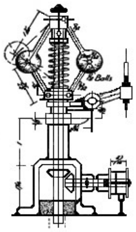

The NEMES Gazette
New England Model Engineering Society Inc.

No. 214 February 2014

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Presidents Corner

Victor Kozakevich

Our speaker this month will be William Howard. Bill is an artist who specializes in model train set scenery. His presentation will be a combination talk, display and demonstration of how to fabricate realistic looking rock structures. Bill is associated with the recently opened Hobbyland in Maynard Ma.

As we had to cancel our January meeting/poster session, I encourage any member with a project, tool or story to tell, to bring it the February meeting. Let's delay the start of the meeting to 7:30 and allow for an extended show and tell at the tables at the back of the room. I believe the room is usually open by 6:30, so that should allow an hour or so.

In canceling the January meeting, in addition to posting on the NEMES list, I asked our treasurer David Baker to email to the list of members he's been collecting. Turns out internet service providers see such mass mailings as spam and tend to block them. So, I encourage members to sign up to the NEMES list which allows easy contact. We'll be making instructions available in the near future.

David also mentioned to me the survey included with the membership renewal shows most members prefer the printed newsletter. So, in light of this and our publisher's wish to retire from the post, I'd like to move ahead on using a local printer to print and mail. Let's get started, even if we have not got everything resolved as far as lowest cost or simplest self-mail format, we can refine as we go.

The Gazette needs more contributions and I would encourage members to write about their

Next Meeting

Thursday, February 6nd, 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 David 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
MAR	FEB 20, 2014
APR	MAR 20, 2014
MAY	APR 17, 2014

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particular interests, whether it's a find at a flea market, an uncommon repair or a creative use for some recycled material. Sharing is good!

"To invent, you need a good imagination and a pile of junk."

-Thomas A. Edison

Shop Talk

Max ben-Aaron

FLY-BY-WIRE

The Wright Brothers knew from their experiments how to build wings that could generate lift. The big problem, as they saw it, was aircraft control. Wing warping was their solution. In an attempt to circumvent the Wright patent, Glenn Curtiss pioneered hinged control surfaces. Hinged control surfaces have the advantage of not causing stresses that create a problem in wing warping, and are easier to build into structures. The basic operating mechanisms of the flight controls systems in use on aircraft first appeared in a readily recognizable form as early as April 1908, on Louis_Blériot's VIII pioneer-era monoplane design. The fundamentals of aircraft controls are explained in Wikipedia_'Flight control surfaces'.

A conventional fixed-wing aircraft flight control system consists of flight control surfaces, the respective cockpit controls, connecting linkages, and the necessary operating mechanisms to control an aircraft's direction in flight. Aircraft engine controls are also considered as flight controls as they change speed. Roll and pitch are governed by moving the ailerons, yaw is controlled by the rudder and the throttle changes engine speed or thrust for powered aircraft.

In early aircraft and, currently, in small aircraft where the aerodynamic forces are not excessive, mechanical or manually operated flight control systems are the most basic method of controlling an aircraft. A manual flight control system uses a collection of mechanical parts such as pushrods, tension cables (and sometimes chains), pulleys, bell-cranks and counterweights, to transmit the forces applied to the cockpit controls directly to the control surfaces.

Higher loads caused by airspeed increases and increases in the control surface area required by large aircraft led to a large increase in the forces needed to move them, so complicated mechanical gearing arrangements were developed to extract maximum mechanical advantage in order to reduce the forces required from the pilots.

The complexity and weight of mechanical flight control systems increase considerably with the size and performance of the aircraft. Hydraulically powered control surfaces help to overcome these limitations. A mechanical circuit links the cockpit controls to a hydraulic circuits. Like the mechanical flight control system, it consists of rods, cables, pulleys, and sometimes chains.

The hydraulic circuit consists of hydraulic pumps, reservoirs, filters, pipes, valves and actuators, powered by hydraulic pressure (generated by the pumps in the hydraulic circuit), to convert hydraulic pressure into control surface movements. Electro-hydraulic servo valves control the movement of the actuators. Movement of a control by the pilot causes the mechanical circuit to open the matching servo valve in the hydraulic circuit. The hydraulic circuit then powers the actuators to move the control surfaces. A mechanical feedback linkage stops movement of the control surface at the desired position by closing the servo valve when the actuator movement is complete.

