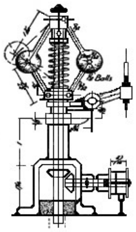

The NEMES Gazette

NEW ENGLAND MODEL ENGINEERING SOCIETY INC.

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NEMES Apparel. We have NEMES denim button down shirts, t-shirts, sweatshirts, and aprons for sale. The aprons are $20, the denim shirts $35, sweatshirts $25, and the t-shirts $15. Contact Rich Baker if you would like to purchase 978-257-4101.

Dues. The 2016 dues are also due. Please bring your $25 check to the March meeting or you can try out our credit card system. Or mail a check mail to Rich Baker at NEMES,

Next Meeting

Tuesday, May 5, 2016 7 PM

Charles River Museum of Industry & Innovation

154 Moody Street

Waltham, Massachusetts

Directions are Here.

The speaker for the May meeting will be Dan Eyring, NEMES member and CRMII volunteer. He is in the process of building a museum exhibit about the W. H. Nichols Company, a local Waltham machine shop business started in Niichols' basement in 1904. He was known for innovative techniques in precision machining and became known as “Accurate Nichols”. His lifetime machinist motto was “Anything Almost Right is Wrong”. Dan will talk about WH and about some key products that his company became well known for. He'll also throw in a few stories about WH's live steam hobby and the mechanical genius of his son Arthur Nichols, who built possibly the world's first front wheel drive car back in the 1920's from a pile of junk car parts in his Father's garage, and wrote his MIT Bachelors Degree thesis about it to boot.

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).

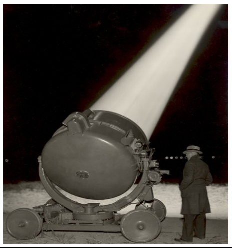
Deadline for submitting articles is two weeks prior to the next meeting.

Table of Contents

Editor's Desk

Dan Eyring

This month, we feature the next episode in homemade horology from John Moran, Gadget Builder.



Searching for Speakers

Bob Timmerman

It's always tough to find speakers for our summer meetings. Bob us working hard on it, some future possibilities include visiting an organ building factory, a talk on novel braille reading devices for the blind, a metallurgist and a company that makes horse shoes. Diversity is our middle name!

If you have an idea for a speaker or a pet subject you would like us to have a presentation on, please tell Bob. He will make it happen.

CHARLES RIVER MUSEUM OF INDUSTRY & INNOVATION

From the Museum

Dan Eyring

As a long time volunteer at the CRMII museum (almost 9 months now!) I can tell you that things are really getting busy there. New donations coming in, new exhibits are in the making, ongoing improvements are being made in signage, and expansion plans are in the works to give us more room to store the collection, put up new exhibits and bring in more machinery and tools to tell the New England Industrial Revolution story..

Bottom line, we're swamped with way too much work for the volunteer crew now in place. So HELP!!!

If you like working on old machine tools, bicycles, cool old fashioned manufacturing machines, clocks and watches, steam engines and engine models, communication equipment and much more, please think about signing up to work one half day a week as a Museum volunteer. If you want to know more, go to the Museum web site at crmii.org. Or contact me (daneyring@rcn.com) or the Director Bob Perry (director@crmii.org).

Shop Talk

Max ben-Aaron

The Invention of the Vacuum Tube Amplifier

One could easily write a book or two about the astonishing Twentieth Century. In my opinion, the pivotal invention – one of the greatest inventions of all time – was the vacuum tube, which jump-started the electronic revolution that characterizes the modern world.

In 1906 the American electrical engineer Lee De Forest invented the Audion, the first electronic amplifying vacuum tube. Originally developed as a radio receiver detector, it was turned into an amplifying device by adding a grid electrode to the Fleming valve. It is important in the history of technology because it was the first widely used electrical device which could amplify. Called a 'triode', it consisted of a partially evacuated glass tube containing three electrodes: a heated filament, a grid, and a plate. Its advantage was that a small electrical signal applied to the grid could control a larger current flowing from the filament to plate.

