

The NEMES Gazette

NEW ENGLAND MODEL ENGINEERING SOCIETY INC.

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April 2012

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Editor's Desk

Frank Hills

Changing of the Guard

My friends, I'm afraid NEMES has reached a difficult point of transition. I had hoped to be writing an article about lasers this month, but circumstances have changed. As much as I have enjoyed editing the Gazette I'm afraid I'm going to have to hand over the task to someone else. This will be my last Gazette as Editor. As much as I hate to share that news I'm afraid there's more. I've only dedicated about 4 years to this effort. Dick Koolish has dedicated even more. For 7 years Dick, as combination Treasurer and Membership Secretary, has kept us financially balanced and organized as a club family. He too is stepping down. His last day comes this month with the election of new club officers. God bless him for all his years of hard work!

Finally, do I need to remind you that Dick Boucher has been President for 6 years and his position is also up for grabs? Dick has been a great President and inspiration to our club. That's one of the reasons so many wanted him to stay for so long. But there are others of you with his kind of drive, talent and love of NEMES. It's time for someone new to step forward.

But this really is an opportunity as much as it is a difficult point of transition. It's an opportunity for those of us with untapped talent to show it off.

Continued next page.

Next Meeting

Thursday, April 5th 2012

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

Membership Info

New members welcome! Annual dues are \$25 (mail applications and/or dues checks, made payable to "NEMES", to our Treasurer Richard Koolish, see right) Annual dues are for the calendar year and are due by December 31st of the prior year (or with application).

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

Addresses are in the left column.

Contents

Editor's Desk.....	1
NEMES Gazette Editorial Schedule	2
President's Corner.....	2
The Meeting	2
Miscellaneous Ramblings.....	2
Aircraft Engines	3
Tool Corner.....	5
Metal Shapers	6
Upcoming Events.....	8



Editor's Desk

-continued from page 1

I saw an incredible upwelling of talent and experience come to life only a few short months ago. I thought the Gazette was going to die and felt helpless to stop it. But after a little tabloid freak-out many came forward with ideas, articles, advice and proof of their interest. I was amazed by the response. As I said then, "this is your club". Now is the time to show how important it is to you. Take hold. Add your flair! The positions of President, Treasurer/Membership Secretary and Editor are critical to the life of any organization, and I can tell you from experience, it feels great to be one of those who make it happen.

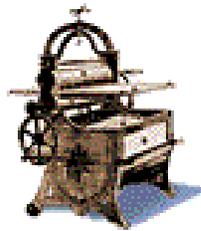
To be President you need a desire to see NEMES continue and a willingness to make it so more than anything else. Add to that some organizational skill, self motivation, a love of our hobby and you've got the makings of greatness.

For the Treasurers/Membership Secretaries position you need to be able to balance a check book and use Microsoft Excel. This too is not overly complicated and Dick has offered to answer any questions. If interested but not sure of you qualifications, drop him an E-mail. Don't worry. He's a nice guy and won't bite (at least I don't think he will?).

To be editor you need to know how to use Microsoft Word, the simple stuff, like cut and paste, inserting text and pictures and altering their format. It's easy. I'll give you written instructions. I choose to write articles, but the next editor needn't do that. Make it your own! And, of course, you need to be able to read and write English and communicate over the internet (I had trouble with the English part).

Don't assume someone else will do what you know you can. Don't just think about it, do it! Get involved. Don't let NEMES die! It doesn't have to be. All we need is people to step forward. We need you, and we need you now!

Your Editor for today
Frank Hills



NEMES Gazette Editorial Schedule

<u>Issue</u>	<u>closing date for contributions</u>
May 2012	April 20, 2012
June 2012	May 25, 2012
July 2012	June 22, 2012
August 2012	July 20, 2012
September 2012	August 24, 2012



President's Corner

Dick Boucher

The Meeting

This month Frank Dorian will be our featured speaker. Frank will be talking about heat treating in the home shop. This should be a very timely topic for our group.

Miscellaneous Ramblings

The main ramble this past month was an item that took something off my "Bucket List". Seeing the Pyramids of the Nile or the rain forests or even the Grand Canyon has never been on my bucket list. On Sunday the 11th of March, Bea and I ventured out Worcester MA to see Buster Keaton starring in "The General" in black and white on the big screen. Now I have a DVD copy of the "The General" of my own and have watched it many times over the years. Seeing it on the big screen isn't even the item that was on my bucket list. What made the afternoon so great was a theater organ supplying the musical score for the movie. This was not just an organ but a "Mighty Wurlitzer" organ that rose up out of the pit while the organist was playing. The program included a selection of tunes from South Pacific and Oklahoma and a lot of repartee by the very personable organist before it descended back below the bottom of the movie screen and the movie began. Yes, seeing a Wurlitzer come up out of the pit has been an item on my bucket list now scratched off.

