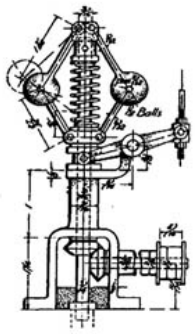


# The NEMES Gazette

NEW ENGLAND MODEL ENGINEERING SOCIETY INC.

No. 198 October 2012





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## *President's Corner*

Dick Boucher

### The Meeting

Our speaker this month will be Charlie Fairbrother. Charlie is a professional clock repairman who has been working on a reproduction of a Masonic clock which has involved having castings made and machined to build the case for the clock.

I have to bring to your attention that the work on the Jackson Room is still a work in progress. It is not definite at the time of this writing just where we will be holding the meeting - be it the Jackson Room or the Appleton Room or if we will have to just sit around in the museum itself so be watchful when you arrive.

Last month we had a great show and tell period that made the meeting run a little long but I feel that show and tell is a very important part of our meeting. Charlie said he doesn't have a very long talk prepared and is planning on a lot of questions so a good amount of show and tell would help fill the evening.

### Miscellaneous Ramblings

Bea and I had three great rambles this past month. The first one was at the Saugus Iron Works. I want to thank everyone who came out either as an exhibitor or just to enjoy the park and the actual Iron pour. If anyone made a casting, bring it along to the meeting and show off your handiwork. The day was really great, New England weather wise - nice and sunny and we had lots of shade thanks to the tent Park Rangers provided. Speaking of the Park Rangers, I must give a special thanks for the terrific hosts they are to us. Any questions or extra needs we had were warmly

# Next Meeting

## Thursday, October 4th 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 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 |
|---|---|
| NOV | OCT 18. 2012 |
| DEC | NOV 22. 2012 |
| JAN | DEC 20. 2012 |

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and quickly met. As a matter of fact when we tell them we are all set they seem almost disappointed that they can't give us more help.

I guess I should have taken an attendance of the exhibitors because as I mention names, I most surely will have forgotten someone.

David Baker had a class at the Academy so he wasn't personally in attendance but he did, as he called them, send his parental units with his display, ROV, foundry, and the beam engine he is working on.

Les Russell had his miniature Sterling in his shirt pocket which he demonstrated a number of times utilizing a huge alcohol torch as a heat source.

There was a fellow who's name I didn't catch who had an ironing board full of unique antique farm kitchen and shop tools and machines.

Norm Jones had his Hero's Fountain spouting water all day and his Merry and Sterling-pumping engine.

Bill Bracket brought along a nice display including a beam engine, a vertical steam engine, a small flywheel device that I need an explanation of and his great South Pointing Chariot.

Todd and Amy had Todd's display up and running all day long.

Herb Cotterly had three of his gas engines running at various times.

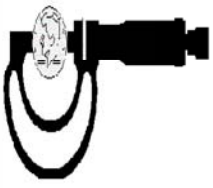
Dick Koolish also had a display of his blacksmithing handiwork which was a rather appropriate display for the surroundings.

One member notably missing was Ed Rogers. Ed's wife fell recently and is in a lot of pain and not too mobile so Ed had to stay home and take care of her needs. We hope she heals quickly and things are soon back to some semblance of normal.

Once again thanks to all who showed up and made it a great day of exposure for the Society.

Bea and I also enjoyed the Waushakum Live Steamers Annual Meet at the end of August and the steam weekend at Clark's Trading Post / White Mountain Rail Road. More on that next month.

Dick B.