A fly-by-wire (FBW) system replaces manual flight control of an aircraft with an electronic interface. The movements of flight controls (joystick, rudder pedals etc.) are converted to proportional electronic signals by flight control computers which determine how to move the servomotors at the appropriate control surfaces to perform the desired maneuver. These signals are transmitted by wire (hence the term 'fly-by-wire') to the servos and activate them, to move the relevant control surfaces. After the control surfaces have been moved, feedback signals are returned to the flight computer to maintain records and maps of what has happened.

The Mind/Body problem

There is an old joke told by philosophers:

What is matter? Never mind. What is mind? No matter.

The relationship that exists between a mind (mentation), and bodily states or processes, the so-called Mind/Body problem, requires explanation. For over two-thousand years philosophers have worked on this problem: to determine the nature of the mind and mental states/processes, and how minds are affected by and can affect the body. Philosophers will never solve this problem because it is not a philosophical problem; only since the advent of computer technology has it been amenable to an engineering solution.

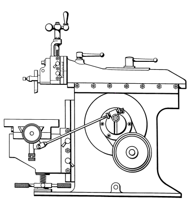
The problem was famously addressed by René Descartes in the 17th century, resulting in Cartesian dualism which maintains that there is a rigid distinction between the realms of mind and matter. Some philosophers, 'monists', maintain that there is only one kind of stuff.

The term 'hardware' refers to the devices and physical interconnections required to store and execute ('run') the 'software' in a general-purpose computer. The term 'software' (first used in this sense by John W. Tukey in 1958) is the generic term for organized collections of computer data and instructions, often broken into two major categories: system software that provides the basic non-task-specific functions of the computer, and application software which is used by users to accomplish specific task. It has been said that 'Hardware is what you can kick; software is what you curse'. In the language of duality, hardware may be metaphorically likened to Cartesian 'matter', and software to 'mind'. It is possible to blur the distinction between hardware and software by burning a self-bootstrapping version of the software into a ROM (Read Only Memory), resulting in 'firmware'.

Our brains did not evolve in isolation. Animals have always been immersed in (and closely intertwined with) their environmental niches. I like to think of a brain as a device to match the impedance of a creature and its environmental niche.

When a child is born, it really knows very little about the world that it has suddenly been thrust into. Its brain is not quite a *tabula rasa* (clean slate); what it has, though, is a powerful suite of programs that enable it to bootstrap itself into an organization that can cope with life. There is not enough information in the genome to control the wiring of the brain, so it generates a large suite of connections and then prunes them. One important process enables the baby to randomly move its arms and legs, say, and use feedback to direct the pruning process and (at the same time) to create internal tables, networks, and programs in the cerebellum to control purposeful actions. Consequently, when a child in primary school is playing the game “Simon says”, when “Simon says raise your right arm” is heard, the brain translates that into a command, a sequence of nervous pulses, and routes it to its cerebellum where the command is transformed into a timed set of matching pulses to activate, in the proper sequence, the muscles needed to raise the right arm. This done, another set of pulses, this time in the other direction, tells the brain to update the (propriocentric) map of bodily stances and attitudes that it maintains. Fly-by-wire!

A science-fiction short-story by Terry Bisson provides a brilliant commentary on the Mind/Body problem. http://www.terrybisson.com/page6/page6.html



