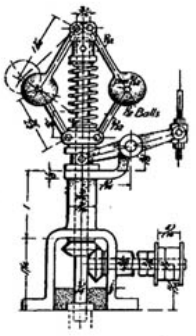

The NEMES Gazette

NEW ENGLAND MODEL ENGINEERING SOCIETY INC.

No. 167 Mar. 2010

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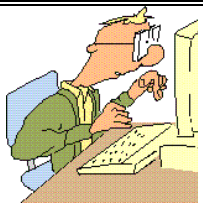

Editor's Desk

Frank Hills

High Tech Fibers

"High tech fiber" is a rather ambiguous name for synthetic, single strand materials. They can be used individually, bundled to make cord, woven to make cloth, or randomly piled to make matting. These man-made fibers have been around for decades. With the exception of carbon nano-tubes, there aren't that many that are truly new technology. So what makes carbon fiber, fiberglass, Kevlar, polyester and others so high tech? It's that they are so misunderstood, and therefore, misused. And why are they so misunderstood? Like any material, each has unique properties, and it's these properties that aren't well known.

Let's take the example of structural reinforcement. For model airplanes, the material of choice used to be fiberglass or polyester. There are many different types and weights to select based on need, like thin material for covering a wooden skin or thick for a rib or spar. There is matting for making tanks and fuselage shapes. So why are many model builders moving to carbon fiber? Well, it is lighter, and under the right circumstances, stronger.

–Continued on page 2

Next Meeting

Thursday, Mar. 4, 2010

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.

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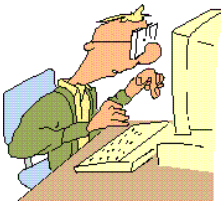


Editor's Desk

-continued from page 1

This is almost the limit of what many builders know or care about it. But carbon fiber also has its drawbacks. It's brittle in thin sections and is prone to "zipper" failure. This could lead to catastrophe during hard landings where more flexible fiberglass might only dent or crack. Carbon fiber's primary use is in extreme strength and/or high rigidity applications. In very thick sections where layers can overlap in different orientations, it can be used as armor plating, but who's shooting at you?

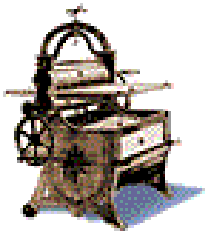
Both carbon fiber and Kevlar are used to reinforce high-speed rotating assemblies and to strengthen pressure vessels. In fact, the first functional micro-turbine had a compressor wheel made of plywood wound with carbon fiber. Today the fiber of choice for this purpose would be Kevlar with its added abrasion resistance (ingested dust and dirt can wear through carbon fiber). It's also recommended for use as an engine bay liner, (just like in the latest full size airliners!) just in case it explodes. No wonder they make bullet proof vests out of it. In Amateur rocketry, where many participants build their own engines, Kevlar is very popular for making fiber reinforced pressure tanks. Kevlar's most sought-after characteristics are high tensile strength and superior abrasion resistance.

Let's not forget one of the older high tech fibers. Nylon is still the material of choice for the coverings on ultra-light aircraft. Nylon cloth is light, strong, and easy to work with. It comes in seemingly unlimited colors and can be purchase in bolts of 36 inches wide and more. It isn't a material you would use with a binder because it stretches more than most binders and so adds no strength, but the fineness of the fibers permits weaving so tightly that it requires no sealant, unlike the cotton fabrics used on old airplane wings. It's not very durable, though. It wears easily and needs to be kept clean to prevent damage. But it's inexpensive and can be found in any fabric store. Nylon is also good for fishing line (obvious though that might be) and as a lightly loaded bearing material (both as a fiber and as a solid). It was also the material of choice for making early pressure suits because it was smooth and flexible. Nylon's characteristics are elasticity, moderate strength, low friction and, in solid form, moderate hardness.

Polyester and polystyrene fibers aren't used by hobbyist very often anymore. Polyester is lighter than fiberglass and was once used as a reinforcing and covering material for model airplanes, this as a step up from the tissue paper used on lighter models. Both polyester and polystyrene make good cheap rope, but have poor abrasion resistance and low melting points. Don't use it near your favorite model engine!

