



The NEMES Gazette

NEW ENGLAND MODEL ENGINEERING SOCIETY INC.

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January 2006

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Editor's Desk

Victor Kozakevich

I hope everyone had a Merry Christmas, and will have a healthy and prosperous New Year, with resolve of course, to finish that project in time for the upcoming model shows.

It's perhaps a good time to thank all the members who have helped with the many up-front and behind-the-scenes tasks and activities that keep NEMES interesting and growing. And also, thanks to those who have introduced new members to the fold. Plus a special thanks to the more experienced among us, who have shared their knowledge with beginners and passed on their wisdom.

Lastly, a reminder regarding NEMES dues: If the word PAID is on your gazette mailing label, you are current with your dues. If the word DUE is on the label, then this is your last gazette unless dues are received by 20 January 2006. A membership form is on the back page.

Send it in now so you don't forget!

P.S. We still have a few seats left on the Cabin Fever bus. Don't miss the show!

Next Meeting

Thursday, Jan. 5, 2006

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

Membership Info

Annual dues of \$25 (via checks made payable to "NEMES" and mailed to our membership secretary) for the calendar year are due by December 31st of the prior year.

Missing a Gazette? Send mail or email to our publisher.

Addresses are in the left column.

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President's Corner

Norm Jones

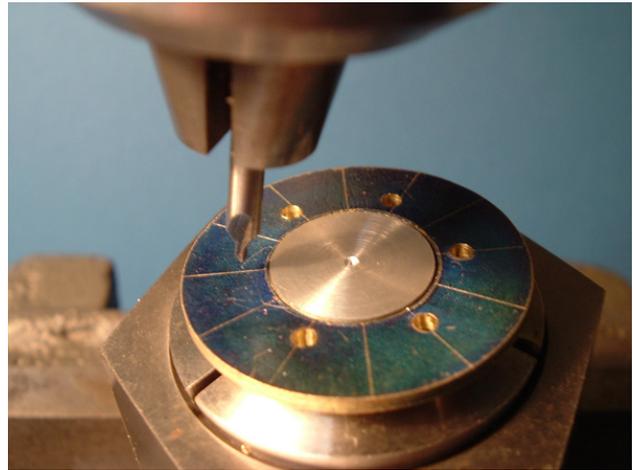
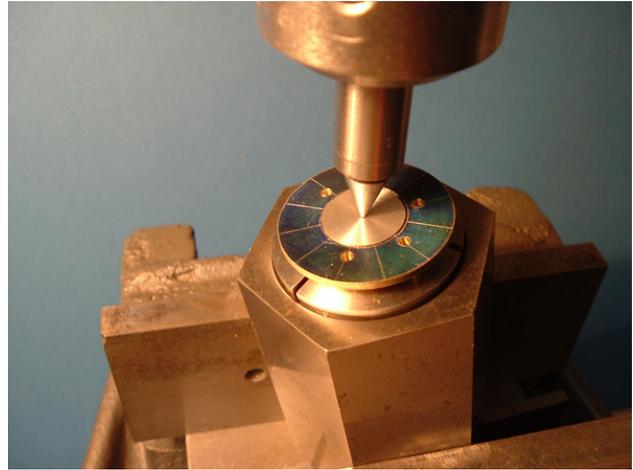
The Meeting

The January meeting will feature one of our semi-annual "Poster Sessions". For those of you not familiar with the term, a Poster Session is an informal get-together where everyone is encouraged to bring in something that they are working on. It is a great opportunity for you to get some assistance in solving a particular problem, or to just show off your latest project. Furthermore it's a great opportunity to just plain socialize!

Communication

I received a call from fellow member Dave Stickler just before last month's meeting. He noticed that I had listed an incorrect departure date for the Cabin Fever Bus trip in my column and wanted me to be aware of it. In the course of our conversation Dave asked what I was working on in the shop. I told him that I was making a burner for a hot air engine model which required a pattern of six holes located on a bolt circle, each to be drilled at a ten degree angle. My plan was to use a "Horizontal/Vertical 5C Collet Index Fixture" which would have been OK except for the ten degree angle requirement. Dave suggested that he had a much simpler collet holder that could be mounted in a vise and set at the ten degree angle with an angle block. There would be six manual setups, but that would be a minor inconvenience. What a great idea! I already had one of these fixtures as I'll bet many of you do as well. Yet another example of how just talking with a fellow modeler can make a seemingly complicated problem just disappear!

