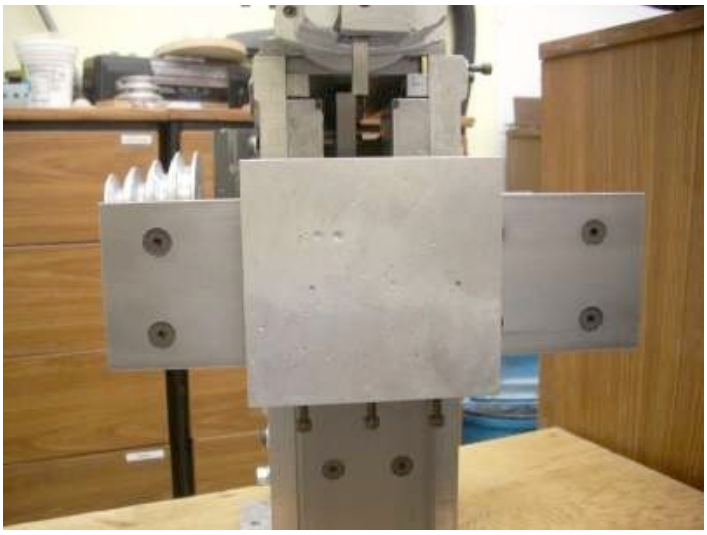
A second gib faces the other pad. I'm using a piece of scrap CRS to hold the gib in place while Loctite® sets up behind it. The gib screws apply pressure.

Marking Out Shim Photo by R. G. Sparber

I'm using the clamp as my template for marking out the first shim. You can barely see the circles made by my scribe.

Shim & Punch Photo by R. G. Sparber

An industrial strength paper punch easily goes through the shim. I then use scissors to separate the strip from the rest of the sheet.



Trial Fit Photo by R. G. Sparber

A trial fit of the cross feed support and cross feed slide looks good. I had to file a tiny ridge off of the cross feed plate but otherwise all worked the first time.

Fitting the Cross Feed Drive

My first impulse was to cut the cross feed drive link. Rather than make it from $^{1}/_{16}$" sheet metal I used $^{1}/_{8}$" aluminum.

Cross Feed Nut & Link Photo by R. G. Sparber

I wasn't sure where the mounting holes would go so waited to drill them until final fitting.

For Sale

Machinist Desperado

Miller Thunderbolt 225 AC stick welder, 220V input. Runs perfectly over the whole range. This is an older transformer machine, and is in good condition. Cables included. Pictures available. For pickup in Owl's Head, Maine – $160.

Marty Feldman, **martfeld@roadrunner.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

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

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

July 13th Pepperell Crank Up 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

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

Aug 3rd Belltown Antique Car Club
47th annual summer show
off of Rt. 151 East Hampton Ct
http://www.belltownantiquecarclub.org/shows/engine%20show%20main.htm

Aug 2-3rd Scribner's Mill Show
Sebago Lake Region near Harrison ME
207-583-6455

Aug 9th -10th Straw Hollow Engine Show
Boylston, MA
J. A. Resseguie 508-869-2089

Aug 17th 9:00am The Flea at MIT
Albany Street Garage at the corner of Albany and Main Streets in Cambridge

Aug 22-24th 44th Annual Meet
Waushakum Live Steamers
Holliston MA
http://www.waushakumlivesteamers.org/

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