Of course it would be impossible for me to cover all available synthetic fibers. The point is that there are many different kinds with many different properties. Note too that where a binder is used, such as in making panels, the binder itself lends its characteristics to the mix, thus the term composite. Because carbon fiber has practically no elasticity, it's used with binders which will reinforce its strength. This is partially why it's so brittle. There's a huge selection of binders for fiberglass, each having its own hardness, strength and melting point. These qualities lend themselves to customization by the experienced user. Some fiber materials should not be used with binders (I've mentioned nylon) and there are others that require special binders, like acetates, polyesters, polystyrenes which might dissolve in the solvents in many epoxies. Choose carefully. Now go play.

Next month, "The Changing Image of Power".



NEMES Gazette Editorial Schedule

Issue	closing date for contributions
Mar. '10	Feb. 22, 2010
Apl. '10	Mar. 22, 2010
May '10	Apl. 20, 2010

President's Corner

Dick Boucher

The Meeting

David Baker along with his father, Richard Baker, will be talking about three dimensional printers, specifically the RapMan 3-D printer (it may be foreign now, but wait until the meeting). They will give a talk about what RapMan is, how it works, how to use RapMan, and where to buy this desktop machine (if your wife doesn't say no). There'll be a slide show and David will be demonstrating RapMan. This is definitely a meeting you'll want to be at.

Miscellaneous Ramblings

For most of us, the winter show season is over with the Cabin Fever bus trip behind us and our own very successful show in the history books. We have a couple months to hopefully spend in the shop starting, working on and hopefully finishing the occasional project for next the coming outside show season starting with the New Hampshire Power of the Past at Dunstable Massachusetts. One great bit of news concerning that show is that the sponsoring club has made arrangements with the farmer across the street to allow extra parking. This will take a lot of pressure off the field. If you exhibit at our show and haven't brought your exhibit out to Dunstable, you might enjoy the day.

As I said in the last paragraph our show was again very successful. I never get over just how well the organization gets behind the show: from setting up and getting the tables and air lines laid out, to the complete cooperation from the members in getting the tables taken down and the Jackson Room put back in the same order in which we find it on Saturday Morning. Of course the show would not be at all possible without everyone, member or not, who comes out and exhibits their fine craftsmanship. Then of course there is our fabulous ladies who man the snack, hot-dog, sandwich, and coffee concession. Thank you ladies!!! I have been asked how the receipts are shared. The museum keeps the receipts from the door. This works well for them and us, since they have been allowing us to use the museum and the Jackson Room since our inception for free. It is our way of saying thanks for this privilege. The concession money pays for our show expenses, which is the table rental. So again I say thanks to the ladies and the folks that bring in things to have at the table.

One last comment about the show - we need to figure out what to do with the compressor so we can have an adequate supply of air for the show. Options are: see if the current compressor is of adequate size and in need of repair, discuss the purchase of a compressor that is adequate or rent a compressor for the show. We should spend a few minutes discussing this at the meeting and input will be appreciated.

Dick B.

More Than One Way!

Bob Neidorff

More Than One Way To – Cut An Arc

There are many ways to cut a curved metal part (partial circle). The most straightforward is to use a rotary table. But many people don't have one in their shop. So this article will show alternatives to the rotary table that worked for me.

One approach is to make your own special purpose rotary table. For one job, I used two slabs of oak with a shoulder bolt holding them together tightly. This is important so that the cutting forces don't pull the part up and don't move the part laterally. The exact dimensions of this fixture depend on your part, but one thing is important – you need a long lever arm to control the cut.

For one end of the cut, a lag bolt serves as the stop. For the other end, a fine threaded bolt allows fine tuning of the stop point. The two pieces of oak are waxed so that they slide on each other smoothly. A long pole is pounded into the moving piece and pushed by the operator. Here's a picture of my home-made rotary table, cutting an arc in a hard steel flywheel:

For this kind of work, a smaller end mill is better because it has less tendency to grab. However, it requires slower cutting.

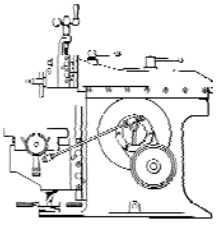
Here's another job, similar to the one above. In this case, the part was long enough and the cut light enough that it could be done without a fancy fixture. The aluminum part was slipped over a $^{1}/_{8}$" steel pin and pushed gently into a small diameter endmill.

Here's another, similar approach to this job, done on a small brass part. In this case, I used a disk sander rather than an endmill. Brass has a habit of grabbing during cutting, but a disk sander doesn't pull tangentially, so has no tendency to grab. This part was extremely small, so a long rod was bolted to the end to give smoother feed and good control.

