The NEMES Gazette

Vol 4 No 38
June, 1999

The Newsletter of the New England Model Engineering Society,
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Our Next Meeting is at 7:00 PM June 3, 1999 at the Museum, 154 Moody Street, Waltham Ma.

Annual dues is $20.00 - Please make checks payable to"NEMES" and send to the NEMES Treasurer: Kay R. Fisher 80 Fryeville Road Orange, MA 01364

This Months Contents

From the Editor's Desk:

Thanks to Bob Neidorff for distributing the Gazette. As time has gone by The Gazette staff has grown, and I'd like to thank everyone who's helped to get it out for the last three years. Ed Kingsley has been a regular columnist since practically the beginning, Kay Fisher has supplied regular Treasurer's Reports, and recently Bill Brackett has taken charge of the monthly Calendar of Events. And of course Ron Ginger not only was the force that got the whole idea of NEMES started but he contributes to the Gazette every month as well. Thanks to all the other people who have contributed to the Gazette in the past, and to those of you who will hopefully contribute in the future.

See you next Thursday -- scl.

President's Corner
by Ron Ginger

June Meeting

Our June meeting speaker is going to be Richard Ketchem, a watch and clock maker, and a friend of our member John Lelievre. John mentioned Richard to me several months ago, and I have been very eager to have him here to speak. We were finally able to make the arrangements for June.

Richard is the principle scientific instrument maker for Harvard University, and a fellow of the National Association of watch and clock makers. He has constructed an astronomical regulator clock, and has a very good slide show about the clock. He will describe its construction, and will show some of the tools and fixtures and parts of the clcok. Richard has also done a lot of work with ornamental turning, a subject that we may entice him back to talk about at another meeting.

Since a clock project is 'on my list' I am looking forward to hearing Richard and seeing this slide presentation.

July Meeting

Again, since this meeting is on what many people take as a long weekend, I am going to make it one of our informal 'Poster sessions'. A couple people have asked me about the term Poster Session, so maybe a short explanation will help. At many computer technical meetings there is a room set aside for Poster sessions. Anyone that has some interesting work to talk about can set up a small display, often with a poster, and can informally meet and talk with anyone else interested in his work. Kind of an adult version of the Science Fair.

For our purposes the poster is not necessary, altough a couple of them have been brought in for other meetings and were very interesting. Simply bring in some item that you think others might find interesting. It can be a finished item, a part under construction, a tool or fixture, or photos or plans if your project is to big to carry. Everyone should have at least one item they can bring to this. Maybe some of you are even brave enough to bring in one of your 'screw ups' like my out of square angle plate :-)

This makes a good evening of conversation, and I know every time we have done this I have found many interesting items.

August

I dont have a subject yet, but **we will have to shift our August meeting date from the normal first Thursday to the SECOND Thursday** because of another event at the museum. We will have details in the next newsletters, but just make a note now of the date change.

September Show.

Last year Ed Rogers arranged to have a display space for our club at the North Shore Old Car Club annual show. About 20 of us went, and I know I thouroughly enjoyed it. Besides having a nice chance to exhibit our models, and to run the gas engines, it was very interesting to see the cars. Apparently the Car Club members enjoyed it as well, because Ed reports we are invited back, and will have an even bigger display space, in a much more prominent area. We will also be getting some notice on the flyers and other show publicity.

The show is Sunday, September 12, at the Topsfield fairgrounds. Mark your calendars now, and dont let anything else get in the way. This was a fine show last year, and I expect an even better one this year.

Election of Officers

Although we try to keep this group informal and simple, we have incorporated, and we do have to hold an annual election. We dont seem to have many candidates for office, so the election should be fast, but we will have a time for nominations and an election.

--Ron

Calendar of Events

May 31, Memorial Day
American Precision Museum opens for 1999
Carriage Wheels to Cadillacs
The Journey of Henry Leland
Winsor Vt. 10-4 S,S,Hol 9-5 weekdays
Till Nov 1st 802-674-5781

June 3, 1999 Thur 7PM
NEMES Monthly club meeting
Waltham, Ma.
Charles River Museum of Industry 617-893-5410

June 5 & 6 Sat & Sun
Steam/Gas Engine Show
W Campton NH Dave Dearborn Show
603-726-3257

June 12 & 13 Sat & Sun
MAPA Show at fairgrounds
Skowhegan ME
Joe Kelly 207-862-2074

June 13, Sat 10-5
Owls Head Rod and Custom Show

June 19th & 20th
Pioneer Valley Live Steam
Steam and diesel trains on a 3000ft track
413-569-0438

June 26-27 Sat & Sun 10-5
Owls Head Sentimental Journey

June 26-27 Sat & Sun
Central MA gas & steam show
Orange Ma airport
Grover Ballou 413-253-9574

