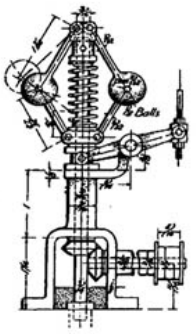

The NEMES Gazette

NEW ENGLAND MODEL ENGINEERING SOCIETY INC.

No. 190 Feb. 2012

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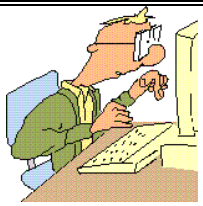


Editor's Desk

Frank Hills

The New Age of Microscopes

In my first article as editor, I mentioned my love of history. Even more to the point, that I loved the fact we hobbyists have the means to replicate some of those scientific break-through gizmos from years past. What impresses me as I write this month's article is just how quickly our ability to replicate those gizmos is catching up with modern technology. The amateur can now build rockets able to reach space, build personal aircraft faster than those developed during WWII, travel underwater in luxury submarines, and build microscopes capable of viewing a world too small for optical lenses.

This month I want to talk about microscopes, but I haven't much room so I'm going to summarize.

Pinhole microscopes are a card with a pinhole in it. It works like a pinhole camera using your eye as the focal plane.

Glass ball microscopes: It's strange that proper lenses were developed before anyone started using these, but a simple glass ball (easier to make than a proper glass lens) will act like a magnifying glass.

Continued next page.

Next Meeting

Thursday, Feb. 2nd 2012

7:00 PM. Meetings held at:
Charles River Museum of Industry
154 Moody Street
Waltham, Massachusetts

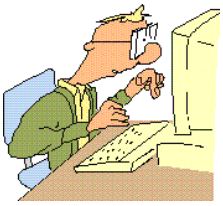
Membership Info

New members welcome! Annual dues are $25 (mail applications and/or dues checks, made payable to "NEMES", to our Treasurer Richard Koolish, 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 mail or email to our publisher.

Addresses are in the left column.

Contents



Editor's Desk

-continued from page 1

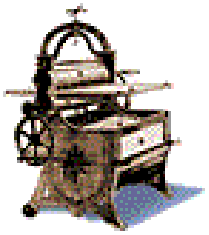
Magnifying glasses: This doesn't need any explanation, does it?

Common Microscopes: Everyone knows what these are, but don't know why they're better than several magnifying glasses stacked together. Good "common", or, optical microscopes use lenses formed of several different materials and shaped to eliminate the distortion created at the outer extremities of magnifying convex lenses. Good telescopes and camera lenses have the same construction.

Electron Microscopes: An electron beam is used instead of light to "illuminate" the specimen. Electro-magnets are used to focus the electron beam and an anode-to-cathode voltage difference accelerates electrons toward the specimen. On impact, some electrons are scattered off of the varying surfaces of the specimen. Those that reflect back to the detector (a phosphorous coated screen, a TV camera or CCD unit) are seen as lighter or darker areas which mimic the surface of the specimen and recreate it as an image.

Tunneling Electron Microscopes: Amazingly, these have been made by electronics tinkerers at home! They work something like an old needle record player. An extremely fine needle is held close to a specimen. The needle is charged as an anode and the specimen the cathode, thus a voltage potential exists between them. When the voltage is raised high enough the electrons will "tunnel" a path to the specimen cathode through the air separating them. This flow is recorded by a computer. As the needle is moved over the surface of the specimen, differences in height are detected as variations in the flow. The closer the needle is, the greater the flow. These variations are mapped by the computer as Z co-ordinates while the motion over the specimen is recorded as X and Y. The computer displays these values as a gray scale image, on a screen. An interesting point about Tunneling Electron Microscopes is that the finer the needle the clearer the image and the greater the magnification. Because of this, the area viewed by the system is very small. How small? Thousandths or tens of thousands of an inch! The actuators which control this motion are Piezo elements. You don't view frogs with these things.