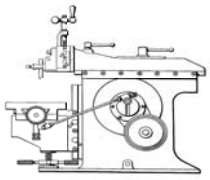
## Tool Corner

Horror Fraught

### Halloween Special

We stock everything from low-grade Shop Equipment, Hand Tools, Compressors and Welders to, inexplicably, Wheel Chairs and Cat Toys. Remember, We Sell What You Don't Want! (from Mad Magazine, June 2012)





## Metal Shapers

Kay Fisher

### R. G. Sparber's Gingery Shaper - Part 29

**Casting the Down Feed and Clapper Box**

This casting session occurred over a two day period. I cast the down feed and clapper box but failed to successfully mold the cross slide support. Eventually it became evident that my problem was with my worn out Petrobond. I had tried to recondition it but the oil did not get into the clay enough. The next morning I bought 100 pounds of fresh Petrobond and 50 pounds of parting dust. This Petrobond is like modeling clay. It rams up beautifully and, as you will

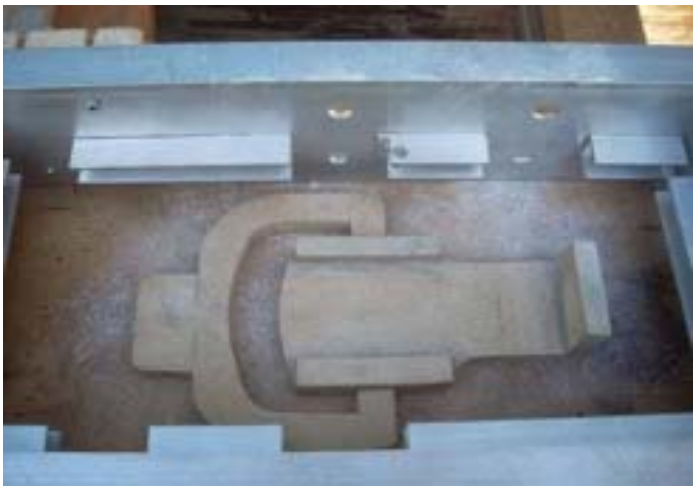
see, it has very high green strength so the castings came out nice and crisp.

### The Down Feed

This was the first time I got to use my new variable volume flask.

Variable Volume Flask Photo by R. G. Sparber

I configured the cope and drag to be rectangular. For some crazy reason, I kept thinking they were only good as squares.



Pattern Loaded Photo by R. G. Sparber

The molding board is down and the pattern with gate system dusted. It is a bit snug on the sides but since this is aluminum and not wood, it can take a lot more heat. The sprue will fit in a hole near the center of the block at the center of the gate system.

Before Turning Over Photo by R. G. Sparber

With a flask this heavy, I use a ratchet strap to hold the boards to the flask before trying to turn it over. A few clicks of the ratchet and nothing slides.

Flask with Pattern Photo by R. G. Sparber

After rolling the drag, you can see the pattern and gate system. Very little sand shows on the aluminum frame of the flask. This proves that the flask was squarely down on the molding board and should therefore be a good tight fit to the cope.

Weak Petrobond Photo by R. G. Sparber

Here is where I started to figure out that the old Petrobond was very weak. Some edges are clean but there is a lot of

breakout. This is a small part so there was still plenty of sand left to prevent drop out.

Sprue & Cutter Photo by R. G. Sparber

The sprue was cut with my home made sprue cutter, which works great. The flask was then closed and moved over to the casting area.

Result Photo by R. G. Sparber

You can clearly see every place that looked bad in the mold. Yet this can be cleaned up with machining.

Side View Photo by R. G. Sparber

It does not look too bad from the side.

Back View Photo by R. G. Sparber

And the back looks fine, too. The two divots are my holes for drawing the pattern.

**The Clapper Box**

Clapper Box in Flask Photo by R. G. Sparber

I used the same gate system but you can see that the pattern is not as wide as the last one, so I just had to cut some sand.

With Gate Removed Photo by R. G. Sparber

I chose to pull the gate system first and do my cuts with the clapper box pattern still in place.

Petrobond Imprint Photo by R. G. Sparber

The weak Petrobond broke a little. This is not so bad but will require some machining of the casting to clean up. You can also see the corner in the upper center area cracked. Otherwise, it is a clean imprint.

Result Photo by R. G. Sparber

With a bit of machining, this will do.

Side View Photo by R. G. Sparber

From the side it doesn't look bad.

Back View Photo by R. G. Sparber

The top side looks the best.

Stay Tuned for part 30 from R. G. Sparber next month. Keep sending me email with questions and interesting shaper stories.