This last approach is for a slightly different problem, but still useful. All of the proceeding examples were convex arcs. In this case, I needed a concave arc in a block of aluminum, so I bolted the part to a faceplate and used my lathe.

As always, I welcome your comments, suggestions, and alternative approaches.

Bob Neidorff neidorff@ti.com



Metal Shapers

By Kay Fisher

R. G. Sparber's Gingery Shaper

This next shaper story is about the building of a Shaper from scratch using the Gingery plans. There plans are available in book form from Lindsay Publications. "Build a Metal Shaper" by Dave Gingery. Dave Gingery has authored a series of books which are available both individually and as a set called "Build Your Own Metalworking Shop from Scrap". The set sells for $59.50 and includes:

The Charcoal Foundry - $7.95
The Metal Lathe - $9.95
The Metal Shaper - $9.95
The Drill Press - $9.95
The Milling Machine - $9.95
Dividing Head & Deluxe Accessories - $9.95
Sheet Metal Brake - $8.95

There are many favorable reviews of the Gingery series of books. Many amateur machinists have successfully built his lathe. I personally have only heard of two people who completed the shaper. One effort is documented in the Home Shop Machinist. The other will be presented here compliments of Mr. R. G. Sparber. If you are considering building your own shaper from scratch, then you owe it to yourself to read Dave Gingery's shaper book. $9.95 plus shipping. Part number 187 from Lindsay Publications Inc.

Lindsay Publications Inc.
P.O. Box 538
Bradley, IL 60915
Fax (815)935-5477
http://www.lindsaybks.com

The following is pretty much a copy of the owner's excellent web site and article at:

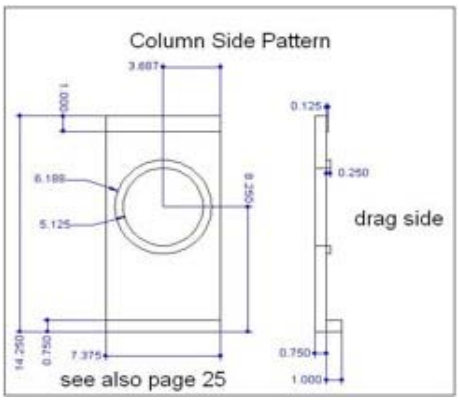
http://rick.sparber.org/Articles/CD/CDM/CD.htm

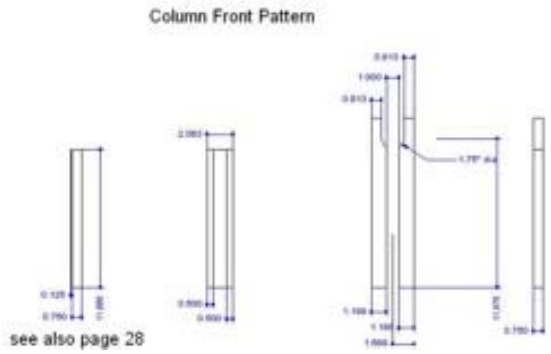
"Updated Gingery Metal Shaper Drawings

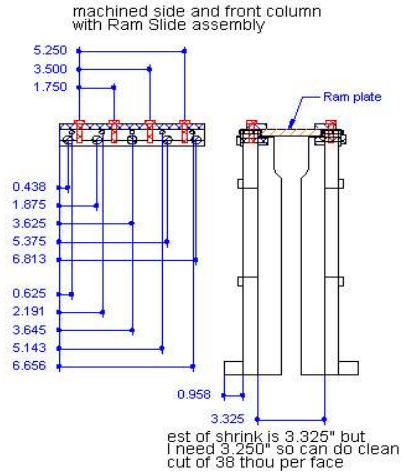
The drawings offered will, when complete; contain about 60 suggested improvements to the original Gingery metal shaper design. I have assumed that the reader has a copy of Gingery's book. These drawings supplement the book.

Patterns and Parts

I first draft the pattern of a part. I then scale this drawing by 0.979, which represents the estimated shrink of aluminum described by Gingery in his Book 1, page 34. Any remaining metal above the needed size is for machining. When parts have been enlarged, I simply added to the size of the pattern. This is not precisely correct since for every inch added to a dimension on the pattern, I really only get 0.979" nominally in the unmachined part. Time will tell if this gets me in trouble.







