The NEMES Gazette

Vol 05, No 058
February-2001

The Newsletter of the New England Model Engineering Society
Ron Ginger, President, 17 Potter Road, Framingham, MA 01701, Ginger@Acunet.net
Rob McDougall, Treasurer, 357 Crescent Street, Waltham, MA 02453, RCMcDougall@MediaOne.net
Kay Fisher, Editor, 80 Fryeville Road, Orange, MA 01364, Kay.Fisher@Compaq.com
Bob Neidorff, Publisher, 39 Stowell Road, Bedford, NH 03110, Neidorff@TI.com

Our next meeting is at 7:00 PM on Thursday 3-Feb-2000 (first Thursday of every month) at
The Charles River Museum of Industry
154 Moody Street
Waltham, Massachusetts

Annual dues of $20 covers from Jan to Jan. Please make checks payable to NEMES and send to our treasurer. (Address in masthead).

Missing a Gazette? Send mail or email to our publisher. (Address in masthead).

This Months Contents

The Editor's Desk

By Kay R. Fisher

This month's issue includes a copy of the membership list. Please treat this information as confidential for your use only. Also look over your own entry and if you detect any errors notify our treasurer Rob McDougall (address in masthead).

Our NEMES web site has moved. Please see the web section in the rear and update your "favorites" in your browser. If you have any problems with links, dislike anything, or want your web site listed send email to our web master – that would be me.

This marks the one-year anniversary of the "Metal Shaper" column. During this time several members have purchased shapers, several shapers have changed hands in the group., and at least one member has spent a lot of time rebuilding a shaper. I believe I have been a catalytic provocateur. Or as your mother might say – "Don't play with him, he is a bad influence."

Kay

The President's Corner

By Ron Ginger

NEMES February Show

It's show time again! Saturday, February 17. We have not talked much about this but I assume we will follow our now fairly well-established tradition.

We will start the setup at 8:00AM on Saturday. The show opens to the public at 10:00AM and we close at 4:00PM.

There is a good chance the old storage trailer will be opened and we will be able to recover our air hose in time for the show. We will know this by the February meeting and can make plans then for an air compressor.

I understand Steve has again had good luck in getting door prizes from some of our regular vendors, so we will have some nice prizes for the exhibitors. As usual, you must be an exhibitor and present to win, so come early and stay until the end.

I will have more copies of our show flyer at the February meeting, so plan to take a few and pass them around to your friends, or hang them at work.

I have not had time to check with them, but I assume our 'regulars' will do their regular parts — Max as registrar, Roland will get our table covers, etc.

I suppose I should be more organized, and directive about this show, but I don't have the time, and it has worked well in the past. I look forward to another good show, without the SNOW we had last year.

February Meeting

Partly because I have not had time to make other plans, and partly by request (well, at least Ed Kingsley asked), I will do my talk on CNC for the Home Shop at the meeting. For those guys on the bus trip, you can skip my talk at Cabin Fever, because you will get to hear it again at our meeting. I have collected a lot of good information, and since I've got it all prepared for the Cabin Fever talk it will be still fresh for our meeting.

Time

As I noted before, and Kay mentioned in the last newsletter, my new job is proving to be a bigger time sink that I had hoped. The major problem for me is short notice scheduling. For example, last Monday night I got a call about 9:00PM asking me to be in Princeton NJ the next morning, as early as I could get there. Now, I won't go into the issues of bad planning, but it is a fact I'm going to have to live with for a while. This is going to make it hard for me to do the calling it takes to line up a speaker for each meeting.

I do get a lot of suggestions from guys at the meetings for speakers, but I seem to never write them down, and when I get home I don't recall who made which suggestion. I would be very happy if we can get someone to become the meeting scheduler. We are soon going to reach a point where I simply can't do it, and we will have meetings without speakers.

On that subject, I should point out that the January meeting was again one of my favorites. I always like the chance to see what everyone else is doing and to talk with so many of the members. I suppose it would not be all bad if most of the meetings had more time to just talk.