Of course this isn't a complete list of microscope technologies, but you get the idea.
Next month…The Ultimate Vacuum.



NEMES Gazette Editorial Schedule

Issue	closing date for contributions
March 2012	February 17, 2012
April 2012	March 23, 2012
May 2012	April 20, 2012
June 2012	May 25, 2012
July 2012	June 22, 2012
August 2012	July 20, 2012

President's Corner

Dick Boucher

The Meeting

Our speaker this month will be model ship builder Robin Neill. Robin is an accomplished model ship builder who has recently completed a model of the Liberty Ship *Jeremiah Brown* and will be talking about the model and giving us a history of the Liberty ships in general.

Miscellaneous Ramblings

Again, the Cabin Fever trip went without any significant events travel wise, with our driver Mark again cruising us out and back with style and grace. I want to thank Norm Jones for getting the trip organized, calling the list to help get the required number of riders, and getting checks in on time to insure the bus charter. On that subject, it would be so much easier on both Norm and I if, in the future, you could make up your mind to go and get the check to Norm in a timely manner.

One of the nicest displays was a twin boom Manitowoc crane. It stood almost six feet tall on the long boom. One reason I enjoyed this model was the fact that there is a full-sized one about two miles from my house, working on a new bridge between Groveland and Haverhill on the Merrimack River. I usually visit the site a couple times a week and since the old bridge is still in place, we have a birds eye view of the work being done to span the river.

The next big event on our horizon is our own show on February 18. Since a big complaint about our show is our inadequate supply of air, Norm and I (again thanks to Norm) are looking into renting an air compressor to insure an adequate supply of air for the show. Since both Norm and I have a lot to do on the day of the show we will need a volunteer with a pickup truck to pick up and return the compressor on the day of the show.

We also need help setting up and breaking down all the tables on the day of the show and that usually goes off without a hitch.

Dick B

2012 NEMES Membership

Don't be like me. I'm late and the guilt is killing me!!

Frank

Please send a check for $25.00 with your name and address, made out to NEMES to:

Richard Koolish
212 Park Ave.
Arlington MA 02476

PLEASE PRINT NEATLY!

2012 NEMES SHOW

The 2012 NEMES Model Engineering Show will be Saturday, February 18, 2012 at the Charles River Museum of Industry in Waltham from 10AM to 4PM. Setup starts at 8AM. The show benefits the museum, raises money for NEMES, and allows us to present our interests to the public and attract new members.

If you have exhibited before, please exhibit again. If you have not exhibited before, please consider bringing one of your projects to the show. Any home project is welcome, complete or work-in-progress. In the past couple of years, we have not filled the room, so it is important to participate. Non-members can also exhibit, so if you know anybody with an interesting project, please invite them to join us. The show flyer can be downloaded from: http://www.dickkoolish.com/ Please print out some copies and post them in local businesses. Some pictures from last year are here: www.dickkoolish.com/rmk_page/pictures_021911.html

Aircraft Engines

By Jim Johnson

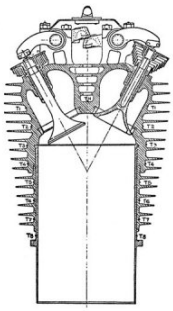
I ask myself "why am I so adamant that readers contemplate parts of the life of Sam D. Heron as a background to air cooled engines?" After all, some air cooled engines did exist even at the time of the Wright Bros. initial flight and within a couple of years, Bleriot flew over the English Channel with a 3-cylinder Anzani air cooled engine. What's more, Anzani was offering air cooled radials with up to 22 cylinders. Renault was in some modest production of an 8-cylinder Vee, an opposed 12-cylinder engine and finally small air-cooled engines were soon on the farm for various tasks. An old friend of ours, LeBlond, was in the business too, offering a reliable 60-horsepower radial in 1929. However, none of the early attempts at air cooling proved reliable enough for warfare, commercial service, or extended sport aviation, except the rotary. Air cooled advantages remained tantalizing and even resulted in major political "wars" between military components.