Here are some photos of drilling the six holes at 10 degrees with a hexagonal collet holder:



Cabin Fever Bus Trip Update

There is still some room on the bus, so if you are still thinking about joining us, this is the last call! Our block of reserved rooms at the Holiday Inn is going to be held until January 3. Call (717) 845-5671 to make a reservation and be sure to mention the "NEMES Cabin Fever" event to get the rate of \$60 +tax per night. Also send a check made out to NEMES for \$110 to Richard Koolish 212 Park Ave, Arlington Mass 02476-5941. The final count will determine the actual bus fare. Anything over 26 riders will allow me to issue a "rebate" on the bus, Friday morning. Everyone who sends in a check will receive a letter with last minute details about a week prior to the trip.

See you at the meeting on January 5th.

Norm



The Meeting

Max ben-Aaron

Ed Seldin

Our speaker at the December meeting was Ed Seldin, an oral surgeon at MIT's medical facility. Ed, who is a CRMI Corporate Member and new member of NEMES donated the large steam engine (near the boiler) to the Museum in 1985 and has constructed several Stirling engine of his own design, one of which he brought to his presentation .

If you have ever had a pair of wire coat hangers in a closet you might have noticed that soon there are more than two of them. By now it is well known that wire coat-hangers breed (paper clips are their larvae), so measures have to be taken to curb their unrestricted proliferation. Ed is at the forefront of the effort to turn surplus wire hangers into ornamental (and sometimes useful) products.

When Ed was an undergraduate at Tufts University, he became interested in making chain mail by wrapping wire around a mandrel to form a helix, linking together single turns clipped from the helix, and flattening them to close the ring. This hobby did not last long because it was intrinsically very boring, but the helices themselves exerted a fascination all their own.

If one were to wrap two strands of wire (of the same diameter) together around a mandrel and then unwrap one of them, what one gets is a helix with a pitch equal to the diameter of the wire*. Two relatively short (elemental) lengths of the helix will then be able to be nested together. This is actually the basis of living organisms (as discovered by Watson and Crick

just fifty years ago — self-assembling double helical strands of RNA and DNA.

The same technique, starting with n strands and unwrapping $n-1$ of them produces a helix with pitch n . 2, 3, . . . , $n-1$ elemental helices which will nest together. (Helices with varying properties can be made by wrapping stock wire around mandrels of different diameters.) Ed speculates that such elemental helices, freely floating in a liquid medium of the same density will tend to self-assemble because that is the minimal-energy configuration. (According to the Totalitarian Law of Physics -- "Everything that is not forbidden is compulsory"-- it is bound to happen, given enough time).



A modular system is one with two kinds of elements – structural elements and connectors to link the structural elements together. One can envisage a spectrum with a modular system with many kinds of structural elements (but only one of each) and many kinds of connectors (but only one of each). Structures built with such a system are complicated. At the other extreme, structures built from a modular system with multiple structural elements and connectors (but all elements and connectors of the same kind) are also complex. In the animate world, as well as the inanimate -- perhaps even more so -- nature is economical of principle and prodigal of structure (Abdus Salam's Law).

Ed's great insight was that elemental helices could form a modular system in which the elemental helices act as both the structural element and the connector and that complex structures could be built starting from these primitive elements. He started by creating models of the five Platonic solids (tetrahedron, cube, octahedron, dodecahedron and

icosahedron) out of elemental helices made from the wire from coat-hangers. Tetrahedrons, octahedrons and icosahedrons have triangular faces, cubes have square faces and dodecahedrons have pentagonal faces. Spirals with 2 1/2 turns are maximally condensed – it is difficult even to see the joints and when assembled into pentagonal rosettes for a dodecahedron, there is little space between the rosettes.



Over many years Ed's repertoire of basic shapes expanded into a rich vocabulary of geometric forms with flat and curved sheet, to create decorative arts and even jewelry.