NAMES Show

I happened to drive to Detroit at the end of December (one of those job things I was talking about above) and so I stopped at Niagara Falls to scout out a nice hotel. I have picked 2 or 3 that are

right on the main drag, with less than a quarter mile walk to the brink of the falls. If we make the NAMES trip we will spend Thursday and Sunday night at the Falls. I think this should really make a nice addition to a good show, and make it into a much better trip. I still don't have enough people interested — only about 12. The bus cost is about $4500, so we need to get at least 24 people to keep the cost to $200 each. The Niagara hotel should be under $70, so the whole trip should only cost about $500.

Note also this is the last year for NAMES in its old location. Next year it's going to be in Toledo Ohio.

We are getting near the end of time to make this trip happen — if we don't reserve a bus and some hotel rooms soon we won't be able to later. I guess I have to say if I don't have another 10 or 12 people interested by the February show I will drop the plans. So this is it LAST CALL FOR NAMES!

Ron

Treasurer's Report

By Rob McDougall

As of 12/31/00

Balance as of 11/30/00:	**$2,855.70**
Dues Received*	160.00
Interest Income	0.69
Less	
Gazette expense	
- Copies	-73.80
- Stamps	-55.56
Cost of PA System	-525.79
Balance as of 12/31/00:	**$2,361.24**

* The fee of $2,125 for the Cabin Fever bus put a huge dent in the corporation's coffers, but the check was sent early January and the club will be reimbursed by end of January by members going on the trip. So, I expect our end of month balance will remain in good health. One member paid me directly in cash at the November meeting and I cannot figure out who it was. Could that member please contact me so I can mark you as paid up – thanks.

Rob

Ramblings

By Max ben-Aaron

Changes to U.S. Patent Law.

Caution: I am not a patent attorney or agent. This column is for information only.

Our Founders believed that there could be a fundamental bargain: An inventor gets rewarded for his or her contribution to the wealth of public knowledge, and the public at large gets free use of the invention when the patent expires. Both the inventor and the public are presumed to benefit from the deal.

For more than two centuries a would-be patentee could take his ideas to the U.S. Patent office and seek patent protection, with secrecy being guaranteed for the invention up until the date the patent was actually granted. A major change in U.S. patent laws took effect on November 29, one year after the Inventor's Rights act of 1999 was signed into law. U.S. Patent applications now filed will be disclosed before any decisions are made as to the scope of the patent claims. The patent application will be published 18 months after the applicant's first filing - regardless of whether or not the patent issues.

To compensate for possible losses due to pre-grant publication, Congress has provided some additional rights to patentees; the right to collect 'reasonable royalties' for the period following publication, but before issuance, as well as the right to injunctive relief and damages (if infringement is proved) for the same period.

In almost every other country in the world, pre-grant publication is the norm, so the pre-grant publication of patent applications in the U.S. is part of a larger movement to 'harmonize' patents and patent granting procedures worldwide.

In response to concerns of small business and independent inventor lobbies, Congress has allowed for some exceptions. If an applicant is willing to certify that no foreign applications have been (or will be) filed (said declaration to be made at the time of the initial filing), the U.S. Patent Office will continue to examine the patent in secret under the old rules. There is also a provision that permits applicants to designate different parts of their filings, so that only those portions of the U.S. patent application that will become foreign filings will be published while the application is pending.

Under the old rules, earlier patent applications by others were not 'prior art' unless the earlier patent application of another was actually granted; only then could a patent examiner cite it as a reason for rejection. Disallowed applications could not be grounds for rejection, so the publication of patent applications now creates a radical new category of 'prior art'. Examiners will be able to cite published patent applications and treat them as 'prior art' from their original filing dates. U.S. patent examiners suddenly have a greater trove of prior art to draw from in conducting their examinations.

Mb-A

The Meeting

By Stephen C. Lovely

The Meeting, January 4, 2001

The January meeting was a poster session, so there was no formal speaker, just a bunch of small groups looking at things, talking, and having a good time.

