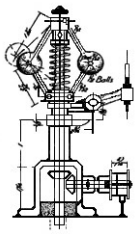

The NEMES Gazette

NEW ENGLAND MODEL ENGINEERING SOCIETY INC.

No. 220 August 2014

Presidents Corner

Victor Kozakevich

The meeting for August will be a poster session, postponed from July. So, once again, bring in those projects, tools and "whatisits" from your collection and share with the group.

I'm not sure if the following should be an ad or an article, but here goes. David Ursin of Rutland, MA has two official US space capsules for sale. Never flown, in fully restored condition, price negotiable. Well, really, it was an article in the Globe from a couple weeks ago, describing what could be thought of as "Extreme Collecting"; of course, none of us would know anything about that.

David started out collecting cars and trucks, acquired a couple of tanks, then in some hoss tradin' of some tank parts in 2005, he acquired an Apollo capsule. He says the first time he climbed in and sat down, it was something of a religious experience for him. Once you've got the bug, you need another capsule. So, in 2010, he found a Gemini capsule for sale in California. You know what happened.

These capsules were first production of their type, intended for test of equipment and practice for the astronauts. David has two of only three capsules in private hands, the ones that flew are all in museums. The reason for sale is partly for his daughter's college, and partly in the recognition that his hobby has gotten out of hand. When you need a crane to move your collection around, maybe it's time to do something else. The capsules have appeared at air shows and at the MIT Flea Market (supports

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
SEP	AUG 21, 2014
OCT	SEP 18, 2014
NOV	OCT 22, 2014

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the adage you can find anything there). David sounds like a guy who should speak at NEMES. Anyone know him?

Shop Talk

Max benAaron

Maxwell and Hertz

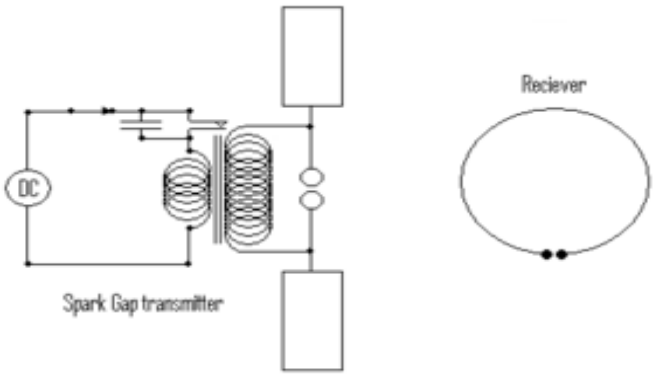
James Clerk Maxwell's mathematical theory, published in 1865, predicted that electromagnetic disturbances should propagate through space at the speed of light and should exhibit the wave-like characteristics of light propagation. His four equations were the mathematical distillation of decades of experimental observations of the electric and magnetic effects of charges and currents. They describe the electric and magnetic fields arising from varying distributions of electric charges and currents, and how those fields change in time.

Maxwell's own contribution was just the last term of the last equation – but inventing that term the 'displacement current', was fraught with dramatic consequences. It declared, for the first time, that varying electric and magnetic fields could propagate indefinitely through space, far from the varying charges and currents where they originated. Previously these fields had been thought of as linked to the charges and currents giving rise to them. Maxwell's displacement current freed the electric and magnetic fields to move through space in a self-sustaining fashion, and even predicted their velocity would be the same as the velocity of light! Many scientists, in the 1880's, were seeking experimental evidence to establish the equivalence of light and electromagnetic propagation that Maxwell's equations predicted.

During Hertz's studies in 1879 Helmholtz suggested that Hertz's doctoral dissertation be on testing Maxwell's theory of electromagnetism. Helmholtz had also proposed the "Berlin Prize" problem that year at the *Prussian Academy of Sciences* for anyone who could experimentally prove an electromagnetic effect in the polarization and depolarization of insulators, something predicted by Maxwell's theory. Helmholtz was sure Hertz was the most likely candidate to win it.