An impulsive invitation to the renowned MIT mechanical engineering professor, Woody Flowers, to have lunch with him at Legal Seafoods, led to the revelation that incoming freshmen seem to know all about computers and Legos but have little or no prior exposure to basic mechanisms. So, now Ed teaches a course which evolves complicated mechanisms with cranks made of bent wire and rotating and sliding bearings made of elemental helices. Examples of such devices are differentials, governors and an ingenious 6-cylinder 'elbow engine' configuration.

Apart from their obvious use as coat hangers, the only other use I have ever found for the wire exploits its stiffness — probes for digging and cleaning out sink drains, for example. The wire seems to be quite hard and is difficult to cut with a small pair of wire cutters. To Ed, though, the coat-hanger wire is a wonderful resource – cheap, plentiful, structurally strong yet easily

formed on a mandrel into elemental helices. The variety and ingenuity of the many samples that covered the table and filled his bag attest to the power of Ed's artistic imagination and creative impulse.

* This, by the way, is one of the answers to a well-known Frequently-Asked Question: How was the first leadscrew made? Twisting two wires or cords together and then removing one of them can provide a screw accurate enough to start a bootstrapping process -- this primitive screw can be used to make a better one . . . and so on, to the maximum precision attainable.

(Due to an editing error, the last page of Max's notes from the November talk printed in the December Gazette regarding the WEP and challenges investigating it, were accidentally left out. That section of the report follows in its entirety. – Ed.)

The second speaker of the evening (November 3rd) was Jim Phillips of The Smithsonian Astrophysical Observatory (SAO) who is in the midst of project POEM, an experiment to validate or disprove the Weak Equivalence Principle (WEP). The WEP states that the motion of a body solely under the influence of gravity is independent of the composition and internal structure. This is the principle that, in popular lore, Galileo tested by dropping two balls of different weights from the Leaning Tower of Pisa.

The WEP is the foundation of Einstein's General Relativity and is critical to the understanding of:

- black holes
- quasars
- gravitational radiation and binary pulsars
- the unfolding of the early universe.

It has been conjectured (Schiff) that, for any complete, self-consistent theory of gravity, WEP implies Einstein's Equivalence Principle (EEP), so the WEP may be more fundamental.

The basis of Jim's experiment is to have two pairs of test mass assemblies (TMA) in free fall in a comoving vacuum chamber for very close to a second, and to employ about 10,000 tosses to reduce statistical error. The experiment is repeated with altered configurations to ensure the correction of systematic errors to the nominal accuracy level. This technique involves measuring the differential

acceleration of a pair of TMA to a precision of $3.5 \times 10^{-11} g$ on each toss. Rapid measurement will allow the experiment to be repeated with several pairs of materials.

Measuring the acceleration of the TMA requires the use of a laser interferometer. Normally such incredibly precise measurements are performed only horizontally on an optical bench. In the POEM experiment, two pairs of TMA and a vacuum chamber are moved together vertically, up and down. The difference of acceleration of the TMA is measured as the pair rise and fall by about 90 cm. The optical bench is formed by the freely falling TMA and components mounted in the chamber. The interferometer is a cavity formed by a retroreflector located within each TMA. It detects variations in the distance between the two masses as they fall.

The experiment requires a 'bouncer' to project the vacuum chamber and its included test masses up and to decelerate them in a controlled fashion at the end of free fall. Initially the experiment used a 'trampoline' to toss the apparatus up. Recently, this was replaced by a bouncer based on torsion bars, sharply reducing the energy lost during a cycle.

The next phase of the experiment is to replace the current slide with one capable of greater precision, using, perhaps, air bearings. Given the industrial capabilities of the US and an unlimited budget, this could be done rather quickly. The challenge is to do it within a finite budget.

This was the motivation for the talk to NEMES. It is hoped that members of NEMES, with their proven wide variety of mechanical experience, would be able to assist in both the design and fabrication of an air-bearing bouncer. Jim Phillips spent some time discussing the mechanical requirements, which are severe. Several spirited interchanges followed.

In particular, Garland O'Connell suggested that the cross-slide of a Hardinge lathe, suspended on ferro-fluids, might be capable of meeting the requirements. Bruce Murray and Heinz Kochling visited the POEM team in the following week for brainstorming and consideration of the alternatives.

We hope that the fruitful interchange between NEMES and the POEM team can continue, to help this important experiment go forward.