One thing that got discussed quite a bit was the project that NEMES will be making at the machining exhibit at Cabin Fever. I had proposed a whistle project and had given Ron Ginger a copy of the drawings for it. He tried making one on New Year's day and sent a message to the NEMES email list saying that it was more work than he had thought it was going to be and he doubted that we'd be able to make them fast enough at the show to give them away at the rate we would need to. Errol Groff came up with a design for a slide whistle made from three simple parts and brought in a few samples made in his shop classes. After some discussion it looks like NEMES will be making the slide whistles at Cabin Fever, with Errol getting a supply made up ahead of time in case production doesn't keep up with the demand.

Alan Bugbee brought in several pieces he had made on his ornamental turning lathe. He has the second ornamental turning lathe built by Ray Lawlor, who produces new ornamental turning lathes. Alan makes his own cutters and tooling and made a rose engine to add to the capabilities of his equipment. There are 120 members in the US of Ornamental Turners International.

Ornamental Turning **Photo by Earle Rich**

Norm Jones brought in his Mery engine for the first time, in it's completed and assembled form. He hasn't run it yet, but it's ready to go.

Mery Engine **Photo by Roland Evans**

Jeff DelPapa brought in his clavichord. It's a copy of a 17th century original and is a predecessor of the piano.

Clavicord **Photo by Roland Evans**

Dick Jones is in the process of building a digital readout for his lathe. He built an ISA interface card to plug into an IBM PC, running a DOS program that gives X and Y readings from an encoder. For his long axis he was concerned about what he could use that wouldn't get messed up by chips and such. He solved that by getting an encoder with an attached cable drum on eBay for about $30. It's got a 152-inch long cable that unwinds from the drum. Currently the calibration is off by .0025 inches in 3 inches but he expects to be able correct that in the software.

Larry Keegan is building a 4 ¼" F4 reflector telescope from a book. The main tube is made out of PVC pipe.

Henry Szostek is going to a four axis CNC mill, so his Bridgeport mill is now surplus. It's vintage 1974, with the head rebuilt in 1998. It comes with an impressive collection of tooling and Henry's asking $5999.

Frank Dorion bought a 62-inch Starrett vernier caliper at the Pratt and Whitney surplus store earlier in the day, and brought it to the meeting. The box was something you could display in your living room, and that's what Frank plans to do with it. He'd seen it in the past and thought about buying it, but then it disappeared so he figured someone else had bought it and it was a sign he wasn't going to get it. Then he came across it again in a different part of the building, decided it was a sign and bought it before it disappeared again.

Bill Brackett brought in a fixture he made to grind the angles on lathe tools accurately. He wants to see if getting the angles in Machinery's Handbook exact will make a difference in the finish he gets on his lathe work. He also brought in the completed hobb he made to cut the pinion gear for the mini drill press he's making from the plans in one of the Village Press magazines a while back.

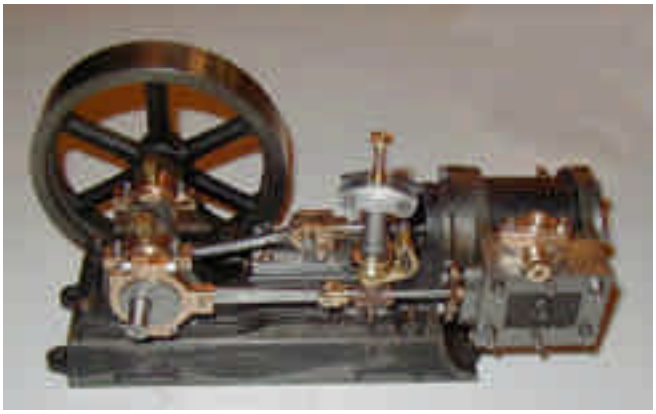
Joe Warfel built a nice little gyroscope based on one of the kid's toys that he has. It works nicely, but he was having a problem finding string that would stand up to the stress of spinning it up to speed. He plans on making a fixture to

hold it so he can use a six-foot string to get it really spinning.

Gyroscope **Photo by Earle Rich**

Gene Martha brought in some cylinder and head wrenches he had made to allow him to disassemble model airplane engines easily without damaging them. He also had the out-of-round gears he got out of a pump on the plate that shows how gears don't have to be round to work.