Honestly, I don't know why we should learn about Sam Heron except for two facts of his life. **First**, the Heron Aircraft Cylinder is "it" design-wise right up to the present day. His background forced the cylinder design to be practical. **Second**, gasoline specifications of today were a primary Heron product, apparently driven by a big gap in understanding between chemists and engineers. Unfortunately, the one authoritative source of S. D. Heron, other than his many papers and a small book, is an autobiography held by the Smithsonian and which "is not to be published in whole or in part". What Heron was telling the world is that gasoline has far too many permutations and combinations at far too much cost for each variant, to be tackled in engine design until useful standards exist. Unless the engine design parameters as a function of gasoline were known, crankshafts, valves and pistons would break and wear out quickly. Today, Detroit has done it and the parameter solution is also happening right under our car hoods without us being any "the wiser". The author has seen a set of these fuel-engine parameters, even though the datum is usually secret, and found them very informative.

Samuel Dietzel Heron was a British mechanical engineer who worked for/with Professor A.H. Gibson in the Royal Aircraft Establishment laboratories (RAE) of the

Royal Aircraft Factory (RAF). Heron was a leader by both speech and actions (he also had a reputation for liking dirty jokes) and eventually became a technical director at Wright Field, the successors to McCook Field as well as research director at the Ethyl Corporation.

Heron attended night school at Goldsmiths College and Durham University, working daytime at Thames Iron Works, then as draftsman at Cutler and Sons, and designer at Whitworth-Siddely Company. His nights were devoted to engineering theory and his days were devoted to various aspects of aircraft engines. At some point he was assigned to determine the drag power loss of whirling cylinders of a Larson rotary engine, which he did by building and using a dynamometer with the engine operating and then with it being motored with the pistons, crank and cam removed. He invented, patented, developed, tested and marketed Sodium-cooled valves. Later, he had enough pragmatism to declare them obsolete and replaced with high heat alloys. With Prof. Gibson, they developed heat flow equations, instrumented test engines to determine local temperatures and began advising Bristol and other engine manufacturers about fin heat flow. He had been doing a lot of engine fuel testing and was invited to help prepare a specification for the RAF. Then in 1916/17 he worked with Prof. Gibson at the RAF and the RAE where they were hired to develop and prove an air-cooled cylinder. Their design is shown in below:



They built several cylinders including one with forged head and machined as well as cast fins, and with multiple as well as duel valves. Apparently they also built single cylinder test engines. It would be another eight years however, before the design was recognized and adopted. Today, readers would recognize the cylinder design in nearly all modern aircraft engines and in all successful WW2 radials. In 1921, Heron went to the US with employment at Wright Field and Wright Aeronautical Corp, where he had a big hand in development of the Wright Whirlwind J-5. The Pratt and Whitney Wasp also emerged from this. He was deeply involved in fuel-engine testing with the Waukesha variable compression-ratio test engine, shown in below.

This engine is used today throughout the world (being replaced now with model 48). Heron coined or accepted the expression "fuel cooled" for early air-cooled engines. In fact, many of these early engines would start to glow at red heat in the dark (about 900 deg. F) if they survived knocking when mismanaged by either fuel choice or lean mixtures.

Heron also focused on fuel knocking and detonation and was instrumental in developing fuel specifications. The reader will find a description and interpretation of most of these parameters in Heron's chapters in the book "The Development of Aircraft Engines and Fuels" by Robert Schlaifer and S.D. Heron, Harvard University 1950. There is also a significant resource that includes data, from the Society of Automotive Engineers entitled "Mixture formation in Spark Ignition Engines". These parameters are mentioned below by title-only because the fuel-to-engine parameters would each take far too much to be dealt with here. These are: 1) Volatility, 2) Engine combustion process cycles, 3) Energy content, 4) Stability, and 5) Low temperature.