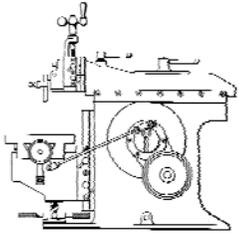
Max



Treasurer's Report

Richard Koolish

Balance on November 14, 2005	6708.50
Gazette printing	-206.08
Brass for whistles	- 92.50
Speakers fee	- 50.00
Sale of 1 apron	+ 20.00
Dues collected	+1045.00
Bus company payment	-2835.00
Balance on December 20, 2005	4569.92
Bus trip checks being held	2310.00



Shaper Column

Kay Fisher

Ludwig Gack Shaper Part 3

This month we will continue our story of Ludwig Siegfried Schmidt's Gack Shaper.

Assembly

"Cleaning and painting took far longer than first estimated. But the lure of assembly is great because one wants to see the fruits of their labor.



Feed Gear Installed Photo by Siegfried Schmidt

The machine's ram and rocker arms are back to work again. The parts for transmission of the load look rather flimsy. Despite this, no signs of wear were visible, even after 50 years. Since it stood this much time and use, I guess it will do the same again.



Base and Column Photo by Siegfried Schmidt

The biggest parts are reunited first. The main body is attached to the base by four screws and a cable.

The crank with the feed gear was installed next. The two shiny areas on the main body are there to attach a chip pan.



Ram & Insides Photo by Siegfried Schmidt

The worktable is back! Vise and t-slotted table are carried by the cylinder and are then tightened down via the central nut. The table can be set in any angle; additionally there are holes on the cylinder for quick setup of special angles.



Table Installed Photo by Siegfried Schmidt

To the left, a plunger can be seen that sets the table to given angles via the holes in the cylinder. The graduation is only needed for special angles. The vertical spindle is mounted rigidly to the machine housing. The worm drive moves the slide up and down by screwing the worm gear up and down on the fixed screw. This is quite a cool idea!



Table Close-up Photo by Siegfried Schmidt

The ratchet for auto feed can be taken off the horizontal feed and attached to the vertical feed. This is another super cool idea.

Movement of the screw on the feed gear sets feed. I won't go into depth here; all shaperists are familiar with this.

On top of the feed ratchet, direction of travel can be set with the small handle. Also, it can be shut off completely here.



Feed Ratchet Photo by Siegfried Schmidt

Now, the machine is ready for the first test cuts. The only things missing are the final electric setup with a VFD, fine-tuning of the ram gibs, paint touch-up, installation of a work light, and reattachment of the chip pan.



Nearly Ready Photo by Siegfried Schmidt

Here is the first curl. For safety reasons, I tested it with plastic. A second clapper box that cuts on drag, not on the pushing motion of the ram, was also part of the machine. With it, the machine cuts on the rearward travel, which makes necessary the alternate direction of rotation. This lets the operator see scribed lines on the work piece. Also, this causes chips to fly away from the operator.



First Cut Photo by Siegfried Schmidt

What moves can be observed. And here, in the drive-line, a lot of parts move. It's a pity no movement is seen in the assembled state - only the rhythmic noise of the machine.

In the assembled state, the drive is no longer visible completely, so I will explain it with the two pictures that follow.

In most shapers, for height reasons, the crank is split in two links.

In this shaper, the problem is solved in a different way.

The link is connected to the housing of the machine via another crank and is able to move at a constant height.

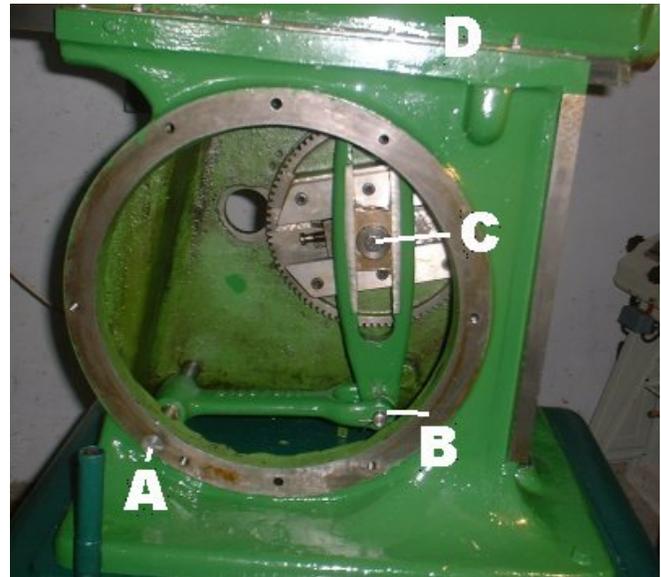
There is a single link in position D. The crank is connected to another link arm (A-B) which can compensate the height movement.