Please note

Norm Jones, Frank Hills, Dick Koolish and I have been holding important roles in the society for many years. Norm has been both President for five years and a very great help to me for six years. Frank and Dick have also been doing their part for quite a number of years. Frank is publishing his last issue of the Gazette this month and due to other pressures, has to give up the job. Dick is giving up the treasurer's post at the end of his term with the upcoming elections. With this information, and my desire to take a back seat after six years as your president, I ask that the membership take a hard look at whether we will continue as a society. Shall we continue sponsoring our show in February, running the bus trip to Cabin Fever, holding our monthly meetings and our occasional gatherings at member's shops and other locations or is it time to just disband and live with our memories? If we are to continue we will need some new energetic faces to take on some of the responsibilities of the society. Please give this your utmost consideration and step forward at the April meeting.

Dick B.

A Note From The Treasurer

After seven years as the treasurer and membership Secretary, I am retiring from the position as of our next election. It is time for another member to step forward and support our organization. You need to be able to balance a checkbook and maintain an Excel spreadsheet with membership information. If you have any questions about the job, please contact me.

Dick Koolish

A Note From The Gazette Publisher

Let me say thank you to Dick, Frank, Dick, and everyone else who contributed to NEMES over many years. It's a long list of wonderful people, including Ron, Norm, Steven, Rob, Kay, Ed, Errol, Vic, Ed, Steve, and Mike. Forgive me, but I'm sure that I'm forgetting someone. To all, thank you very much!

We welcome you to join this elite group and bring your new ideas and perspectives. NEMES needs you now. As NEMES Gazette Publisher, let me offer volunteers my help in any way that I can.

And, no, I am not resigning (yet). ☺

Bob Neidorff

Aircraft Engines

By Jim Johnson

THE ALLISON AND MERLIN ENGINES OF WWII

By 1930, the stage was set for high altitude, high speed aircraft engine development; a) both the Allison and the Merlin would soon exist substantially as we know them; b) radials and aerodynamic drag were now understood, c) supercharging was recognized as the way to go in lieu of high compression ratio, and d) there existed test methods and tetraethyl lead for adequate fuels. However, the "devil is in the details" and this is an overview of the evolution into and throughout the 30s and then WWII. It was no longer a matter of a few critical rules of design such as identified in the author's prior articles but a host of "details", like gearing, system vibration, bearing shells, valves, radiators, propellers, RPM and manifold pressure controls, carburetion/injection, exhaust manifolds, superchargers and turbo controls, and gasoline. I recommend the book "The Development of Aircraft Engines and Fuels" by Schlaefer and Heron, and for some detailed engineering, "The Internal Combustion Engine in Theory and Practice" Vol. 1 and 2, by Charles C. Taylor. Figure 1 is a view of engine overhaul of a very early Merlin at the Canadian Museum in Hamilton, Ontario showing cylinder liners screwed into the head preparatory to reassembly in the block. Cracking cylinder heads and leaks are problems that just won't go away.



If you gently rap the first crank arm of a crankshaft with a hammer, the tiny torque in this "rubber-band" would travel to all the other crank arms and the other end of the crankshaft in a short time. That time defines a natural vibration frequency with many sub-harmonics. If the V-12 engine is doing 3600 RPM, there are 900 power pulses with reversal of the order of several tons per minute per cylinder or 10,200 power pulses per minute. If this pulse rate happens to correspond to the natural frequency of vibration, something is likely to "give". The same thing applies to quill shafting for accessories. Early engines, notably certain models of the Hiss and the British Dragonfly experienced these failures. Mount the engine speed-reduction gear or supercharger drive directly to the crankshaft and these amplified power pulse problems may all show up at the

gear tooth or cause crankshaft failure (a large supercharger takes 100-600 horsepower!). Power impulse absorbers based upon moving weights with proper dynamic balancing are feasible in long crankshafts and are practical in radials. A separately supported quill helps but introduces its own natural frequency, so basically the problem must be minimized or go away in the basic design.

Radiators for coolants and oil, air-cooling, and certain aspects of exhausts all trace the origin of their technology back to National Advisory Committee for Aeronautics Langley wind-tunnel tests and theory developed in 1927, and Meredith's test work at the RAE of the RAF in the early 30s. If cooling air with its very large drag, is abruptly expanded and made turbulent to slow it down, then heated by the oil or coolant and then straightened and squeezed through a slot/flap or nozzle which speeds it up, the result can be more thrust than there was drag or at least reduced drag. This is the function of wing leading-edge coolers on the Hurricane, boxlike radiators under the Spitfire, coolant scoops of the P-51 and cowling of the Focke-Wulf 190 radial engine fighter. It's also used in exhaust systems primarily by the British and was used, to some extent, by the Japanese Zero.