Ron Ginger is almost finished building a Stuart #9. He says it'll be done in time for the Cabin Fever Show.



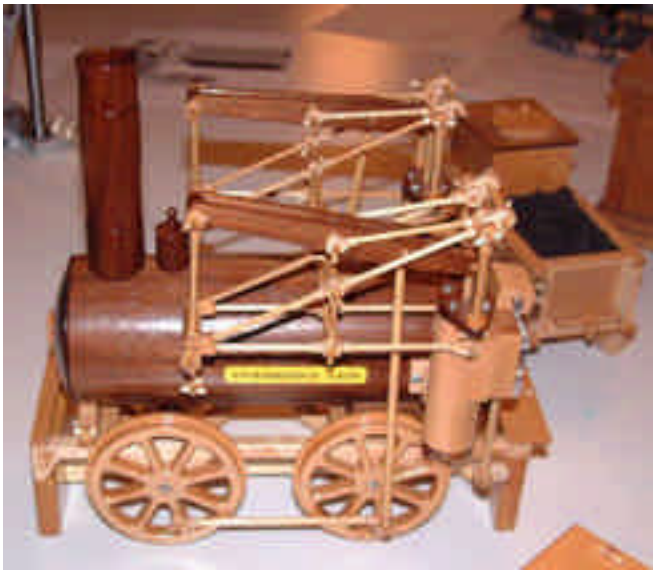
Stuart #9 **Photo by Roland Evans**

Les Russell brought in his recently finished Kozo Climax in ¾" scale for 3.5" gauge track. Les did a lot of research trying to find a nice tough paint to use on it. All the paint companies told him there wasn't anything available, but when he asked at the auto store they suggested engine paint. After it's baked on, it's plenty tough and is good up to 500 degrees F. The engine runs great on air and Les is planning on test steaming it in his backyard as soon as it's warm enough.

Climax **Photo by Roland Evans**

Earl Riche had a selection of stepper motors on display, including two that he had wired in parallel. Like all permanent magnet motors, when you turn them they act as generators. The result is that when you turn one the other one moves too. It made a fascinating little demo, complete with the disconnected power plug. He also had his latest digital camera with him. It takes a picture with 2400 by 1800 pixels and he says he can make an 11 by 14 inch print from it.

Ed Wlodyka had his wooden version of the Stourbridge Lion with him, along with his cylinder of compressed air to run it. He also had what he calls his "Pump N Dump" engine. It's also wood, and is based on piston style aquarium pumps. The crank axis is offset from the cylinder axis so that the piston wobbles in the cylinder as it goes up and down. The wobbling action of the piston makes the piston act as its own valve. Finally he had a two-cylinder oscillator that was self-starting in either direction depending on which way the input valve was set. The two engines were made of wood, just like the locomotive.



Stourbridge Lion **Photo by Earle Rich**

Pump N Dump Engine **Photo by Earle Rich**

Two Cylinder Oscillator Engine **Photo by Earle Rich**

Victor Kozakiewicz brought in a prototype electric winding clock from about 1900. The clock is wound by electricity every time a set of contacts closes as the spring winds down. It winds itself about every ten seconds.

Dave Piper is still hard at work building his steam engine. He's currently building Rudy's workhorse engine at 1.5 times the size Rudy had in the magazine. It will run the boiler feed pump and the air pump on the condenser in the boat's system. Dave is building such a complex system into his boat because his systems will mirror the systems on the full size Sabino (ported in Mystic Seaport CT) and the Coast Guard has said he will be able to count the time engineering his boat against the time he needs to accumulate to get a license to operate the Sabino.

Workhorse Engine 1.5 size **Photo By Roland Evans**

Rich Puleo brought in his gasoline engine built to Dick Upshore's design. It has aluminum cooling fins on a steel sleeve and an aluminum piston with a Buna-N rubber O-ring for the piston ring. It was running nicely on a plug Rich had made himself. The plug he bought to use in it wasn't working well. He said he thinks it's because he used metal oxide sandpaper to clean it and embedded conductive particles were shorting it out.