Important process cycle parameters (also known as vibe functions) include preflame reactions, preignition, ignition, flame speed, ignition delay, combustion and charge motion, combustion knock, chamber design, turbulence factors, squish, and efficiency. Knocking was and continues to be one of the most important aspects. In early days, these factors were partially resolved by world petroleum and refinery site location; California gasoline for the US military, Dutch East Indies for UK and French forces and heavy reliance on benzol additions from coal for Germany (at very, very high cost).

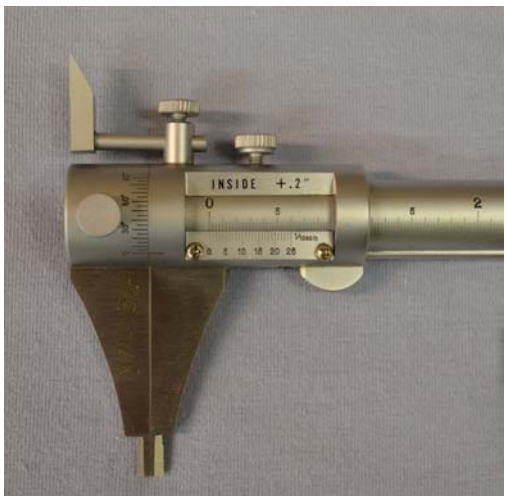
In 1934, after a year with Ethyl Corporation in London, he became Director of Aviation Research at the Ethyl Corporation, going to the US at Wright Field during World War II and retiring from the Ethyl Corporation in 1946. During the war, he became active in turbine-blade metallurgy and considered turbo-propulsion to be the most productive engine area for the future. He remained active as consultant on both sides of the Atlantic until his death in about 1969.

Tool Corner

By Frank Dorion

Cabin Fever is history for another year, but, as usual, it yielded some items of interest. One I was fortunate to pick up is a very unusual caliper made quite a few years ago by Mitutoyo, but long since discontinued. No doubt though there are still some floating around out there, so I thought a description and some photos might be of interest. Here's what this nifty tool, Mitutoyo Model No. 190-101, looks like:

The first thing that catches your eye is the unusual tubular body. This feature allows some functions that are difficult or impossible with a regular 6" vernier caliper. I'll describe them in a bit, but first, let's take a closer look at the details of this tool. Note the nice clear vernier that can be read without squinting. Then see that little adjustable foot riding on the spine of the vernier – what's that all about? Finally, notice the graduations around the barrel on the fixed head of the vernier and the thumbscrew just to their left. Never saw that before?



Let's take one last look at the construction of this tool before listing its capabilities. Here's a shot of the head end of the caliper below. Both ends of the caliper are hardened, ground and lapped flat to provide accurate reference surfaces.

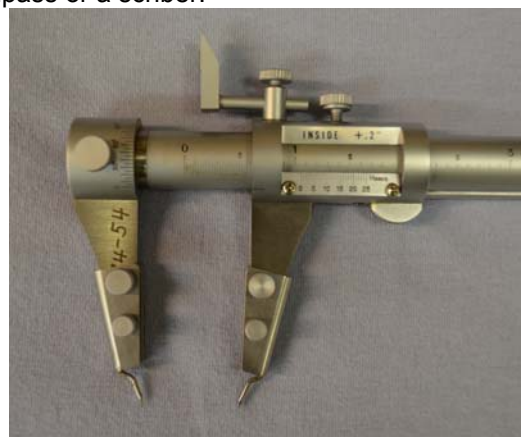
What can you do with this thing? First, it's a very serviceable 6" vernier caliper. It's also a much better-than-average depth gage due to the generous flat on the tail end of the tube. Ever try to keep a conventional 6" vernier vertical as you take a depth reading? It's much easier with this tool's flat base and the round depth gage will go into a smaller hole than the flat one on a regular vernier. It's more versatile than a depth mike for getting into tight spots too.

The next feature is unique to this caliper as far as I know. What is usually the "fixed" jaw swivels! That means you can take a measurement between two points that are offset from one another. Also, since the "fixed" jaw's axis of rotation is graduated through an arc of 90°, the flat sides of the jaws can be used to measure angles like a small bevel protractor.