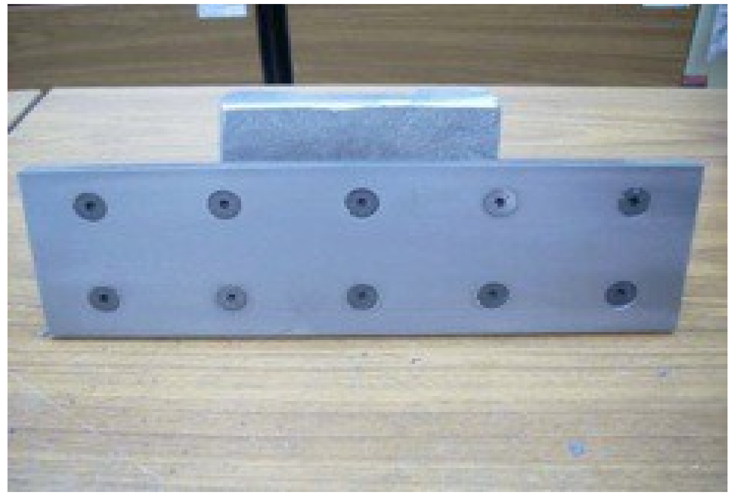
Metal Shapers

Kay Fisher

R. G. Sparber’s Gingery Shaper - Part 45

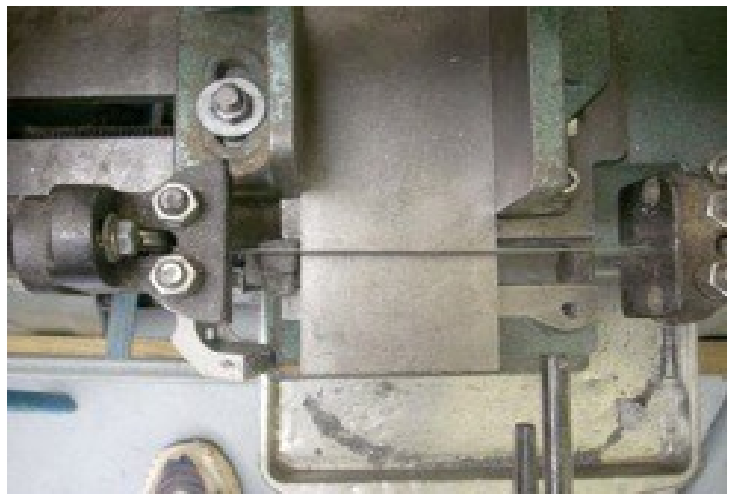
Installing The Cross Slide Ways

The next task was to attach a CRS plate to the casting with a lot of countersunk screws. This is the ways that the table rides on for horizontal motion.



Cross Slide Plate Photo by R. G. Sparber

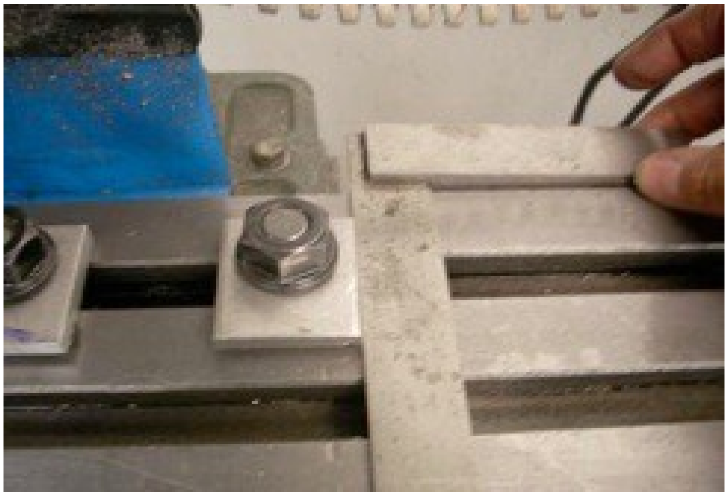
Gingery calls for a plate ¼” x 3” x 10” but my supplier only had 3/8” x 3” x 10”. This will not be a problem. I just have to remember to modify the cross slide to accept 3/8” rather than ¼”.