Early audion tube

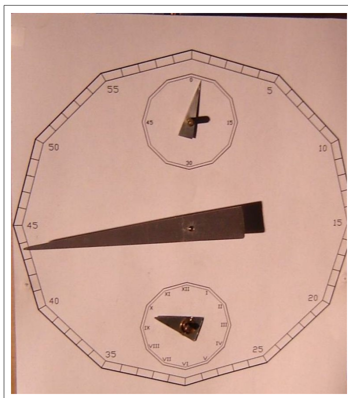
It had been known for fifty years that gas flames were electrically conductive. Early wireless experimenters had noticed that the presence of radio waves affected this conductivity. This intrigued De Forest who found that the gas, in a partial vacuum heated by a conventional lamp filament, behaved similarly. From this, he surmised that a wire wrapped around the glass housing of the device could serve as a detector of radio signals. In his original design, a small metal plate was sealed into the lamp housing, and connected to the positive terminal of a 22 volt battery via a pair of headphones with the negative terminal connected to one side of the lamp filament. A wireless signal, applied to the wire wrapped around the outside of the glass, caused disturbances in the current, and produced sounds in the headphones.

De Forest constructed one of the earliest Audion radio receivers in 1914. This was a detector (rectifier) and two stage audio amplifier. The radio signal came from a separate "tuner" unit. To prevent the delicate filament from sagging down and touching the grid, its Audion tubes were mounted upside down.

The primitive Audion, (unlike later vacuum tubes which require a hard vacuum), had a small amount of gas left in the tube, because De Forest thought that it was necessary. This residual gas, rather than being necessary, resulted in erratic performance and non-linear characteristics and limited the dynamic range. It was hardly used until around 1912, when several researchers recognized its amplifying ability and used it to build the first amplifying radio receivers and electronic oscillators. This led to its rapid development and deployment, motivated by many practical applications for amplification. The original Audion was superseded within a few years by improved versions with higher vacuum, developed by Irving Langmuir at GE and others. These were the first modern "hard vacuum" triodes.

The triode was a significant development. Existing commercial wireless systems were heavily protected by patents. A new type of detector would allow De Forest to market his own system. He eventually discovered that connecting the antenna circuit to a third electrode placed directly in the current path greatly improved the sensitivity; in his earliest versions, this was simply a piece of wire bent into the shape of a grid-iron (hence "grid").

In virtually all other early radio systems, all of the power to operate the headphones had to come from the antenna circuit itself. This tended to "damp" the tuned circuits, and limit their ability to distinguish discrete frequencies, and so to separate stations. The Audion was unique compared to all competing devices at the time, in that it did not draw significant power from antenna/tuned circuit. This allowed the tuning circuitry to operate with maximum selectivity.

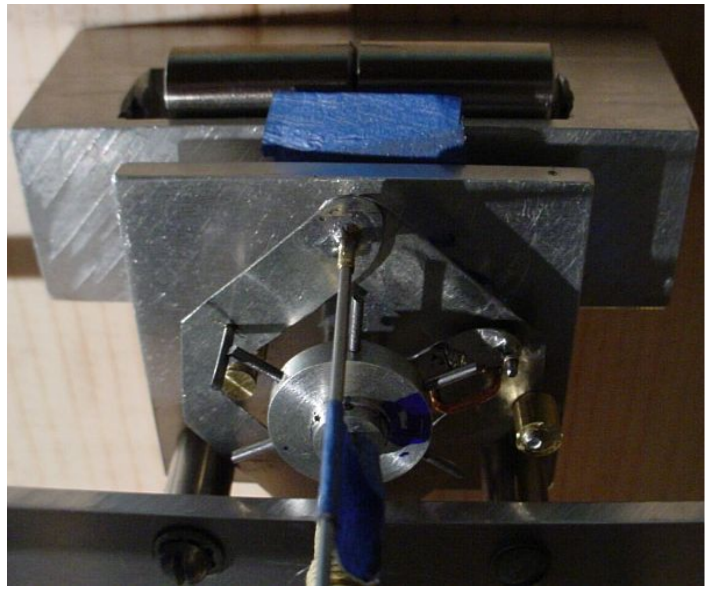


On Building My First Clock

John Moran / Gadjet Builder

This month, we post the second installment of John Moran's clock building article, which can be found at: http://www.gadgetbuilder.com/Clock/Clock.html