My email address is: KayPatFisher@gmail.com

## White Steam Generator

Rolly Evans

**¼ scale model White steam automobile generator**

They don't call them boilers because it's really one long piece of pipe, called a mono tube generator.

But the White 20 HP generator is unique in that it is comprised of seven spiral coil sections and a double bottom grid used as a superheater. Feed water comes in at the top coil and goes down to the next coil in succession but each coil returns to the top before dropping down to the next level.

Top Coil

Middle Coil

The bottom coil is formed in a grid so as to support all the spiral coils above it and the grid is supported by a scalloped cast iron ring that forms the combustion chamber. This ring forms the frame for the fabrication of the outer jacket as well as the mounting of the burner plate.

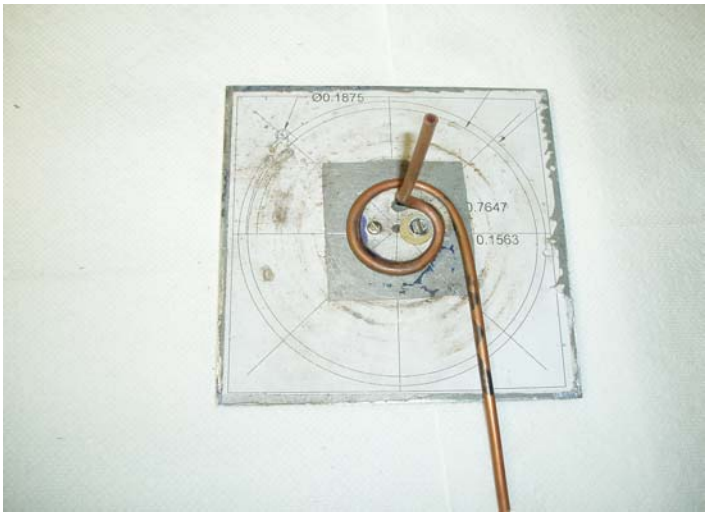
Bottom Coil

I wanted to make a model to show the uniqueness of the coil stack and the combustion ring. This was a challenging project. I visited two friends that have White steam cars and have had the generators out of the cars for repair. I also studied photos and other catalog drawings for details. Several owners who have worked on these generators have said I got it right.

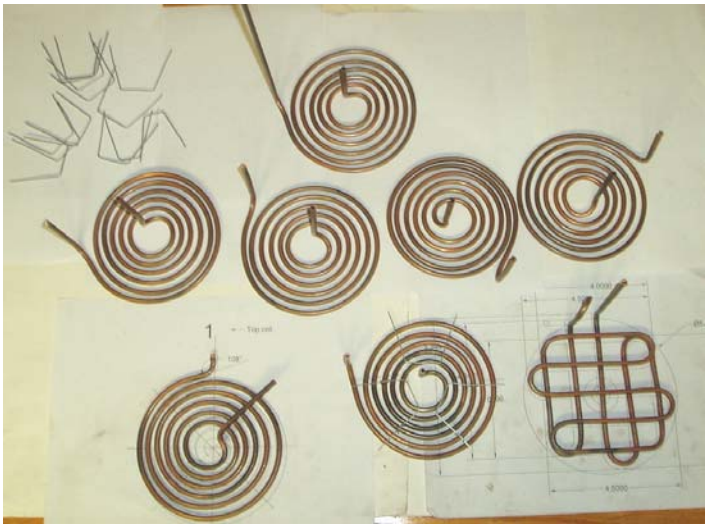
For the model, the combustion chamber was drawn out in CAD and then a water jet cut the outer and inner shapes from one-inch plate which were then machined on the Bridgeport.

The tubing I used is heavy wall 3/16 copper. I made a jig to wind all the spirals before bending the necessary offsets. I used 1/8 strip of leather for spacing while winding the spiral windings. I also had to make a tubing bender for two different radius bends.