Upshore Design IC Engine **Photo by Roland Evans**

Todd Cahill had some Myford-Dixon tool holders he built for his Myford ML7 lathe and a taper attachment he had made to use on it. Also he made some custom dials that can be set to zero.

Myford Accessories **Photo by Roland Evans**

Bill Schoppe brought two brass plumb bobs he made, along with a partially complete steam engine he's working on that was started by Don Hoxie.

Jim Conery brought a 30cc Wall single cylinder engine that he is building. The castings came from Cole's Power Models. It is close to running.

That covers most of the things people brought to the poster session, but I'm sure that in all the confusion of people milling around and having a good time I missed a few things. If you brought something and I missed it, bring it again to the next poster session because we'd all like to see it. See you all next Thursday for the February meeting.

scl

Tool Steel in the Home Shop

By Larry Twaits

Like most hobbyists I have occasionally used drill rod or "tool steel" to make the occasional cutter or punch without a lot of thought. Heat it with a torch, quench it, temper it a bit, and test it with a file- it's actually a very forgiving material at a gross level. Even using less common material like "air hardening" to minimize warping isn't very difficult.

Over the past year I have been attempting to make form relieved milling cutters, and this has lead me to a closer look at tool steel choices. While I am sure the pragmatic view that I am offering here is not perfect, it may encourage you to use tool steel to enhance your work, and of course if you find it interesting there is an endless supply of reference material on the topic.

The obvious tool steel choices

A quick look though any industrial supply catalog will yield three primary options: W1, O1, and A2, usually as drill rod or ground flat stock and occasionally as less expensive oversize unground material.

W1

W1 or "water hardening" is essentially high carbon steel, it is the least expensive choice and will cover most casual needs. For the amateur the primary attribute that makes W1 different than O1 or A2 is the rate that it must be cooled during the hardening quench, it requires water (actually brine) to cool the metal faster than oil or air to achieve full hardness. The hardening process is simply heating the material to a critical temperature, then quickly reducing the temperature below a second point. In the simplest case this is just heating the part with a torch. My favorite approach to judging temperature is to watch the color increase steadily until it reaches a point where it refuses to change for a few moments then when it does move ahead again, it's ready to quench. Another technique is to test the part with a magnet, when the magnet stops attracting the work, it's ready. The traditional approach is to heat until the color is a deep red but this involves some judgment.

As it turns out, W1 is capable of reaching a harder state than O1 or A2, and in fact harder than HSS, I assume this is why we occasionally hear of its merits for very fine gravers, knives, etc. The key limitation of W1 is that a part with a large section cannot be chilled fast enough to harden through because the center is insulated by the surface. One reference suggests that 3/4" is the practical limit. Another describes a half-inch rod as achieving a very hard "case" .050" deep on the surface and being less hard and tougher toward the center.

A second problem caused by the fast and inevitably variable water quench is that parts can warp, and often by an amazing amount. Traditional techniques for hardening slitting saws and plane irons include clamping the ready to quench part between large iron plates to force even cooling and to keep the part in its final shape as it is cooled.

Another technique for straightening work is to take advantage of the fact that the quench only needs to drop the temperature below 1100 degrees (from 1400-1500 degrees) to establish the

material's ability to harden, but it continues to be soft until it reaches 400 degrees or even less. If the work is maintained between these two temperature points it can be readily straightened. Of course manipulating a hot metal bar of any size may be a challenge...

Tempering is generally well understood, always temper at least to 400-500 degrees F. The traditional approach of using the color of the oxidized surface to judge hardness works well (I understand that this works reliably only with high carbon steel or W1).