This rare design results in rather complicated kinematics, since the length of the link changes in relation to the slide and also in relation to the slide block.

Because of the change of link ratio during one rotation, the direction of travel is locked to the direction of the tool. The head has to move slowly during cut and fast during the retract cycle. This movement is superimposed with the up and down travel of the crank.

During the retract cycle, the lowering of the crank aids in braking the slide motion. Seen over the whole cut, the ram moves with a little more even speed. Even small alterations here can have large effects, since, added to cutting

forces, the masses of the slide must be accelerated and decelerated.



Height Corrector Photo by Siegfried Schmidt

While looking at the links, two bumps were found in the main body of the machine. Possibly, it was planned to add an axle here that can aid as another support for the link. Another possibility is that a rigid mount of the rocker arm was planned here for another version of the machine. By looking at the picture, one can estimate that a rocker arm with a second link attached to the slide in a more classical design could be put here quite reasonable.

Axle A has no reinforcements of the castings in the place it's mounted. It's housed in the same place corresponding to the side cover as the two bumps. The axle is secured in its position by the cover.

The question of lubing and of the kind of lube was not answered for quite a while. The grease seen in the following pictures is not the right lube, but there were no bad effects found on the machine. Lucky me!

Since the machine's body forms an enclosure, the bearings are only accessible indirectly. Axle (A) is lubricated via an oil port and a hollow shaft. All other bearings (B, C, & E) are oiled via the oil port visible in the ram position lock. I was astounded to see deep dents on the handle. There is no need to tighten it with a hammer!



Ram Handle Photo by Siegfried Schmidt

Below is a photo of the rocker arm in its raw state. On top is the (hollow) connection to the ram. To the left, the link shaft is seen.

The bearing is drilled through on top, so the oil can move through to the rocker arm, into the bearing and downwards from there. There's a small oil guide cut on the rocker arm. After lubing of the link shaft, the oil travels on via the small gunmetal pipe.



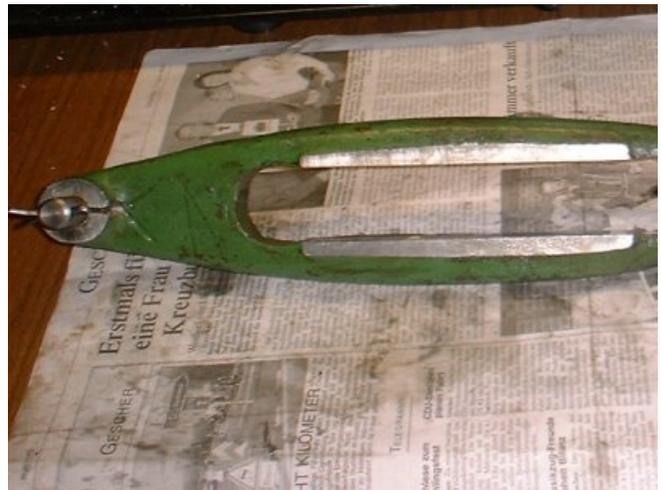
Rocker Arm Photo by Siegfried Schmidt

Directly under the pipe is the crank block. Here, oil drips into the cylindrical indent and is distributed towards the outer sliding surfaces and the crank block's central bearing. At least that's how it's planned if there's no grease in the way.



Crank Block Photo by Siegfried Schmidt

But the oil is not done yet. Oil from the slide way sags down and gets caught in v-shaped cut outs on both sides of the lower link shaft, which is lubed in this way."



Drive Link Photo by Siegfried Schmidt

Next month we will continue with the electronics of Siegfried Schmidt's Ludwig Gack Shaper.