Tube Bender




Bending Jig



Completed Sub-assemblies

# Circuit Corner

George Gallant

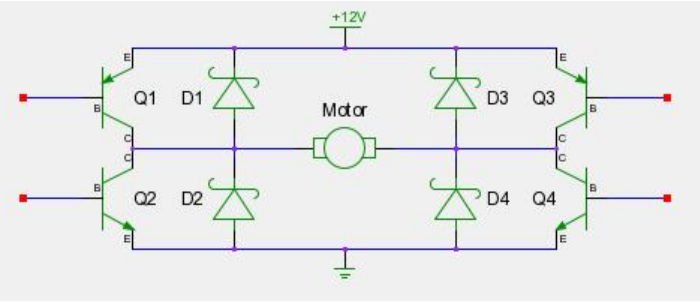
I have had a request to explain how to drive a DC motor from a microprocessor. For example purposes, we will use a Pittman model GM8712J089-R1 motor and a Microchip dsp33FJ64M804 processor (both selected because I have them).

Firstly: I am not formally trained in electric motors. Nor do I do it for a living. What I have learned is based on reading articles, talking to others, and experimentation.

Simply stated, you drive a motor by supplying sufficient power where power is the product of the current and the voltage. As the motor rotates, it behaves like a generator. The motor will accelerate until this electromotive force (back EMF) equals the power supplied.

Our motor is rated at approximately 500mAmp at 24V while our processor is 25mAmp at 3.3V. Clearly this cannot be directly connected.

The solid state glue need to hook the motor to the processor is called an H-Bridge which consists of 4 transistors as shown below. You can build your own or purchase a dedicated IC. For simplicity purposes, the drawing shows conventional PNP & NPN transistors. Most modern H-Bridges will be construction using MOSFETs due to their superior performance in the ON state.




Turning on transistors Q1 & Q4 will drive motor in one direction while turning on transistors Q3 & Q2 will drive the motor in the reverse direction. Enabling both Q1 & Q2 or Q3 & Q4 at the same time will result in a short circuit (bad idea!) while enabling Q1 & Q3 or Q2 & Q4 will result in a braking operation (may require additional components). Just follow the arrows to draw a current path.

DC motors can be modeled as a resistor in series with an inductor. The resistance affects the steady state current while the inductor impedes any changes in current. The diodes provide a low impedance path back to the power source when the transistor are switched OFF. Without the diodes, the transistors will be toast.

Lately I have been favoring the Rohm BD622 series of parts because they are easy to solder and contain the built in protection diodes. Their ON resistance isn't great, but the ease of fabrication wins. Whatever chip you decide on, read the spec sheet!!! The BD622 (and many others) can be wired directly to the output pins on the micro, but this is not universally true. Many higher performance H-Bridges will require special driver circuits.

Our software task will be to instruct the processor to activate the appropriate transistors to regulate the voltage/current in the motor and maintain a target speed.

To regulate the voltage, we will use Pulse Width Modulation (PWM). The processor will assert output pins to turn the transistors ON for a portion of a cycle. Fortunately, the PIC DSP33FJ (and most other embedded CPUs) have hardware support for PWM. In its simplest form you:

1. Set one register to specify the period (frequency).
2. Set another register to specify the ON time.
3. Setup the time-base.
4. Enable the module.

The operating frequency (period) will influence the stability of the motor speed. Take an extreme case. You turn the motor on for 10 seconds and then let it spin without power for 50 seconds. There will be an average speed but probably not what you want. The trick to smooth operation is to pulse the motor such that you never turn off the current. Ideally that would be at a very high frequency. However, the higher the frequency, the more the switching losses (transistors consume more energy while not in the ON or OFF states). Another possible concern is the motor will "sing" so you might want to avoid switching frequencies in the human audio range. All said and done, the "ideal" operating frequency appears to be in the 20kHz to 40kHz range.

To accurately control the speed you will need feedback. A nice feature of the GM8712 motor is that it contains a quadrature encoder (100 slots). Encoders typically have 2 optical transceivers that are mechanically placed 90º apart. Typically the output from the encoders are named A & B.

Other feedback schemes use Hall-effect sensors, variable resistors, back EMF sensors, or detecting the noise generated by commutator spikes.