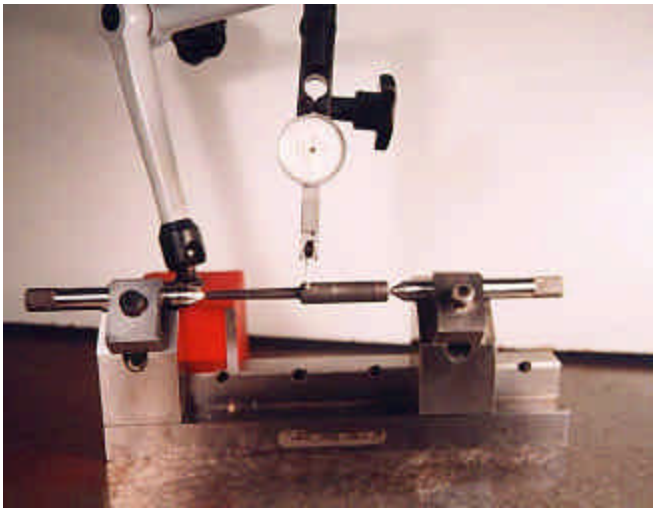
O1

O1 or Oil Hardening tool steel is a better choice for large parts because it can be quenched more slowly than W1 and still achieve full hardness. A second benefit is that the parts tend to warp less in the more gentle oil quench.

A2

A2 or Air Hardening tool steel can be heated to its critical temperature and allowed to cool in still air and achieve full hardness. For large parts this is obviously important (quenching a six inch steel cube in the sink could be exciting), but it is also very good for spindly parts that tend to warp. My attempts to make small taper reamers for a watchmaker's lathe tailstock spindle failed because W1 warped so much that the flutes could not be cleaned up during grinding, but careful use of A2 kept warping to less that .002" for a three inch long reamer.

A2 reamer blank held vertical in oven to avoid sagging
Photo by Larry Twaits



A2 reamer blank - runout is minimal
Photo by Larry Twaits

Scale and decarburization

When steel is heated in the open air, scale forms on the surface that is at least a cosmetic problem. While scale can be mostly removed with mild acid, the surface of the part will not be hard because the carbon is burned out. The easiest solution is simply to make the part oversize and grind off the deteriorated surface, but if the part is formed to size before hardening, this is not possible. There are a number of ways to keep oxygen away from the part while heating to prevent decarb, some that seem suitable for the home shop include pack hardening, tool wrap, and "diamond block".

Tool wrap is normally used with A2, the process is as simple as carefully wrapping the part in stainless steel foil, heating it to the critical temperature and allowing it to cool in still air. A2 requires a fairly high temperature and is best heated in a small furnace. When using tool wrap, the parts can look like they were never heated. I have successfully used tool wrap with small parts made from O1, and it could be used with W1 if a technique is found to cool it fast enough.

The traditional technique for avoiding decarb is "pack hardening". Essentially the part is placed in a metal box and with a material that will use up the available oxygen so that it cannot react with the work. "Iron drillings" seem to be the

material of choice for packing the box. Apparently carbon cannot be used as is done in case hardening. There is a good deal of period material about construction of these boxes and their use. For example, steel watch parts were hardened with this technique.

I know of one home shop that includes an electric furnace designed to heat work placed in a ceramic tray, that is in turn placed in a graphite box that fits the cavity in the furnace. As the box is heated it consumes oxygen to protect the work. Exposing the work to air during any quench is still a problem. I assume the name "diamond block" furnace comes from the graphite box. This process is interesting but best suited to the very high temperatures required for HSS.

Some other thoughts

Drill rod is not accurately sized. It is good enough to run well in a collet but it tends to have lobes from centerless grinding. Don't expect it to be better than .001" in size. A better choice for shafting finished to size is case-hardened rails for linear bearings. In large sizes, they are less expensive than drill rod and the surface is very hard. Unground tool steel generally can't be held in a collet because of its arbitrary size.