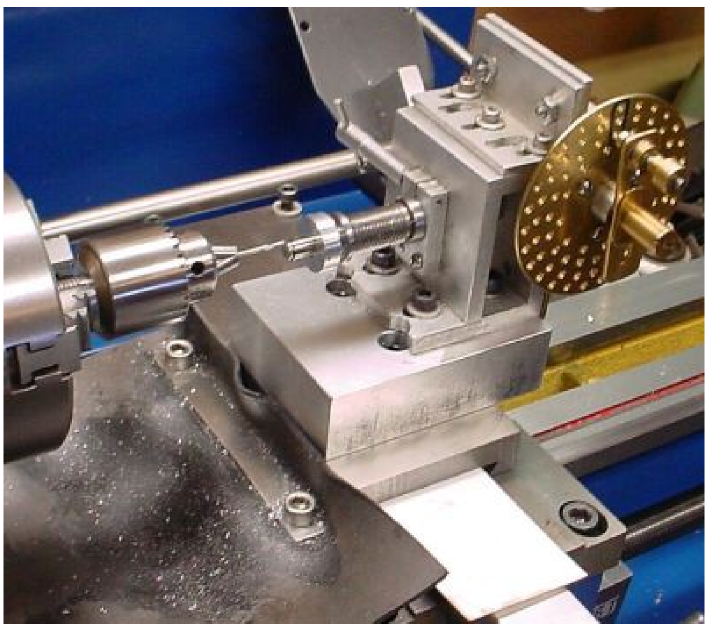
Escape Gear and Escapement



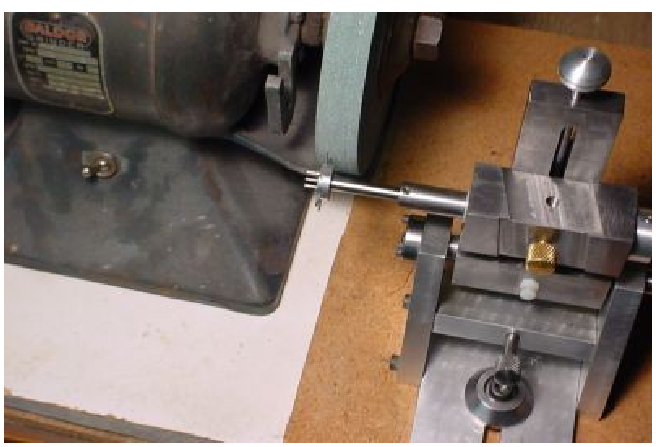
One of the reasons I chose the Arnfield escapement is the simplicity of the escape gear. My Test Escape Gear uses an aluminum collet to hold the wire teeth. There are six radial and six axial teeth (drilled as shown); after insertion, the radial teeth were ground to length and then the ends of the teeth were ground at an angle for a clean release from the stop. Grinding was done in the Tinker fixture to provide good control of the process.

Test Escape Gear

Drilling Radial Teeth



Drilling Axial Teeth



Grinding Teeth at an Angle

The test escapement arms are from scrap tin plate because it could be cut to shape with scissors and solders well. The stop is piano wire ground flat on one side. Several items are adjustable either with a screwdriver or by unsoldering. It took some time to tweak things so it would work but it was surprisingly reliable considering the construction.