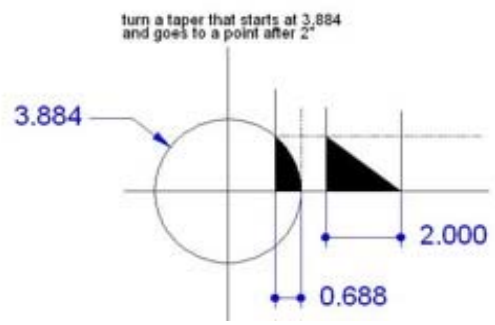
The ram slide is entirely encased in brass strips. Bronze would be better but I have brass and this project has already cost me enough money.

Note that the slide is symmetrically held. The $^{3}/_{8}$" x $^{1}/_{8}$" strip on the right is the gib and will have pointed 10-24 screws pressing on its surface. The twin strip on the left will be drilled and tapped so it does not move. A set of ½" x ½" bars support the ram slide from below and is held on with five ¼-20 screws.

A Possible Ram Side Transition Piece

Rather than shape Bondo to form the transition areas on the ram, I was looking for a way

to machine them. The plan is to turn a taper with a major diameter of 3.884" and bring it to a point at 2". Then cut out the sector shown in black below. A second sector is cut from the opposite side.



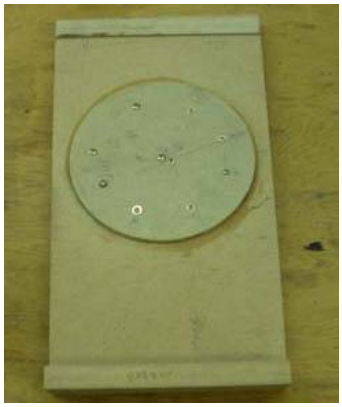
Background

This was the first serious casting that I have done in about 6 years. I'm using my new Dan Hartman electric furnace, which worked great. My old furnace was a Gingery Charcoal furnace and had two problems. First, the home-made refractory was failing and had cracks all the way through the side wall. Second, it did not have the capacity needed for these side plates. I also was tired of the mess and "drama" of using charcoal. My electric furnace makes as much noise as a toaster. I figure that it costs me $0.60 for the first melt of the day and $0.30 for each subsequent melt if no delay is incurred. My second melt today was about 3 hours after the first and it cost around $0.40. Obviously power costs are not an issue.

One unexpected issue is aluminum. In the past I cast much smaller parts, so, without much thought, figured my store of ingots would last a long time. Each of these side plates weighs 8 pounds 4 oz including sprue and riser. My store of 25 pounds of ingots is no longer that impressive to me. I now have about 6 pounds of aluminum left. It is time to round up more scrap aluminum.

The pattern

My pattern was made from MDF. Elmer's glue was used along with Elmer's wood filler for the fillets. After much experimenting, I found that if I cut the wood filler with water, it would flow like toothpaste from a large plastic syringe. This made it easy to lay a bead right in the corner. I then used a dowel to smooth and shape it. While waiting for the first casting to cool in the flask, I used an idea learned from the yahoo group "gingery_machines". It is a ball bearing about $^{3}/_{8}$" in diameter brazed to a rod. I coated it with car wax and use it to form fillets. This shape permits me to form fillets both between both 2 and 3 perpendicular surfaces.



Above is the pattern before I cut the hole. One lesson learned is to write lots of instructions on the pieces to be glued together. The draft is only 1 to 5 degrees and it is easy to stick a piece of wood on upside down. It also prevents me from using a finished strip of wood as a glue spreader.

The hole was cut with a saber saw. The draft was done with a homemade drum sander mounted in my Gingery drill press and worked well.

The finished pattern, shown below, looks much better in the picture than up close on the sand. After the first casting, I had to increase the draft on the hole and add more fillet between the foot and the vertical.

Ramming Up

I had never used ribs and gaggers before. A rib is a block of wood that engages the inside ribs of the flask to provide additional vertical surface for the cope sand to grab. Gaggers are strips of metal that

bridge these ribs and provide horizontal surfaces to also grab sand. Well, this is all true if you ram the sand correctly. Ramming is all about feel. It takes a bit of practice to remember exactly how hard to ram. Too hard and the cope can distort the drag sand. Too gentle and the cope sand falls out as it is lifted. If you are lucky, it drops out after clearing the drag. If you are not lucky, it dumps into the drag and you have to redo both cope and drag.

I was lucky in that when my cope dropped out, it was away from my drag. You can see the ribs from the bottom and the gaggers too. I just did not ram hard enough.