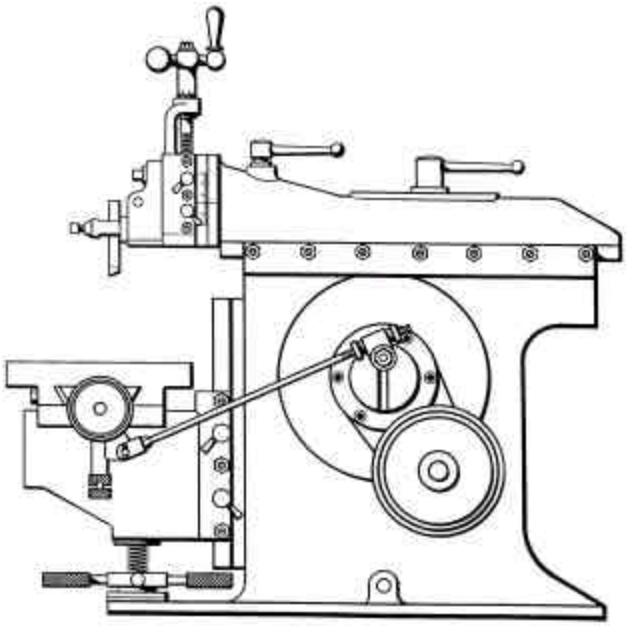
For casual hardening and occasional silver soldering, I have two MAPP gas torches that I use together to heat work. The pair seems to work better than one larger torch to heat a part evenly.

Sometimes simply buying round high-speed steel blanks is a good alternative to tools made from W1/O1/A2. There is no practical way to soften HSS, but it can be ground with much less attention to heat buildup. W1/O1 cutting tools really do need to be kept cool enough to hold in the hand or they will soften. We use HSS so much that this detail is sometimes difficult to keep in sight.

Hard tools can be dangerous! Hitting a punch that is hard through its length with a hammer can cause small chips that fly like bullets. Watch your eyes…

Grinding tools on the bench grinder is a related topic that gets little attention. Most bench grinders have very hard wheels and if you haven't dressed them in the past five minutes of use, your tool bits are probably overheating and you will be frustrated by the slow rate of metal removal. An inexpensive star wheel dresser will make a huge difference (a diamond dresser is not the right tool).

Larry



Metal Shapers

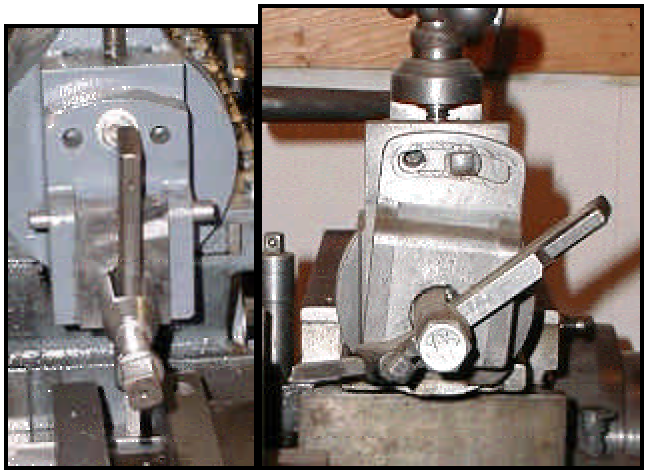
By Kay R. Fisher

I received an interesting question in the email this month. "I needed to make a vertical cut. As I was lowering the cutting tool, I noticed that on the backstroke it was still hitting the piece, making an interesting curved scrape across the surface. Is there anything that can be done to eliminate or minimize this? More simply asked: what's the proper technique to do vertical cuts on a shaper?"

It sounds like you're not slanting your clapper box to the side. All shapers have a method of tilting the clapper box to the side. Its primary use is for making vertical cuts. With the clapper box straight up and down, the tool will not deflect away from the part properly. You want to

make sure that you slant the top of the clapper box away from the surface you are cutting

I also received email this month giving advice for slanting the clapper box on vertical cuts. That fellow said the direction of the slant is not obvious and he learned the technique from a 60 year old machinist where he worked. Here's the rub. If you put your tool in at an angle or have an offset tool holder you can usually get away without properly setting your clapper box. But don't try. Do it the right way and it will be safer and have a better-looking part when you are done.



Clapper boxes **Photo by Kay Fisher**

In the picture above you can see my 9" shaper on the left has an adjustment for the angle of the clapper box by fixed offset with a bolt. The picture on the right shows my 7" Rhodes shaper has a continuously variable adjustment with a slot. It is set up for a vertical cut now with an offset tool holder. The amount of offset isn't critical. Any angle over a few degrees is fine.