I tried to find information on the Arnfield design at CT libraries but haven't been successful to date; Yale has the Horological Journal but wants $20 to copy the 3 page article... Articles concerning the Arnfield Escapement are included in the CD of "Horological Science Newsletter" but I haven't been successful in getting a copy of this either - clock info seems hard to come by for home shop machinists who are dabblers rather than dedicated clockmakers :-)

So, I made a drawing of the escapement essentials in IntelliCAD. Basically, a stick figure showing the lift arms and the escapement suspension point. A circle at the escapement suspension point with radius matching the distance where the lifting arm pivots is informative when coupled with circles with radius equal to the length of the lifting arm centered at the end of the escape teeth which lif the arm. This allows varying the sizes of various pieces and measuring the resulting lift angle without having to bend wires and then tweak things (stop for lifting arm, shape of gravity arm, etc). This was very helpful in improving my understanding of the Arnfield design.

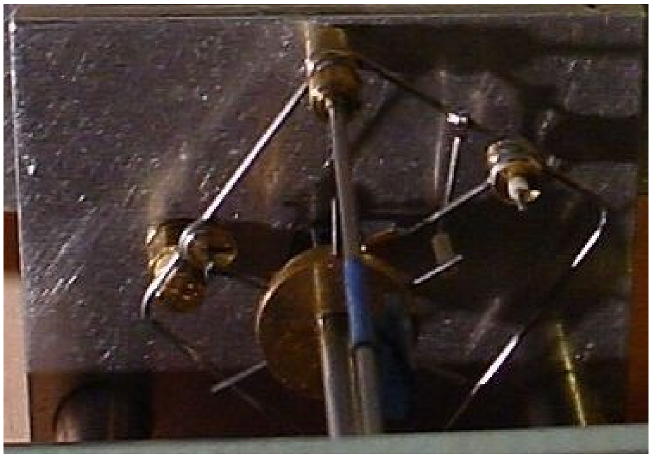
I have developed some ad hoc methods for tweaking my version of Arnfield's escapement plus some observations which other experimenters might find helpful:

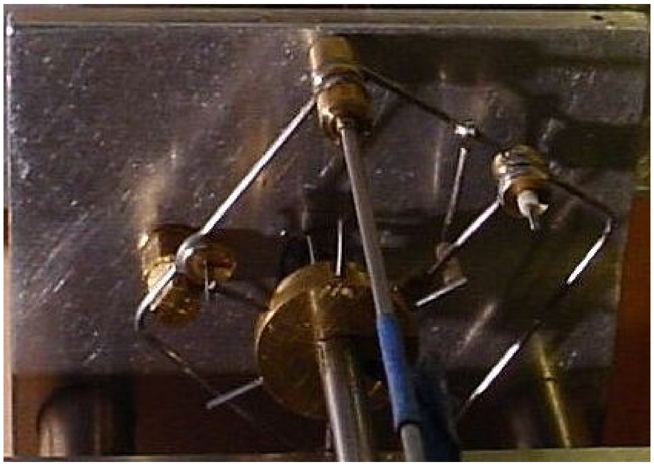
- The stop on the locking arm should hold the tooth so that the tooth is at 90 degrees to a line from the stop through the escapement arm suspension.
- Decreasing the distance from the escapement suspension point to the lifting arm pivot increases the lift angle. Adjust as needed so the gravity arm is just clear of the locking arm following the lift, necessary to ensure a positive lock.
- The minimum pendulum swing depends on the sum of (all angles referenced to pendulum angle):
    - The lift angle required to move the lock arm from the stop to unlocked
    - The extra lift angle needed to ensure the gravity arm is clear of the locking arm following lift
    - The lift angle required to release the lip (allowing the lifting arm to drop to its stop)
    - Extra pendulum swing beyond the lock and lip release points to ensure reliable

operation

On gravity arm construction: the lifting arm should be on the same side of the gravity arm as the pin which drives the pendulum. This takes up any looseness in the bearing supporting the gravity arm -- putting the lifting arm on the other side causes the gravity arm to twist slightly during the cycle and requires extra lift to compensate.

The pictures of the escapement below show the relationships in the first two points.