In 1883 Hertz became a docent in theoretical physics at the University of Kiel and two years later he was appointed professor of physics at Karlsruhe Polytechnic. In 1887 he designed a brilliant set of experiments to test Maxwell's hypothesis. He made an oscillator out of a pair of polished brass knobs connected to an induction coil, and separated by a tiny gap over which sparks could leap. His reasoning was that, if Maxwell's predictions were correct, each series of sparks would generate and transmit electromagnetic waves. To confirm his he placed a simple receiver of looped wire with two small knobs at the ends of the loop, separated by a tiny gap, several meters away from the oscillator.

According to theory, if electromagnetic waves were spreading through space from the oscillator sparks, they would induce a current in the receiver's loop that would send equivalent sparks across their gap. When Hertz turned on the oscillator, his prediction was confirmed, producing the first transmission and reception of electromagnetic waves. He also noted that electrical conductors reflect the waves and that they can be focused by concave reflectors and found that nonconductors allow most of the waves to pass through.



The experiment produced and received what are now called radio waves in the ultra high frequency range. These days, we would say that his receiver was a simple half-wave dipole antenna.

With his apparatus configuration, the electric and magnetic fields radiated away from the wires as transverse waves. Hertz had positioned the oscillator about 12 meters from a zinc reflecting plate to produce standing waves. Each wave was about 4 meters long. He was able to record, using the ring detector, how the wave's magnitude and component direction varied and demonstrated that the velocity of these waves was equal to the velocity of light. The electric field intensity, polarity and reflection of the waves were also measured by Hertz. These experiments established beyond doubt that light and these waves were both a form of electromagnetic radiation obeying the Maxwell equations.

Paradoxically, Hertz's experiment, which was the crown jewel of classical electrical experimentation, simultaneously established the photoelectric effect, the first quantum effect -- which was later explained by Albert Einstein -- when he noticed that charged object loses its charge more readily when illuminated by ultraviolet light.

In 1887, he made further observations of this photoelectric effect and of the production and reception

of electromagnetic (EM) waves, published in the journal *Annalen der Physik*. He placed his apparatus in a darkened box to see the spark better and he observed that the maximum spark length was reduced by the box. A glass panel placed between the source of EM waves and the receiver absorbed ultraviolet radiation (UV) that assisted the electrons in jumping across the gap. When the glass panel was removed, the spark length increased. He observed no decrease in spark length when he substituted quartz for glass, because quartz does not absorb UV radiation. Hertz concluded his months of investigation and reported the results obtained. He did not further pursue investigation of this effect, nor did he make any attempt at explaining how the observed phenomenon was brought about.

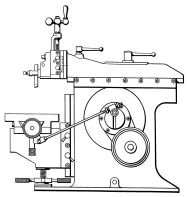
Hertz did not realize the practical importance of his experiments. He stated that:

> "It's of no use whatsoever[...] this is just an experiment that proves Maestro Maxwell was right —we just have these mysterious electromagnetic waves that we cannot see with the naked eye. But they are there."

Asked about the ramifications of his discoveries, Hertz replied:

> "Nothing, I guess."

How wrong can you be?



Metal Shapers

Kay Fisher

R. G. Sparber's Gingery Shaper - Part 51

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

Positioning Bearing Block Photo by R. G. Sparber

The position of the bearing face was adjusted until the side face of the nut lined up with the edge of the cross slide.

Left Bearing Block Photo by R. G. Sparber

Note the ¼" wide parallel providing a precision offset for the bearing block.

Right Bearing Block Photo by R. G. Sparber

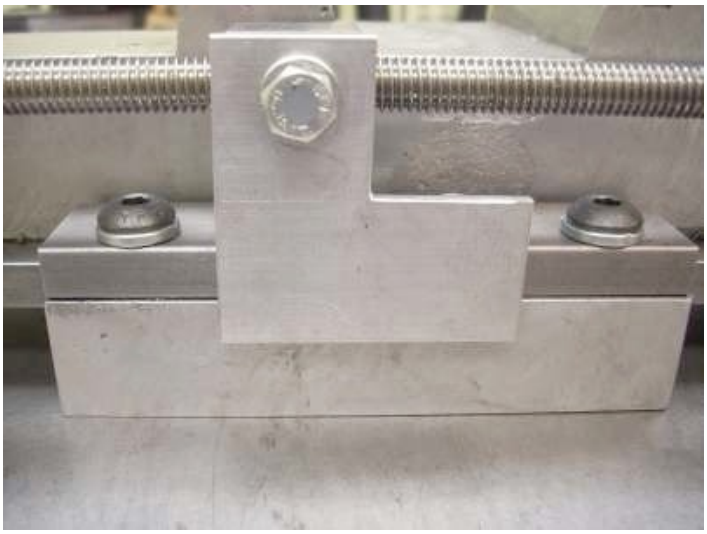
A length of straight $^{3}/_{8}$" rod was used to align the two bearing blocks.