Keep sending me email with questions and interesting shaper stories. My email address is:

KayPatFisher@yahoo.com

Kay



In the News

Bose, the Framingham-based manufacturer of high end audio equipment has spent the past 25 years trying to figure out how to take their technology and apply it to automotive suspensions. They take an linear electro-magnetic motor and replace the MacPherson struts with it, then add controllers and software to sense when the car is hitting a bump, and make the motor move the wheel in the appropriate direction and speed to smooth out the ride.

You can see a video of this in action at:

http://www.bose.com/controller?event=VIEW_STATIC_PAGE_EVENT&url=/learning/project_sound/suspension_components.jsp



Discoveries

The Automat

by Bob Neidorff

Our town has a town dump. The landfill was capped years ago. We still call it the town dump, but now it's just a transfer station. It has recycling containers for plastics, cardboard, newspaper, metal, and household waste. It also has a "Second Chance Shop" where you can buy good and sometimes new items that were discarded. This story is of something I found at that shop.

A really nice guy named Gus runs the second chance shop. He periodically scans the metal pile and the household waste pile for good merchandise, but most of his stuff comes from people who give him things that are too good to crush.

One day, after tossing my household waste and recyclables, I visited the Second Chance Shop and saw a non-descript wooden box with box-joint corners and latches. The box was the size of a large attaché case, 5½" x 14½" x 20". There were no markings on it.

"Gus, what is this box?"

"Bob, you've spotted a gem. Let me tell you what that is. Fifty years ago, before there were calculators, the Swiss made beautiful mechanical adding machines. To keep them running, a team of repair technicians traveled the country doing service calls. Each technician carried one of these boxes. Inside are spare parts for these adding machines."

I opened the box and looked inside. Wow! Fascinating! There were linkages, gears, brackets, spacers, and other little parts. I have no clue what I will ever do with it, but it's cute. "How much?" We settled on a very reasonable price and I was off with my loot.

When I got home, I opened the box to look at the contents more carefully. I didn't realize it when I bought it, but this box has four layers of parts in it, each layer consisting of one or two wooden trays divided into sections for different parts.



The Top Tier of the Automat Kit

Like many other things, this sat in my basement for a few years before I opened it again. When the spirit finally moved me, I looked inside for a brand name or other identifier. Two parts had the name "Automat" on them. One said "Made In Switzerland". So I went to the web and searched for "Automat Adding Machine". Nothing. It's rare to do

a web search and get nothing, but this was a true dead end. I tried every tool that I knew. I even searched ebay. Nothing.



The Second Tier of the Automat Kit



The Third Tier of the Automat Kit



The Bottom Tier of the Automat Kit

Then I got creative (desperate?) I searched ebay for just Automat. I got hits for many things including cameras, wristwatches, Horn and Hardart mugs (does anyone remember the Horn and Hardart Automat?), and one device called

an "Automat Erector Set". A what??? I clicked that link. Someone was selling a box just like mine and calling it a cousin of the child's metal construction toy, the Erector Set.

So I searched <http://www.google.com> for "Automat erector set". Nothing. But when I searched <http://groups.google.com> for "Automat erector set", I got a few hits. Most were from "Steamboat Ed Haas". Ed also has an Automat and confirmed that it is indeed a mechanical prototyping set. It is still made, in various configurations. Ed said that he finds it very useful for prototyping projects. He gave me this link to the manufacturer:

<http://www.compact-technik.de/englisch/baukaesten/baukasten.html> and this link to his website where he shows something that he built with his Automat set: <http://www.nmpproducts.com/linear.htm>

So what is in an Automat kit? That depends on the particular kit that you get. One thing is certain: everything is metric. Mine contains an assortment including these things and other things that are, well, indescribable:

- Springs
- Shafts
- Linkages
- Screws
- Nuts
- Threaded Rod
- Couplings
- Washers
- Spacers
- Collets of different lengths
- Collet sleeves
- Collet nuts
- Angle channel
- Cams
- Followers
- Universal coupling
- Racks
- Gears
- Partial gears
- C-clips
- Wrench
- Ratchet wheels
- Discs
- Drums
- Shims

My mystery is solved. The guy at the Second Chance Shop was dead wrong about everything,

except for the fact that it is indeed a gem and worth many times what I paid for it, based on what one kit sold for on ebay. If you ever stumble on an Automat, grab it! I haven't made anything with my Automat yet, but now that I see some of the possibilities, I'm going to have some real fun, just like when I was a kid and got my very own Erector Set!