But this was not a big set back. I just cleaned out the sand, put the cope back on the drag, dusted, and began ramming again. This time I paid more attention to ramming each corner and using more force. It paid off as there were no more dropouts during the day.

With the cope removed, you can see the drag with the pattern bedded. The two tiny holes accept metal hooks used to draw the pattern out of the sand. I used Petrobond from BCS and it works great.

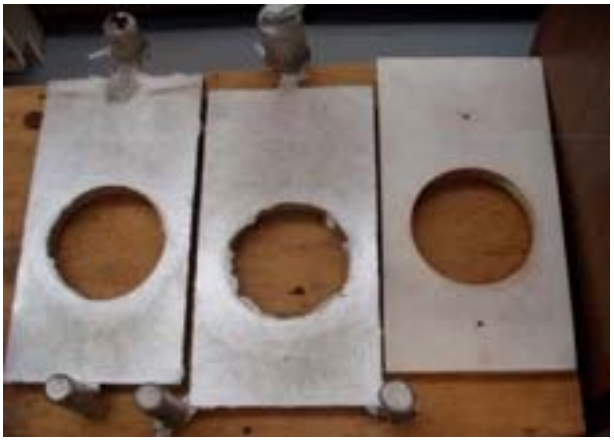
With the pattern drawn, you can see some damage to the edge around the hole. I did not ram hard enough. On my second casting with this pattern, I rammed much harder. I used my narrowest tool and worked the sand into the pattern at a 45-degree angle. It greatly reduced this problem.

Here you can see the sprue on the right cut into the heaviest part of the pattern void. On the left are my two risers. When metal shows up in these riser holes, I know my void is full. The sprue and riser forms were not pulled out at this time.

The flask is ready for pouring. I have about 75 pounds of sand in that flask. It was not easy to carry from my sandbox to the casting area. It was murder gently lowering it down to the ground. My back is a bit tender now. Next time, I will ram flasks this size on my wagon and then wheel them over. I will still have to flip the drag over but that is not nearly as bad.

Notice the muffin tin and ingot molds next to the flask. If the flask fails, these will take the melt. The propane torch is used to heat these molds just before I pour, to guarantee no moisture is present. My controller, documented on my web site, sits next to a very cheap digital temperature meter. I slip my thermocouple through a hole in the lid to eliminate guesswork. As the content of the crucible starts to

get soft, I push down on the thermocouple and can feel the mush. Only then can I believe the temperature readings. The temperature rises and then levels off, indicating that we are entering the phase change from solid aluminum to liquid. I see this at about 610°C. Then it begins to rise again as we go to super heat. I let it get to 732°C and then do my best to keep it under 760°C for 10 minutes. The melt then pours like water and stays that way until after the void is full.



Above is a full day's work. You are looking at the face that will be inside the metal shaper's column where no one will see it. As usually happens to me, the parts that are not seen look far better than the parts that everyone sees. On the far right is the pattern.

The center casting is my first of the day. I used 2 risers. You can see some leakage of metal into the hole. This is a sign of sand not rammed tightly enough and is easily cleaned up.

The casting to the left is my second of the day. I see some minor shrink marks near the sprue (top of the casting) but less leakage. One riser was enough.

Above are the faces that everyone will see. The center casting has some damage near the hole. It is ugly but will not affect the part's strength. A bit of Bondo and paint can hide this. At this time, I'm not interested in casting another side plate.

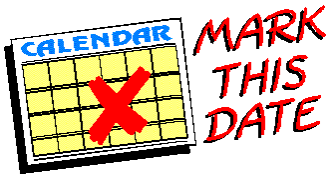
The second casting, to the left, came out much better. It is satisfying to see improvement."

Stay Tuned for part 2 from R. G. Sparber next month.

Keep sending me email with questions and interesting shaper stories.

My email address is: **KayPatFisher@gmail.com**

Kay



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

Bill

March 5th Thursday 7PM
NEMES Monthly club meeting
Charles River Museum of Industry, Waltham, MA
http://www.neme-s.org
781-893-5410

March 19-20 10:00-6:00 21st 10:00-4:00
Maine boat builders show
58 Fore St Portland ME
www.portlandcompany.com

April 1st Thursday 7PM
NEMES Monthly club meeting
Charles River Museum of Industry, Waltham, MA
http://www.neme-s.org
781-893-5410

April 17th – 19th NAMES Expo
Toldeo, OH
http://www.modelengineeringsoc.com

April 18th 9AM The Flea at MIT
Albany Street Garage at the corner of Albany and Main Streets in Cambridge