Bandsaw Plate Photo by R. G. Sparber

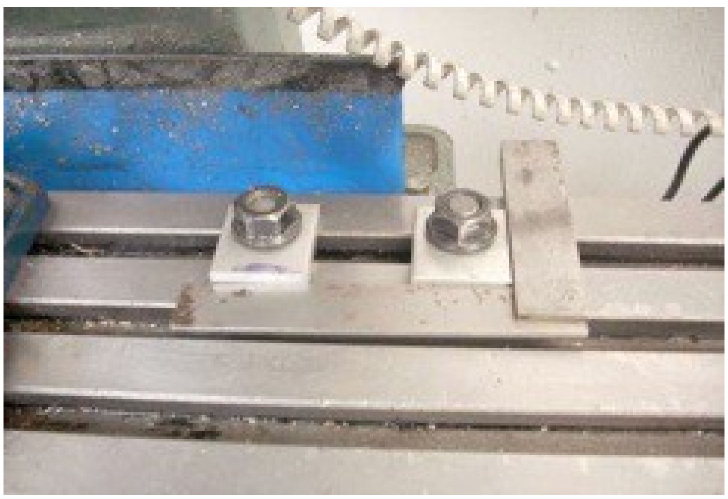
The first step is to cut the plate to a little over 10”. I did this on my horizontal/vertical bandsaw with the stock laying flat. It takes longer but it turns out closer to square this way. A block of paraffin wax to the left of the plate lubricates the blade just before it reaches the stock.

The plate was then put in my mill vise and the ends squared by side milling with a 5/8” end mill. The overall length is not critical.



Aligning 1st Pad   Photo by R. G. Sparber

In preparation for drilling a lot of holes in the cross slide casting, I put down two pads on my mill table. Their location was dictated by putting down the casting and being sure that the pads contact machined surface. I then used a square to align the first pad.



Aligning 2nd Pad Photo by R. G. Sparber

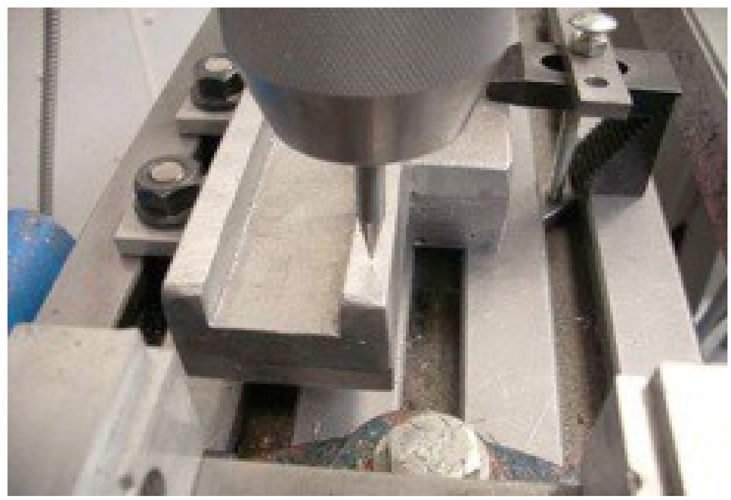
Next I used the square to align the second pad's vertical face to the first pad. This minimizes how much material I must remove as I side mill. After milling these vertical faces, I am left with precision stops aligned with the X axis.

Testing Drill Reach   Photo by R. G. Sparber

The next step is to put down the casting with plate and test that I can reach the entire surface with my drill. It is best to test this now rather than half way through machining. Note that the mill/drill head has been rotated to the right and therefore has no trouble reaching the front right corner of the plate.

Drill Reach to LeftPhoto by R. G. Sparber

It can also reach the back left corner.

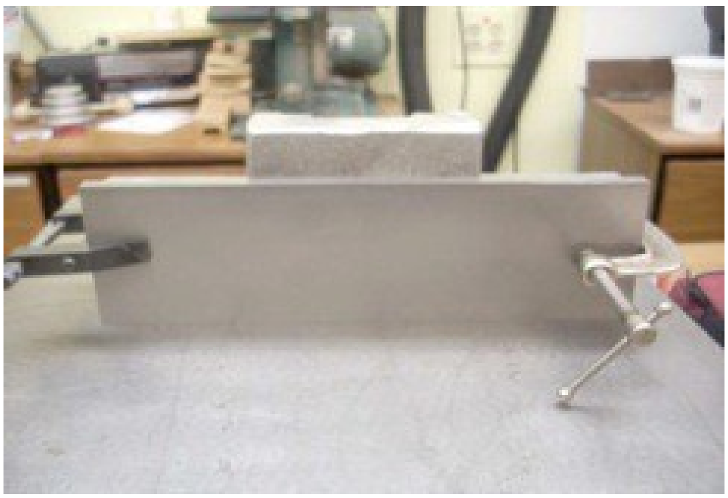


Locating Center of Pad   Photo by R. G. Sparber

The casting is gently held in place with a small clamp and also firmly bedded both on the table and the two stops. I located the centerline of each pad with a spud mounted in my drill chuck and my DRO, and recorded these locations. Once the plate is put down on the casting, it will be hard to see these pads and find their centerline.