Why does engine RPM reduce when one magneto (of two) is turned off and why do we always have two separate systems? The answer is that two spark plugs alter the time and spread of ignition due to hydrodynamic delays in the flame front—a sort of effective squish factor. Cable harness and wires were critical because dielectric strength failed at high altitude. Even the Liberty engine, with a distributor, coil and battery, used 2 spark plugs. Windmilling the engine by the propeller caused Merlin engine sparkplugs to foul and required replacement or cleanup. I think it also tended to mess up the magneto. Pilots somehow liked to windmill the P-51 in their landing pattern and thus mechanics changed a lot of sparkplugs. A buddy fired up the engine and the mechanic put his hand up consecutively on the exhaust in airplanes like the P-51. This was very common practice and experts claim they could tell plugs from harness, and maybe magnetos or valves.

If the manifold air is a few feet away from the super/turbo charger, then there is a delay in addition to the engine ramp-up. If a control system bleeds off too much manifold air or diverts (waste gates) exhaust gases, the delay has to be properly implicit or the system (engine plus compressor) will "hunt" and, in the case of marginal fuel operation, it may cause detonation. This was a very significant problem for the P-38 Allisons with turbochargers in the rear fuselage about 10 feet from the engine.

Most other problems, which were severe, could be solved by testing, analysis and then design or materials changes. These are enumerated in the

cited books, so let us move on to the Merlin and the Allison engines. First, there was a big difference in testing strategy between the US and Britain. The US emphasized testing to specifications. Rolls-Royce tested until it broke. Consequently, the Allison V-1710 and the Packard-Rolls V-1650 "Merlin" were very stable whereas there were many different Merlins by Rolls-Royce. Additionally, Rolls-Royce emphasized craftsmen's skills, whereas Packard and Allison designed for manufacturing production.

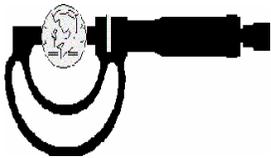
Design changes were funded by Rolls in Britain, but the Allison design was funded first by the Navy and then by Wright Field. Quantities of both were enormous. Merlins totaled about 100,000 including 50,000 for spares. Packard-Rolls built 60,000 for the USAAF and RAF. Allison totals were at least 50,000 units. Allison V-1710s do have a supercharger. However, it was single stage, single speed and designed to improve 10-15,000 ft. altitude performance. Wright Field would not fund Allison for R&D in superchargers, preferring instead to fund GE on turbochargers. Allison had only 25 engineers to resolve production and test problems; not enough to also conduct supercharger R&D. As Rolls-Royce found out, supercharger development was extraordinarily difficult and expensive, primarily in the area of gears and clutches enhanced by harmonic vibrations. However, Rolls-Royce ended up with practical 2 and 3 stage, 2 speed superchargers. Allison (Now a division of GM) ended up in 1946 with lots of turbocharger experience, and moved immediately into turboprop engines. Outside of hopeful uses in the B-36 and the super-engines, Allison had nearly no market for its now-very-high-horsepower piston engines. Designers in Britain, on the other hand, believed in the invincibility of in-line liquid cooled engines, demonstrated by the Lancaster bomber, for commercial aircraft. Rolls-Royce also readily sold other countries on new military aircraft employing Rolls-Royce engines. The picture below shows an Australian Spitfire in Japan with the bigger Griffin engine and 5-bladed wooden propeller, being examined by my very good friend Wm. "Mac" Jordan. By this time, the reliability and maintainability of air-cooled radials was so fully proven in the USA in bombers, that Boeing, Douglas, Lockheed and others had no hesitation on using them for their commercial aircraft.



Schleifer and Heron compared weight of a Merlin V-1650 with an R-2800 radial, both with 2- stage, 2 speed superchargers, both with a full complement of accessories and loads of oils and coolants. Although the

Merlin is lighter than the radial, 3315 lbs vs. 3697 lbs, the Merlin produces 1260 SHP vs. 1540 SHP for the radial above 25,000 feet. The Rolls-Royce Griffin engine, and perhaps the last Allison, would compare more favorably, but the author does not have the numbers. Perhaps maintenance and reliability were more important and favored newer engines.