Winding Arbor, Gravity Clutch and Ratchet

It seemed only fitting to use a gravity operated clutch (rather than a click) for winding in a clock with a gravity escapement. So, I cut pockets to hold "gravity pills" where the weight of these pills causes them to wedge between the outer and inner pieces of the clutch -- when turned one way, friction moves the pills into the wider part of the slot, releasing the clutch to allow winding. The outer part of the clutch has a ratchet which engages a pawl to allow the maintaining spring (inside the front of the outer clutch piece) to keep pressure on the gears during winding; a ball bearing supports this piece on the winding shaft, ensuring that it remains concentric with the brass piece which holds the gravity pills. The winding shaft (not shown) passes through the hour hand shaft. The winding arbor is supported by ball bearings front and back.

This gravity operated clutch works nicely. It is silent and nearly frictionless when released, yet locks immediately when direction is reversed. There are two pawls used with the external ratchet for safety and to minimize ccw movement due to the maintaining spring during winding. The pawls are gravity actuated (of course). The maintaining spring is a nearly straight piece of 0.046 piano wire with a hook on the end to catch a pin of the gear; I may have over-done this - the clock will run for about 10 minutes on the maintaining spring. To work on the clock I remove the weight, apply CW pressure with the key and release the pawls.

From the Gazette Archives

Some Threads on Threading

From the September 1996 Gazette

Errol Groff was next. First he passed around the swaging tool that he fixed for the local fire department to put fittings on the end of fire hose. It expands an internal ferrule to lock the fitting onto the hose. (He teaches Machine Tool at a Votech High School in Connecticut, which is why the fire department came to him.)

After he started the tool around, he held up some pieces of 1” Brass rod and explained how being a Votech

School they get all sorts of things show up surplus, and at one point a lot of this brass rod had appeared and he just HAD to make something out of it. They were talking about threads at that point, so he figured that was the perfect use for it-thread samples.

He started out with a single start thread. The pitch and the lead on it are the same, .083”, which gives 12 threads to the inch. With 12 threads to the inch on a 1” OD brass rod, Errol had a really nice sample to pass around.

Next was a double start thread. This one had the same pitch as the single start,but since it was a double start thread the lead (distance that asingle thread travels along the rod in one revolution) was twice as much at .166”. To make the double start thread you cut one thread to the same depth as for a single start thread,but you set the lathe as if you were only cutting half the number of threads (in this case, set the lathe to cut 6 threads per inch.) After the first start’s thread is completed, index the spindle 180 degrees and cut the second start the same way you cut the first start.

For a three start thread you set the lathe to cut 1/3 the number of threads that you want (in this case,4) and then cut the first thread. If you have a cam-lock spindle with three cams, the three start thread is easier than the two start since all you need to do to index is to cut one thread in each of the three possible alignments of the chuck or face plate with the spindle. It’s cut, index 120 degrees, cut, index 120 degrees, and cut.

For a four start thread the lathe needs to be set to 1/4 the number of threads that you need, so for 12 threads to the inch you need to set the lathe to cut 3 threads per inch. The four start thread has a lead of .333 inches,while the pitch is still the same as the single start case, .083 inches.

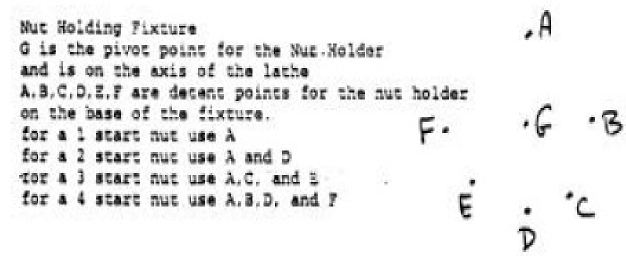
To show the utility of multiple start threads there was a fifth sample, a piece of the same brass rod with a single start thread with a lead of .333 inches. There wasn’t a whole lot of metal left. For the two and four start threads Errol used the slots in a standard four slot face plate, moving the drive dog between starts to position things correctly.

When he was done showing the five sample threads there was a lot of discussion about the whole issue of cutting multiple start threads. Henry Szotek told how to cheat and avoid the whole issue of indexing to handle the multiple starts. Use a formed tool like a geometric thread chaser to cut the threads and set the lathe to the proper lead and cut all your starts at once, side by side.