Casting on Parallels Photo by R. G. Sparber

It is now time to align the plate to the casting. The lip of the casting must be ½" beyond the pad. I first put the casting on ½" parallels. I am working on a surface plate here.



Centering Plate on Casting Photo by R. G. Sparber

The plate is then positioned on the surface plate and roughly centered on the casting. The surface plate is dead flat, the parallels are of equal height, and the plate is square. The result should be a plate that is aligned with the casting.

Narrow clamps were used so they would fit into the slots on my mill table as you will see later.

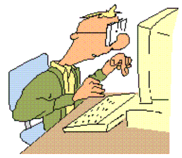
Rear View Photo by R. G. Sparber

The parallels are in contact with my "primary reference 2" as well as the surface plate. The 3" CRS plate is also in contact with my surface plate. As long as all surfaces are clean, I am insured that the edge of the 3" plate is parallel with my casting.

Stay Tuned for part 46 from R. G. Sparber next month.

Keep sending me email with questions and interesting shaper stories.

My email address is:
KayPatFisher@gmail.com



Editor's Desk

George Gallant

When submitting articles please remove any links. Getting rid of them is a pain with Open Office.

Over the holidays I built one of the "Most Useless Machines". My simple machine is modeled after numerous versions that can be found on the internet. Flip a switch on the top of a box. The lid opens and an arm pops up and turns off the switch.

The typical electronics consist of a double pole, double throw switch and a gear-head motor. I decided to make a circuit board with microprocessor, single pole switch, and a hobby grade servo motor. If I am going to make something useless, I might as well make it complicated and useless. Just like real work.

For a processor, I chose the Microchip PIC24F08KL200. It is a 14 pin device that requires 3.3 volts at a few milli amps to operate. It supports a sleep mode so power consumption while idle should be very minimal. The architecture is very similar to other PIC projects that I have done and the development tools are already in place.

One of the I/O pins acts as a switch input and another as a servo output. Set the servo to about -75° and wait for the switch to close. When the switch closes do a short delay and check if it is still closed. If it is, set the servo to approximately +75° and wait for the switch to open. Just like the switch closure operation, delay and verify that the switch is truly closed. Then return to the idle position.

The more complex software involves servo timing. An internal timer generates a 1 msec interrupt. Every 10 msec it starts a servo cycle: assert the servo output pin and enable a timer to generate an interrupt proportional to the desired angle. When that motion interrupt fires, deassert the servo control pin.

Hobby servos require a 1.5Msec pulse every 20msec to stay positioned at 0°. -90° is about 0.8msec while +90° is about 2.2msec. The exact number will depend on the location of the motor relative to the switch, the shape of the arm, and the position of the servo horn to the motor spline.

There were a couple of problems:

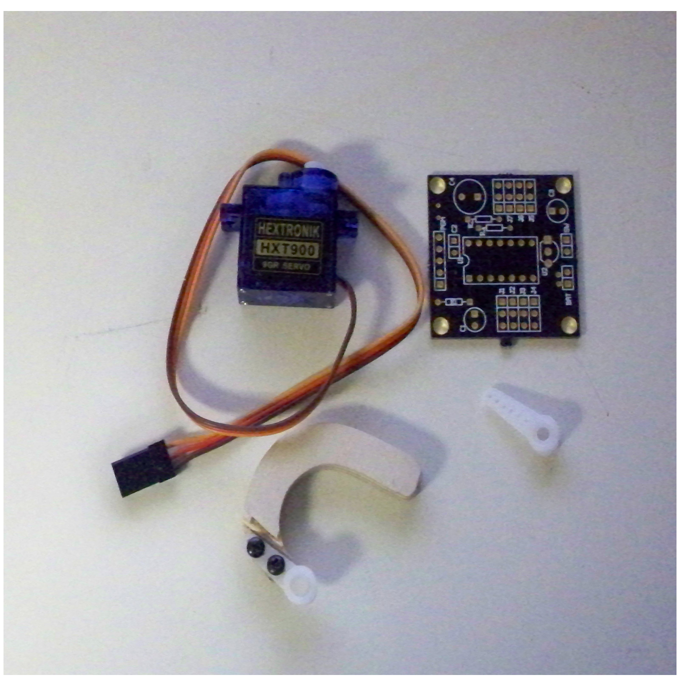
- Pin reversal on the 3.3V regulator layout. Luckily, it is a 3 pin package that works when soldered with pins 1 and 3 swapped.