For Sale

Myford milling attachment available

I have a piece of equipment that I would like to give away to an individual. The equipment that I have is a Myford Rodney milling attachment for the Myford ML7, ML7-R and Super 7 lathes. I used it a couple of times before obtaining a regular milling machine and since then it has gathered dust and some surface rust. I'm prepared to make a suitable wooden box for carriage by UPS, or, if within 100 miles of Newbury VT, I would consider delivering or meeting someone halfway. The bare weight of this attachment is about 60 pounds; gross weight with case probably about 70 pounds.

Jim Kemble 802-429-2974

See a photo and description of a similar Myford Rodney on the web at:

<http://www.lathes.co.uk/myford/page13.html>

Shaper Work CD

Put out in 1944 by the New York State education Department this 326 page manual is chock full of valuable tips and information on using the King of Machine tools....The Shaper. Covered is everything you need to know about the care and feeding of the shaper, use of the shaper, even how to sharpen tools for the shaper. Scanned and saved in Adobe Acrobat format. The CD now has a lot more info on it, and the price has increased accordingly. \$10.00, shipping included.

Errol Groff
180 Middle Road
Preston, CT 06365 8206
errol.groff@snet.net

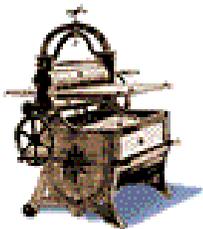


Web Sites of Interest

Sign up for the NEMES mailing list at:
<http://groups.yahoo.com/group/nemes>

MAKE magazine has a free blog that has all sorts of interesting article pointers:
<http://www.makezine.com/blog/>

This "V8-Engine", the most complex paper model in the world, has semi-realistic exterior and interior detail. It is made entirely from paper (except a motor, a battery holder, a few plastic tubes and electrical wires).
<http://www.yeesjob.com/v8engine.htm>



NEMES Gazette Editorial Schedule 2006

Here are the closing dates for Gazette written contributions in the coming months:

<u>Issue</u>	<u>closing date for contributions</u>
February	1/20/2006
March	2/17/2006
April	3/24/2006
May	4/21/2006
June	5/19/2006



NEMES clothing

NEMES Tee Shirts

NEMES tee shirts and sweat shirts are available in sizes from S to XXXL. The tee shirts are gray, short sleeve shirt, Hanes 50-50. You won't shrink this shirt! The sweat shirts are the same color, but long sleeve and a crew neck. Also 50-50, but these are by Lee. The sweat shirts are very comfortable!

Artwork by Richard Sabol, printed on front and back:



Rear



Front

Prices:

	Tee Shirts	Sweat Shirts
S - L	\$12.00	\$22.00
XXL	\$14.00	\$24.00
XXXL	\$15.00	\$25.00

Add \$5 shipping and handling for the first tee shirt, \$1 for each additional shirt shipped to the same address. Sweat shirts are \$7 for shipping the first, and \$1.50 for each additional sweat shirt.

Profits go to the club treasury.

Mike Boucher
 10 May's Field Rd
 Lunenburg, MA 01462-1263
mdbouch@hotmail.com

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



**MARK
THIS
DATE**

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 wbracket@rcn.com or (508) 393-6290.

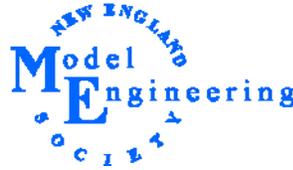
Bill

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

Jan 21-22 Cabin Fever Expo
York, PA Gary Schoenly 800-789-5068

Feb 2nd Thursday 7PM
NEMES Monthly club meeting
Charles River Museum of Industry 781-893-5410
Waltham, MA

Feb 18, 2006 NEMES Model Show
Charles River Museum of Industry
Waltham, MA 781-893-5410



Membership Renewal Form

**Renew your NEMES membership
for calendar year 2006**

**Enclose check for \$25 payable to:
NEMES**

Name _____

Address _____

City _____ **State** _____ **ZIP** _____

Home Phone _____

Work Phone _____

Email _____

**Please bring this form to the next
meeting or mail to:**

**Ed Borgeson, Membership Coordinator
11 Peck Avenue
Wayland, MA 01778**

*(If bringing cash, place in envelope with your
name and address on outside)*