Howard Gorin brought up that at some point you reach the point where it makes more sense to drive the lead screw than the spindle because it’s rotating faster. Don Strang said that yes that’s true but you have to be careful because the gears aren’t usually set up to be able to transmit the power from the lead screw back to the spindle so you run the risk of stripping the teeth off them.

When the discussion died down Errol brought out the nuts that fit the various threads and said that a thread isn’t much good without a nut, so he figured they’d have to make some. In order to do it he needed a fixture, so he assigned it to one of his better students, a high school junior who spent about two weeks working on it.

The student made the 1, 2, and 3 start nuts before he ran out of steam, so Errol only had to make the four start. The nuts are brass, so they lucked out and were able to cut all the threads on each nut without having to resharpen the bit so they were able to fit the nuts to their threads knowing that the position of the tool was the same for all of the starts. If the tool had needed to be taken out and sharpened in the middle it would have complicated getting the internal threads the correct size.



At this point Roland Gaucher handed Errol a fixture to show, since it fit right in. It was to make the threaded rod to activate the reversing gear on a small steam engine he had made. As originally set up it took 27 turns of the crank to reverse the engine, using a 5/16-18 thread. Rolly thought this was too much, so he decided to go with a triple start thread on the rod, so now it only takes 9 turns to reverse the engine.

The fixture holds the part in a collet and has a 12 hole indexing circle with a lock to hold the collet in any of the 12 positions. To make the nut to go with the rod Rolly made a 5/16-18 triple start tap and cut the nut. Don Strang mentioned that the Hendy lathe has marks on the spindle that allow you to easily index it.

Then Errol showed us one last way to cut multiple start threads. Use trigonometry to back the tool out,move it over, and move it back in, allowing for the play in your cross slide and such of course. It’s possible, but I don’t think very many of us would want to do it that way too often.

Upcoming Events

Errol Groff

May 1 New Hampshire Power of the Past Collectors Dunstable Show
Dunstable MA

Rts 3 and 113, 1 mile west on Rt. 113 follow signs - Contact: David Beard Nl4 South Mammoth Rd., Manchester NH 03109;   603-623-2217

May 1 ATCA Western Mass Chapter 12th Annual Antique Truck Show
8:00 to 3:00
Yankee Candle Corporate Headquarters
Yankee Candle Way (off routes 5 & 10)
South Deerfield MA

May 7-8   Zagray Farm Museum Spring Gas-Up and Swap Meet
544 Amston Rd., Rt. 85 Colchester CT
Contact: Arthur Chester, 180 S. Plumb Rd., Middletown, CT 06457   860-982-5158
email: artc@cmtelephone.com
www.zagrayfarmmuseum.org

May 14   Scantic Valley Antique Engine Club 39th Annual Antique Engine, Tractor and Machinery Show

Tolland County Agricultural Center, 24 Hyde Ave. (Rt. 30). Vernon

From I84 exit 67 toward intersection of Rts. 30 and 31, 150 yards east on Rt. 30 toward Tolland.

Contact: Joe Perko Jr., 168 Monson Rd., Stafford Springs, CT 06076   860-558-3043;

email: tiredironcoliector@hotmaiLcom
www.svaec.com

May 15   Hillside Tractor Ride
Cummington MA   RT 9 to Fairgrounds Road to Cummington Fairgrounds
Contact: Francis Judd, 145 Berkshire Trail West Goshen, MA 01032; 413-268-3264

email: gdjuddandsonsll@verizon.net

May 21 Bob Wallace Steam Engine Show

157 Old Rt. 109 Moultonborough

Contact: Bob Wallace, PO Box 393, MOultonborough, NH 03254; 603-476-5685;

www.granitestategasandsteamengineassociation.com

May 28 – 29 40th annual Bernardston Gas Engine Show and Giant Flea Market
Bernardston, MA Exit 28 off I-91 and turn right
Contact: Vickie Ovitt   PO Box 542, Bernardston, MA 01337   413-834-0103
email: whoir3@yahoo.com
http://www.unitedchurchofbernardston.org/