- Placed the mechanical connectors too close.
- Wanted to drive the servo with a 3.7V lithium-Ion battery. Turns out that there just wasn't enough power to flip the switch. Burned out 2 motors trying. Changed to 9V battery and external 5V regulator.
- The arm was not centered properly.
- The lid was cut on a power miter saw with a relatively wide saw blade for the size of the lid. Big ugly gap!

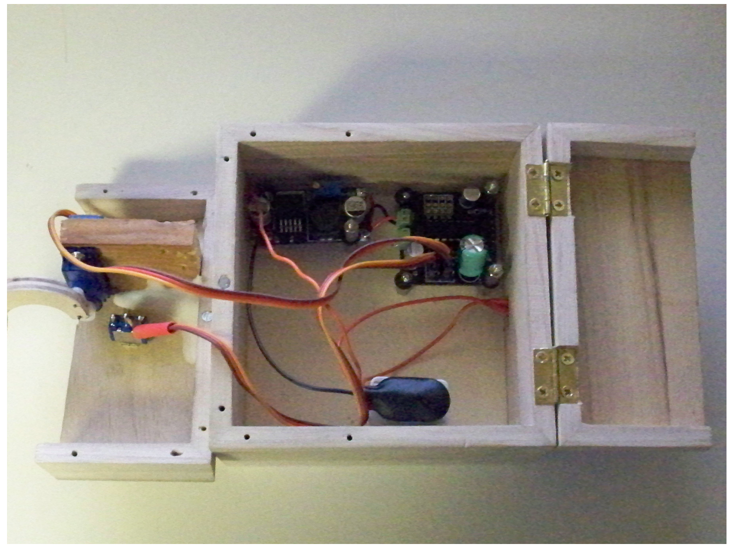
I was planning on doing at least 2 builds. The first box was going to be sacrificial while I experimented with placing the motor and arm.

There are some real advantages to using a processor on such a simple project such as this:

- Possible to add a second motor dedicated to opening the lid. It will be synchronized with the switch turn off actuator such that the user sees two distinct operations.
- When closing the switch, the software can retract the arm after a period of time to avoid leaving the motor turned on and overheating.
- After making the arm, adjust the software to tune it to the needs of the lid, arm and switch. This includes the angular position and possible the angular rate.
- Putting a random delay after the switch closure spooks the user who is trying to outsmart a dumb box.
- Could and light and/or audio alarm.



Servo, Circuit Board, Arm, Servo Horn



Inner Box

The holes in the rim and front lid are intended for alignment pins. Was using sanded down match sticks but kelp breaking them. Probably will use nails. It seems to be important to have the servo motor securely attached to to the surface that the switch is mounted to.

Outer Box

I am open to suggestions on how to apply text to the box. Most useless machines attach a “Do Not Touch” label near the switch.

The box cost approximately $30.00 to build with the most expensive component being the 9V Lithium battery followed by the $4.00 wooden box. You can find kits in the internet for approximately $35.00.

A side advantage of building this circuit board is it will be used in my next “Almost Useless” project. If all goes as expected, this 8 hour project will be ready in 8 months.

The revised schematic, artwork, and BOM along with the source code will be posted on the NEMES web site. If you want to make one, I do have some spare boards and chips and can bring the programming tools to the NEMES meeting to load your code on your project.