Many R&D organizations were already developing larger/super/hyper engines, with bigger cylinders, and with X, W and H shapes, by the beginning of WWII. Then, soon after WWII, compound engines entered commercial aviation such as Lockheed's "Connie" (Constellation), and many "old timers" were then convinced that turbojets and turboprops would take over. We will examine some of these enormous piston engines next time.



Tool Corner

By Frank Dorion

Several months ago, we reviewed some classic books on machine tool operation, all of which are valued tools for amateur and professional machinist alike. However the most recent of those titles was published over 40 years ago and subsequently there was a long drought in similar publications that might be useful to us as home shop machinists. Recently, a few publications have appeared that are worth considering as a means of expanding our shop skills.

The first of the books that we'll look at is Machine Shop Trade Secrets by James A. Harvey. Subtitled "A Guide to Manufacturing Machine Shop Practices", Harvey's book promises to provide practical "how to" information for a machinist working in a small shop using conventional machine shop equipment. He does get into CNC work here and there, but his main focus is on manually-operated equipment. Reading Harvey's book is like having a seasoned old shop hand at your elbow, pointing out all those little and not-so-little things he's learned during his years in the trade. If you have been playing with machine tools a while yourself, you will no doubt be familiar with some of the tips and techniques that Harvey presents, but I think it's likely you will still pick up several ideas of value from this book. The book is loosely organized into general topics, but it is by no means a classic vocational training text. Harvey assumes you know your way around a lathe and a mill, so he doesn't spend time on the basics. Instead you get clear presentations on many neat things Harvey has learned on the job over 30 years. His writing style is well-organized and concise. He doesn't sacrifice content to achieve brevity. Each of his topics is fully developed, so you won't be left with

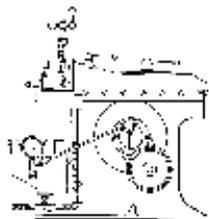
questions, or, worse yet, incomplete information. The book is well illustrated with many photos. In the end, he delivers what he promised, hard-won "trade secrets" that you might otherwise never learn working alone.

Next, we'll take a look at another recent publication, Metalworking Sink or Swim by Tom Lipton. This book's subtitle is "Tips and Tricks for Machinists, Welders, and Fabricators". At first blush, this book sounds quite similar to Harvey's book. However, there are some important differences. Lipton expands beyond machine shop topics into discussions of welding and fabrication techniques so his scope is broader. Also, he presents his information in a manner that imparts his own personal views and values on work methods and attitudes. Fortunately, I think most of us would find Lipton's views largely compatible with our own. His writing is sprinkled with colorful and engaging stories of the people he's worked with and things he's done during his many years in the trade. Most of the stories have a moral of some sort buried in them, so they help us learn how to do things well and safely in the shop. If you are doing strictly machine work in your own shop, you may conclude that Lipton's discussions of welding and fabrication are outside your sphere of interests. However, it's a rare home shop machinist that doesn't eventually get involved in welding or fabrication projects, either doing them himself or having them done. Understanding these processes is of considerable value in either case. Lipton's writing style is relaxed and informal, and his book is illustrated with over 1,000 color photos. You may have already encountered some of the information Lipton presents, but there will be plenty that is new to you, and it's a fun read. Interestingly, Lipton includes a recommended reading list at the end of his book and James Harvey's book, reviewed above, is on it.

The third book in this group is Machine Shop Essentials by Frank Marlow. In this book, the writing style is less personal and more similar to classic vocational training textbooks. It is written in a question and answer format throughout. There are no photographs, but includes numerous well-executed drawings. The focus is on manual machines and the traditional tools associated with them, but this text contains a fair amount of quite basic material that is more appropriate for a newcomer. Also, some of the discussions are of limited practical value. For example, there is a brief discussion on tramming the head of a vertical mill that does very little to convey the subtleties of the process. However, there are certainly pearls here and there for the diligent reader.

Overall, I would rank Machine Shop Secrets and Metalworking Sink or Swim as excellent additions to any home shop machinist's library. These books condense what two sharp professional machinists have learned during their careers into collections of information that should be of substantial benefit to anyone looking to be a better machinist. Machine Shop Essentials also contains information of value, but it is not in the same league as the previous two books, and would be better suited for someone new to the use of machine tools.

One last note. All three of these books are best read in small increments over at least several sittings to retain the information they offer. They are great to keep by your favorite reading chair for a quick read every now and then. You will be a while digesting all they have to offer.



Metal Shapers

By Kay Fisher

R. G. Sparber's Gingery Shaper - Part 23

Final Assembly of Feed Crank

The feed crank plate was machined in the last article. Now I will add the plates that form the T-slot plus cut the T-nut.