Kay

Calendar of Events

By Bill Brackett

Feb 3, 2001 Thur 7PM
NEMES Monthly club meeting
Waltham, Ma.
Charles River Museum of Industry 781-893-5410

Feb. 11 2001 Ct. River Ant. Collectors
Ice Harvest Day -Ely, VT
Doug Driscoll 802-333-3243

Feb. 17, 2001 NEMES Show, Waltham MA
Charles River Museum of Industry 781-893-5410
Call: Ron Ginger 508-877-8217

March 1, 2001 Thur 7PM
NEMES Monthly club meeting, Waltham, Ma.
Charles River Museum of Industry 781-893-5410

May 19, 2001 Jim Paquette Open House
There will be an Open House at Jim's shop again this spring. The date has been set for Saturday, May 19. Hours will probably be 9:00 am to 2:00 pm. More details next month. If you have any suggestions, comments etc. please contact Jim at uxbtoolman@netzero.net. Start saving goodies for sale or trade.

To add an event, please send a brief description, time, place and a contact person to call for further information to Bill Brackett at wbracket@ultranet.com or (508) 393-6290.

Bill

For Sale

Comparator

Free - Old Covel Comparator. Floor Model. 24" X 44" footprint. Works OK. Needs only a couple of indicators.

Jim Paquette, (508) 278-2203.

Bridgeport Mill

Vintage 1974, with the head rebuilt in 1998. It comes with a large collection of tooling. $5999

Henry Szotek, (978) 927-1834

Air compressor

Six cubic feet/min, oil-less type, 110v, Sears. Very limited use, probably less than two hours run time. Works great but noisy. $150 or trade?

Vertical Milling Machine

Van Norman No. 1/2, Bridgeport "M" Head, Table 7" x 27" with 3 T-Slots, 18" Longitudinal Travel, 5 ½" Cross Travel, 7" Ram Travel, 10 ½" Spindle Nose to Table (May be increased by modifying the mounting of the "Head"), 230 Volts 3 Phase, Weights 1200 lbs. $500 or Best Offer.

Frank Stauffer (978) 443-2895

Wanted

Thompson Mill-Drill Table

Wanted in good condition. These were made by the Thompson linear slide people, consisting of a table that can be moved in two directions. It has a sub-plate and a holder for a pattern. In use, a "master part" is clamped to the sub-plate and a stylus on the sliding table can be lowered into pre-drilled holes in the master plate. A part up on the X-Y table thus can be drilled and tapped using an ordinary drill press. These used to be common. Now they are hardly used in these days of milling machines with DROs. I've come across a few jobs where a mill-drill table would be a good way to make small batches (say, five) of parts. But, dealers say they have none. Anyone know of one for sale or a lead on possible source(s)? Thanks

Jay Stryker in western Mass 413-665-3125

Bob the Shop Rat

This is a picture of a cute machine shop related tee shirt as seen at our previous meeting. Errol Groff provided the following description: "This is the artwork for our new official shop tee shirts. I just got the OK from our assistant director who thinks that we are not altogether wrapped too tight."

If you might be interested in buying one of these shirts please let me know via e-mail and I will start a list of interested folks. Don't be in too much of a hurry since this project has been moving at a glacial pace so far. I don't know yet what the cost will be but we are going to be trying to keep them as inexpensive as possible. Any money we do manage to make will go to buy tooling for our shop.

Errol Groff
Instructor, Machine Tool Department
H.H. Ellis Technical School
613 Upper Maple Street
Danielson, CT 06239
errol.groff@pop.snet.net

Web Sites of Interest

NEMES home page

w**ww.naisp.net/users/fisher/nemes.html**

NEMES Gazette Back Issues

www.naisp.net/users/fisher/gazette.html

Shaper FAQ (Frequently Asked Questions)

www.naisp.net/users/fisher/shaper_faq.html

Shaper Columns

www.naisp.net/users/fisher/shaper_columns.html

Fred Speckman's model car web site

http://fspeckman.freehomepage.com/