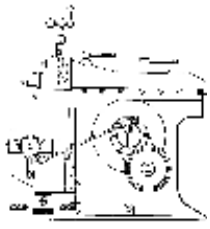
And what is that little adjustable foot? Remember that it's mounted on the sliding jaw of the caliper. Stand the caliper on end on a flat surface, slide the little foot down until it contacts that surface, lock it in position and you now have a handy little height gage/scriber that will get

into much tighter spots than regular versions. Set the sliding jaw to the height you want to scribe and away you go. The flat on the head end of the caliper provides a small but stable base as you slide it along.

And finally, remember the two little gizmos in the first picture? Clamp them on the jaws with the set screws provided and you have an effective divider, a compass or a scriber.



When I found this tool, it was in its original wooden box lined with Mitutoyo's notorious black "disintegrating" foam, whose corrosive effects has ruined many a fine Mitutoyo tool. Fortunately this caliper has heavy satin chrome plating that protected it from the effects of the foam. And it's great that it survived in such good shape, because this caliper is a very rare item - a multi-purpose tool that actually works! Keep a lookout, you may find the next one.



Metal Shapers

By Kay Fisher

R. G. Sparber's Gingery Shaper - Part 21
The Clamp Guide

Clamp Guide in Place Photo by R. G. Sparber

I almost made the clamp guide as per the plans. The front hole was drilled and tapped to secure the guide to the bottom of the ram plate. However, the rear hole was drilled for clearance through the ram plate and right through the ram casting. More on that later.

Ram Guides Front View Photo by R. G. Sparber

In this front view of the ram guides, note the $^{1}/_{8}$" thick brass gib inside the black circle. This gib shifts the ram and its plate off center to the left.

As best as I can figure from Gingery's plans, he wants the yoke centered in the column. At the very least, this permits it to cleanly pass through the front column casting.

We have a minor problem – the ram is off centered while the yoke is centered. My only choice was to offset the clamp guide by $^{1}/_{16}$". That didn't seem like a lot.

Clamp Guide on Ram Photo by R. G. Sparber

The clamp guide has been screwed to the ram plate. A trial fitting set the exact orientation of the guide. I then carefully transferred the ram to the mill and set it up on angle plates. This insures that the hole will be perpendicular to the ram plate. After this picture was taken, I added a hold down clamp to be extra sure that the ram plate was securely sitting on the angle plates.

To recap, the clamp guide is positioned to insure that the yoke is centered in the column. The ram plate is set up so the clearance hole about to be drilled will be perpendicular to the ram plate. What could go wrong?

Crooked Hole Photo by R. G. Sparber

The answer can be seen here. I broke out of the casting a little bit at the end of the hole. Some of this is due to the taper of the vertical support. What puzzles me is that I only shifted the center by $^{1}/_{16}$" yet you can see that the hole is off by $^{3}/_{16}$". This will work, but look bade. In hindsight, I could have added a bit more meat to the ram pattern in this area.

The Bolt

Gingery calls this "the bolt" but it is really the clamp guide clamp. I guess I now see why he just called it the bolt. Anyway, I departed from his design and like the result.

The Bolt Photo by R. G. Sparber

I machined a piece of $^{3}/_{8}$"x 1" bar stock to a length equal to the width of the clamp. The sides are milled down 0.1" resulting in the center portion being raised up 0.1". The hole is tapped $^{3}/_{8}$ -16.

The Bolt Installed Photo by R. G. Sparber

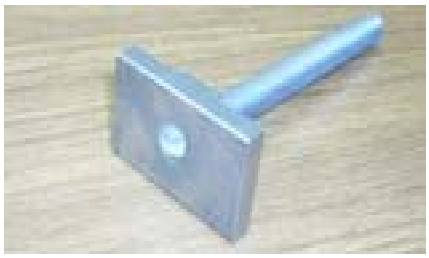
The "bolt" fits in just below the clamp guide. The raised center section prevents it from turning.