Almost Positioned Photo by R. G. Sparber

Isn't everything aligned now? No. With both bearings clamped down, the rod bound up. One problem was that the mating surfaces were not machined and there was about a 0.005" difference in height between them.

Trim Cut Photo by R. G. Sparber

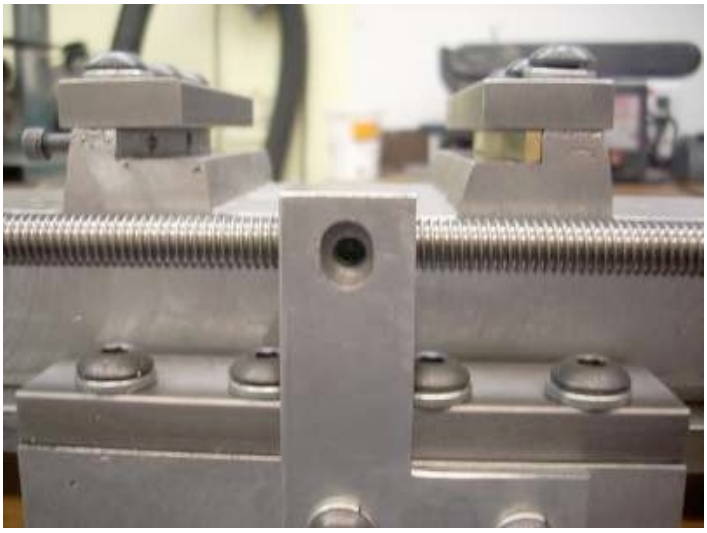
After removing the cross slide, I mounted the assembly back on the mill and took a light cut on the cross slide support in the area to be in contact with the bearings. That helped a lot. Four screws with split washers were installed and the bearings were done, or so I thought.



Link Problem Photo by R. G. Sparber

Now the cross feed drive link didn't fit. So I had to make another one.

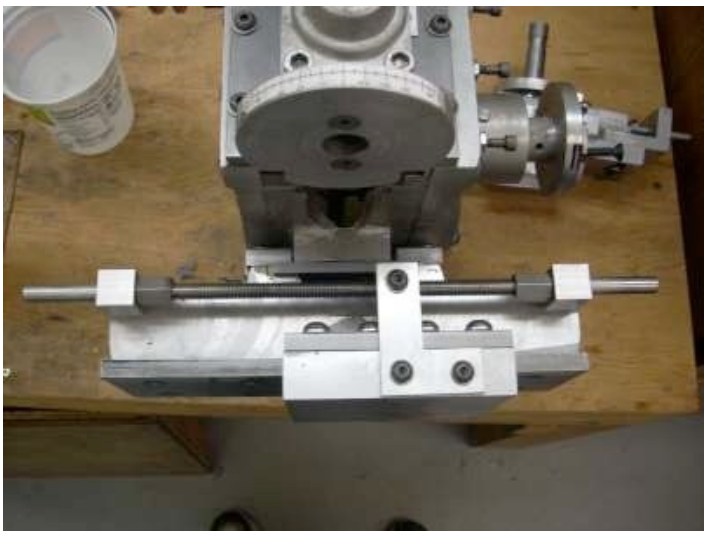
As the cross feed drive came together I realized there was a design flaw. The system was "over constrained". This means that too many support points were fixed and the result was lots of binding of the drive. The first thing to realize is that the only motion that matters is motion along the cross slide. Small motions perpendicular to this axis don't matter. The cross feed drive assembly was not perfectly straight and the nut moved up and down 0.01".