Upcoming Events

Bill Brackett

To add an event, please send a brief description, time, place and a contact person call for further information to Bill Brackett at:

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

Feb 6th Thursday 7PM
NEMES Monthly club meeting
Charles River Museum of Industry 781-893-5410
Waltham, MA

Feb 15th 10:00-4:00
18th Annual NEMES Model Engineering Show
Charles River Museum of Industry 781-893-5410
Waltham, MA

March 6th Thursday 7PM
NEMES Monthly club meeting
Charles River Museum of Industry 781-893-5410
Waltham, MA

March 23-23rd Midcoast Model Festival
Owls Head Transportation Museum Owls ME
http://www.ohtm.org/events_2000.html

MEMBERSHIP FORM

For 2014 Calendar Year

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PAPER COPY [ ]   or   E-MAIL COPY [ ]

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ADDRESS___________________________________

CITY_______________________________________

STATE _________   **ZIP**________________

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(_____)_____________________________

WORK PHONE

(_____)_____________________________

E-MAIL_____________________________________

Please enclose form in an envelope along with $25 cash or check made payable to NEMES.

Dues can be brought to our next meeting or mailed to our treasurer:

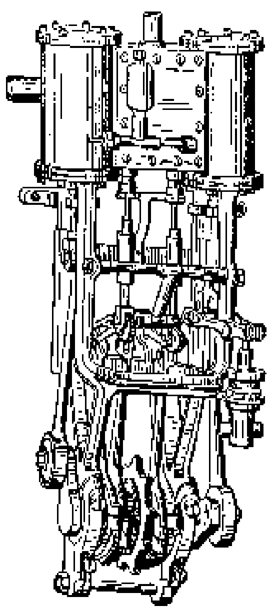
David Baker
288 Middle St.
West Newbury, MA 01985

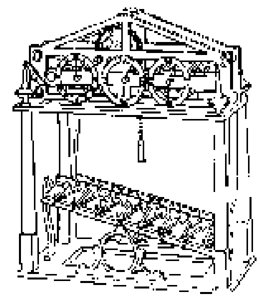
18TH ANNUAL N.E.M.E.S.

MODEL ENGINEERING SHOW

FEBRUARY 15, 2014

10:00 AM TO 4:00 PM
CHARLES RIVER MUSEUM OF INDUSTRY
WALTHAM, MA

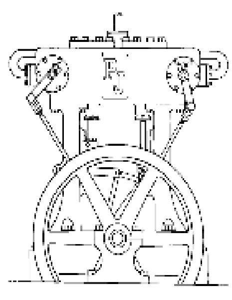


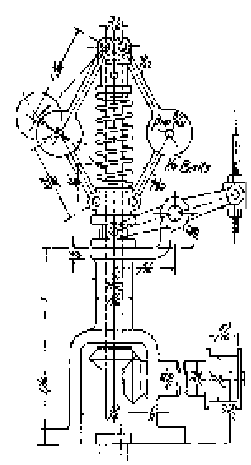


SEE OPERATING SCALE:

- STEAM ENGINES
- GASOLINE ENGINES
- AIRCRAFT ENGINES
- STIRLING CYCLE ENGINES
- CLOCKS
- MACHINISTS TOOLS AND FIXTURES
- LOCOMOTIVES
- TRACTION ENGINES
- MODEL BOATS - STEAM AND GAS

AND MEET THE CRAFTSMEN
WHO BUILT THEM.





EXHIBITORS SETUP STARTS AT 8:00 AM
COMPRESSED AIR FOR RUNNING MODELS
GAS ENGINES ALLOWED
NON-MEMBER EXHIBITORS WELCOME

GENERAL ADMISSION FOR SHOW AND MUSEUM

ADULTS	$7.00
CHILDREN 6-12 WITH ADULTS	$5.00
EXHIBITORS AND CHILDREN UNDER 6	FREE

Directions:
Take Rte. 128 to Rte. 20. Go East on Rte. 20 to Central Square, about 2 miles. Right on Moody Street. Cross the river, left on Pine Street to municipal parking lot on left. Short walk over the footbridge to the museum.

For additional information call the Museum at 781-893-5410 or go to
www.neme-s.org