One dimension is critical – the slot must be uniform. For this reason, I did almost no measuring and instead relied on spacers of known thickness.

My first step was to rough cut the slabs of CRS. I then placed them on the castings to mark the curve. My belt sander was used to finish the ends. Two holes were marked 0.8" from the end. The exact distance is not important.



Drilling Plates Photo by R. G. Sparber

I don't care exactly where the holes are on the plates but I do want them to be uniform. I erected a fence to guide my drill press vise. This insures that both holes are the same distance from the edge of the plate. The first hole is being center drilled in the photo above. The vise is slid to the left and the second hole is then center drilled. I then drilled clearance holes for 10-24 screws.

The second plate was then clamped into the vise with the finished plate on top. I spotted through to mark the second plate and then removed the finished plate. Clearance holes were again drilled.



Bottom of T Slot

Photo by R. G. Sparber

Now it is time to fit the plates to the casting. The machined slot is 0.750". I have a piece of scrap 0.500" thick.



1/4" Gap

Photo by R. G. Sparber

This leaves a 0.250" wide gap.



Aligning 1st Plate

Photo by R. G. Sparber

My first plate is clamped to the casting with the inside edge snug against my 0.500" spacer. This edge is then parallel to the far edge of the 0.750" slot and 0.250" overhanging the near edge.



Clearance Drilling Photo by R. G. Sparber

It is then a simple matter to spot my clearance drill through these holes.



Ready for Tapping Photo by R. G. Sparber

The cones left in the top of the casting accurately guide the tap drill.

With the plate removed, I chucked up my spiral point 10-24 tap. A squirt of WD40 is my cutting fluid. The drill press is run up to full speed and then power removed. As the spindle coasted down, I ran the tap into the casting. That has plenty of inertia to fully tap the hole.

The casting is deburred using a countersink mounted in an old brace and bit drill.



1st Plate Done Photo by R. G. Sparber

I did my final fitting of the first plate with the 0.500" spacer back into the slot.



Aligning 2nd Plate Photo by R. G. Sparber

Now I employ a piece of 0.250" thick scrap to set my second plate.

I again spot through the plate with my clearance drill to cut cones into the casting. As with the first plate, I drill and tap for the second set of screws.



2nd Plate Done Photo by R. G. Sparber

The first plate was set parallel to the far slot edge. I now use it and my 0.250" thick scrap to do my final positioning and screwing down of the second plate. The gap is now uniform and 0.250" wide. It is far more accurately set than needed yet no measuring was done.



Finished Part Photo by R. G. Sparber

The T-nut is just a piece of 1/8" thick CRS tapped 1/4-20. I milled it square and is a sliding fit to the slot.

I see a potential safety hazard here. The ends of the T slot could snag a finger. I may add covers to the ends later.

Not shown is that I cut the shaft to length. There is not much to it except for having to remove and replace a lot of screws.

Stay Tuned for part 24 from R. G. Sparber next month.

Keep sending me email with questions and interesting shaper stories.

My email is: KayPatFisher@gmail.com

Kay

NEMES Shop Apron

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

Contact Rollie Gaucher 508-885-2277



Upcoming Events

Bill Brackett

Calendar of Events

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

April 5th Thursday 7PM
NEMES Monthly club meeting
Charles River Museum of Industry
154 Moody St; Waltham, MA 781-893-5410
<http://www.neme-s.org>

April 21-22 NAMES Expo
Wyandotte, Michigan
<http://www.namesexposition.com/>

April 15th 9AM The Flea at MIT
Albany Street Garage at the corner of Albany and Main Streets in Cambridge
<http://www.mitflea.com/>

May 5th Connecticut Antique Machinery Museum
Spring Power Up
Kent Ct. John Pawlowski President P.O. Box 1467,
New Milford, CT 06776
www.ctamachinery.com/SpringPowerUP2012.html

May 6th NHPOTP engine show
RT 113 Dunstable MA
Robt Wilkie 207-748-1092

May 3rd Thursday 7PM
NEMES Monthly club meeting
Charles River Museum of Industry
154 Moody St; Waltham, MA 781-893-5410
<http://www.neme-s.org>

May 20th Spring Steam-up
Waushakum Live Steamers
Holliston MA
<http://www.waushakumlivesteamers.org/>

May 20th 9AM The Flea at MIT
Albany Street Garage at the corner of Albany and Main Streets in Cambridge
<http://www.mitflea.com/>

May 26-27th Bernardston Show
Rt 10 off Rt 91 Bernardston, MA
Vickie Ovitt 413-648-5215

May 26th American Precision Museum opens
<http://www.americanprecision.org/>