File a Slot Photo by R. G. Sparber

My solution was to turn the nut attachment hole into a slot. A spacer was also machined so the screw was not clamping the cross feed drive link. About 0.005” of shim stock was placed between the cross feed drive link and the cross slide to center the link on the spacer.

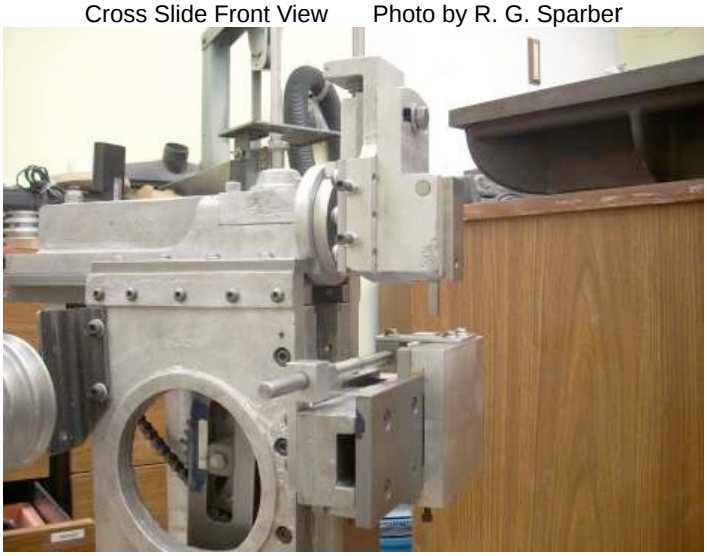
A final adjustment was to make one of the bearing holes 0.002” larger in diameter. That was enough to give a smooth cross feed drive action. There is about 0.005” of backlash from the slotted hole in the drive link. If necessary, some of this could be taken out by making a slightly larger diameter spacer.



Cross Slide Top View Photo by R. G. Sparber

As a final step, I wrapped some copper strips around each end of the drive and clamped these with Vise-Grips®. It was then possible to adjust the coupler nuts to a sliding fit against the bearing blocks and lock the end rods into the threaded rod. Tightening the end rods into the couplers straightened the assembly so there was only about 0.005” of perpendicular movement of the nut.

Cross Slide Front View Photo by R. G. Sparber



Cross Feed Side View Photo by R. G. Sparber

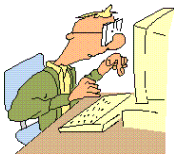
Notice that the cutter can be place far enough back to plane the table when it is attached to the cross slide.

The vertical screw assembly will be built next. The monsoons are not over yet so it is not safe to run my furnace. When I can be assured of a few days without rain, I will cast the 3 cranks. One of these cranks goes on the down feed. It will then be possible to finish designing the down-feed collar and dial assembly. The other two cranks go on the cross-feed drive rod.

The shaper's table will be a welded cube of ½” CRS plate. I've been collecting many great ideas that will let me tilt the table, have a choice of hold down bolt sizes, have an integrated V groove, and a front support that will always point down. Long stock clamped in this V groove can extend down below the shaper's base when the groove is oriented vertically.

Stay Tuned for part 52 from R. G. Sparber next month.

Keep sending me email with questions and interesting shaper stories.



Editor's Desk

George Gallant

Twas the night before NEMES
and all thru the house,
all computers were off,
not even a mouse.

The tools were all hung on
the pegboard with care
in hopes that St. Bridgeport
soon would be there.

The wife and the dogie
were all snug in their beds
with hopes that my snoring
would bypass their heads.

Settled down for a long night of
channel surfing was I
when what to my dull brain
a shock the TV apply.

The voice it was known,
the name just a hint,
the beard said it best,
Jeff DelPapa in the flesh.

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.

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

Sept 4th Thursday 7PM
NEMES Monthly club meeting
Charles River Museum of Industry 781-893-5410
Waltham, MA

Sept 6-7th Dublin Show
RT 101, Dublin, NH

Sept 5th – 14th
Annual Lee's Mills Steamboat meet
Moultonburough, NH
http://www.steamboating.org/

Sept 21th 9:00am
The Flea at MIT
Albany Street Garage at the corner of Albany and Main Streets in Cambridge

Sept 26th 28
Connecticut Antique Machinery Museum
Fall Festival
http://www.ctamachinery.com/