With the quadrature encoder you can either measure the pulse width or count the number of transitions per unit time to compute the motor speed. Again the DSP microprocessor has hardware to support edge detection. It is appropriately named the Quadrature Encoder Interface (QEI) and it will count the transitions on both inputs. A nice side effect of quadrature encoding is that you can also deduce the direction of rotation. If the transitions on A precede B then the direction is opposite of B preceding A.

There are a number of conditions that can be mitigated when using a micro-controller to drive motors. The first is detecting stalls. DC motors consume significantly more current when stalled. Remember the back EMF? Your h-bridge is probably sized (power) to drive the motor under normal loads. Excessive current will produce heat that the package cannot dissipate. Then the little smoke appears. Placing a sense resistor in series with the h-bridge power and measuring the voltage across it will enable you to monitor the current. This resistor will consume power so use the lowest value possible. You could also use the QEI to indicate that the motor is not turning as expected. Note: this doesn't work for assemblies that may slip.

A second condition (artifact) that can be compensated for is startup. Often motors will require extra power to get started. And, once they are moving you need to quickly reduce the applied power.

A third condition is variable loads. If you know, or can detect, a change in load you may be able to adjust your feedback response parameters.

To put it all together, use the QEI to sense the motor speed and direction and use that information to adjust the pulse width. If you are too fast, shorten the pulse. The typical feedback algorithm is called PID, (Proportional Integral Derivative) and could be the subject of another article.

Google searches for PID & PWM will generate thousands of hits. Combining the search with "robot" will generally bring up more pragmatic results

Schematics and code can be found on the NEMES web site under projects. I will bring the my breadboard and debug tools to the October NEMES meeting for members to play with.


## For Sale

Machinist Desperado

Bob Wilson has some machines he wants to give to a good home or send to the scrap yard.

Monarch EE 1959 no power supply, but has motor
Grob belt filing machine on stand
Craftsman 12"lathe long bed
Craftsman 18" jig saw on a stand
Antique 14" hack saw
6"stroke traveling head shaper
Covell surface grinder 5 X 10" magnetic chuck
Brown and Sharpe #0 horizontal mill
Burke horizontal mill model B 3 3/4" X 16" table
Kick press
Many drills

Other stuff available on visit:

Lally's Garage

40 Essex St. Swampscott, MA

781 593 2020

FREE to a good home - Sargon Gold Tracer DRO. Approx. scale travels 11" in Y an d 28" in X. Was mounted on a small Bridgeport. Y axis is fine. X axis needs cleaning (again) since it skips in one place.

Contact Steve Earle at:
steven.m.earle@comcast.net.
781-585-3929


## 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 events@neme-s.org

Oct 6th 8:00-4:00 The Original Yankee Steam-Up
The New England Wireless and Steam Museum, Inc.
1300 Frenchtown Road East Greenwich, RI
www.newsm.org/index.html

Oct 7th 12:00-5:00
Roland's Shop visit
90 S. Spencer Rd. Spencer Ma.
508-887-2277

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

Oct 6th -7th 8:30 to 4:30 Battle for the Airfield
The Collings Foundation
137 Barton Road in Stow, MA Cost at gate: $20 Adults
www.collingsfoundation.org/cf_OpenHouseEvents12.htm

Oct 6th -7th Foreign Auto Festival & Antique Aeroplane Show
Owls Head Transportation Museum Owls ME
http://www.ohtm.org

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

October 13th 9-5 American Precision Museum
10th annual Model Engineering Show,
Windsor Community Center, Windsor VT
www.americanprecision.org 802-674-5781.

Oct 31 & Nov 1 Design-2-Part Show
Royal Plaza Trade Center
Marlboro Ma.
Free admission at D2P.com/ma

Nov 1st Thursday 7PM
NEMES Monthly club meeting
Charles River Museum of Industry 781-893-5410
Waltham, MA

Nov 2nd-4th World Championship Punkin Chunkin
East of Bridgeville, Delaware
http://www.worldchampionshippunkinchunkin.com/