Ram - Good Side Photo by R. G. Sparber

A length of threaded rod runs through the hole in the ram. Here you see the rod before it is trimmed. Above is the pretty side of the ram.

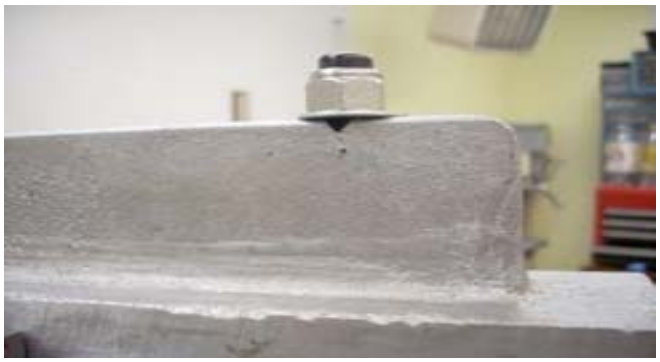
Ram - Other Side Photo by R. G. Sparber

The above photo shows the other side, with the hole just breaking through at the top.



The Bolt with Threads Photo by R. G. Sparber

After the threaded rod was cut to size, I used red Loctite to secure it to the "bolt".



New Nut on Ram **Photo by R. G. Sparber**

I used a closed-top nut on the ram. It only takes a quarter turn of the nut to lock the clamp to the ram. It is a simple matter to loosen this nut, set the position of the ram, and tighten. The nut is $^{7}/_{16}$", just like the bolt head that acts as the pinion and the bolt that locks the tool head in place. I like having a minimum of wrenches around a machine.

What Next?

After calibrating the yoke, I'll start on the feed crank. The casting is done so I will be able to work entirely in my air conditioned shop. It is 110° F outside and my foundry clothes would not make me any cooler. No doubt I will be firing up my foundry when it really gets hot outside.

Stay Tuned for part 22 from R. G. Sparber next month. Keep sending me email with questions and interesting shaper stories.

My email address is: KayPatFisher@gmail.com

Kay

For Sale

NEMES Denim Shirt

Ron Ginger found us a great deal on high-quality, denim shirts with the NEMES logo embroidered. Ron will place an order for these shirts before the show and have them available for pickup at the show. You must order in advance to get a shirt at the show. All sizes for $30 except 2XL for $31 and 3XL for $32.

Contact Ron Ginger directly by February 3rd to order your shirt. Make sure to specify size:

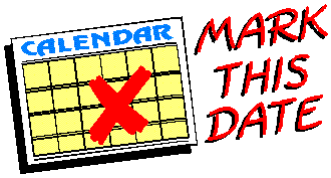
ronginger@roadrunner.com or (207) 633-4203

Anyone who misses out on this deal will still be able to get a NEMES denim shirt, but will have to send your money to the vendor and pay extra for postage. We'll share details on this next month.

NEMES Shop Apron

Look your best in the shop! The NEMES shop apron keeps clothes clean while holding essential measuring tools in the front pockets. The custom strap design keeps weight off your neck and easily ties at the side. The apron is washable blue denim with an embroidered NEMES logo on top pocket.

Contact Rollie Gaucher 508-885-2277



Upcoming Events

Bill Brackett

Calendar of Events

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.

Feb 2nd Thursday 7PM
NEMES Monthly club meeting
Charles River Museum of Industry
Waltham, MA 781-893-5410
http://www.neme-s.org

Feb 18th 10AM-4PM
16th Annual NEMES Model Engineering Show
Charles River Museum of Industry
Waltham, MA 781-893-5410
http://www.crmi.org/

March 1st Thursday 7PM
NEMES Monthly club meeting
Charles River Museum of Industry
Waltham, MA 781-893-5410
http://www.neme-s.org

March 24-25th Midcoast Model Festival
Owls Head Transportation Museum Owls ME
http://www.ohtm.org/