July 1, 1999 Thur 7PM
NEMES Monthly club meeting
Waltham, Ma.
Charles River Museum of Industry 617-893-5410

July 11, Sun 10-5
Owls Head Fabulous 50s & Sensational 60s

July 11 Sun
Steam/Gas Engine Show
Pepperill MA town field Rt 111
Kim Spaulding 978-433-5540

July 17-18 Sat & Sun
Car show mach flea mkt, auction, engines
Norwich CT, 590 New London Tpk Regional School
Dick Babbitt 860-376-0863

July 23-25 Fri Sun
Steam/Gas Engine Show
Eliot ME Raitt Homestead Farm Rt 103
David Raitt 207-748-1046

July 24-25, Sat & Sun 10-5
Owls Head Trucks, Tractors & Comm Vehicles

For a listing, please send name and brief description of event, time and place and a person to call for further information to.
Bill Brackett at wbracket@ultranet.com or 508-393-6290

May Treasurers Report

Remember dues is due at the next (June) meeting.

Please make checks payable to NEMES for $20.00

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Previous balance ---------------- $2213.67
Dues Deposit ------------------- 50.00
Interest ----------------------- .93
Bob Neidorff News Letter Expense -105.25
Dues Deposit ------------------- 120.00
New balance -------------------- $2279.35
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Respectfully
Kay R. Fisher
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The Meeting, May 6, 1999

Before the meeting began Ron had the last of the books from the Charles McDonald estate out on tables for people to buy. They went fairly well, and a lot of people seemed to be bringing home books after the meeting.

Once again, Ron has asked everyone to be on the lookout for good meeting speakers. We've had an amazing string of good speakers so far, and they're what keeps things going. The poster sessions are great, but if that's all we ever did things wouldn't be the same at meetings and I wouldn't have anything to write here in the Gazette. So, think up a topic you'd like to hear about, or a speaker you think might be good. Maybe even give a talk yourself.

The NEMES table (tent?) at the North Shore Old Car Club Show last September at the Topsfield Fair Grounds was a big hit. Lot's of folks came to see the old cars and spent some time looking at our stuff. We're going to do it again and Ron wants to see if he can get the info to the magazines in time to be announced nationally.

Ron had a great time at the NAMES show in Detroit, and attended a session on Model Engineering and Home Shop Clubs. Joe Rice told him that he's hoping to be able to be able to get Machinist's Workshop (known as Projects in Metal in a previous life) to be the magazine that supports the Home Shop Clubs, the way that Live Steam supports the live steam railroad clubs. Ron also told us that he's

still thinking about writing an article for Village Press about how to go about forming a Model Engineering Club. He's a good person to do the article, because he certainly did a good job of getting NEMES going.

Raytheon is selling a machineshop sometime in the relatively near future. They have a Hardinge TR lathe and some Bridgeports to sell among other things. As a genuine Massachusetts Corporation with tax numbers and everything NEMES can participate in the sealed bidding for the items that will be going on the block. More to follow as time goes on and the actual sale gets closer.

Max ben-Aaron announced that on a recent Prairie Home Companion Show on NPR that the musicians stated that they were playing Arch Guitars made by Walter Stanul of Malden Mass. Walter got a round of applause and showed us pictures of the instruments played on the show. They have more strings than a standard guitar. The extra strings are pitched lower than the normal six strings.

Dave Robie had one of the laser pointers he's proposing as the unit for his Laser Design Contest, connected up to an external power supply so that it wasn't eating expensive batteries. The presentation of peoples designs will be at a future meeting. There are only two rules. It should be something useable by the people in NEMES and it shouldn't be too complicated or expensive to build.

Don Strang reported that the NEMES email list had had some discussion on carbon brushes for motors recently. Brush hardness and resistance are important to how a motor works - and keeps working. Since the carbon brush conducts current to the copper commutator segments, and is not in perfect contact with them as it slides over the rotating armature there is constant arcing. This arcing erodes the copper. If the carbon brush is too soft it won't wear the mica between the copper segments down as fast as the copper erodes. This leads to undercutting of the copper with the mica sticking up from the metal surface. Needless to say, this is bad as it leads to more arcing and metal erosion. For proper operation the brush has to be the correct hardness to wear the copper and mica evenly to keep the commutator in good shape for the long haul.

In addition to the hardness, the electrical resistance of the brushes has to be correct as well. If the resistance is too low the brush will short two coils together where the voltage changes as the motor turns. This shorting can cause high currents that will burn the commutator out prematurely.

Brushes in a motor are a low maintenance item, but can be a big problem if you don't get them replaced properly when the time comes. A good motor rewinding shop can provide guidance if you can't get the correct brushes from the manufacturer.

Variacs have brushes just like motors, and it was the proper brushes in them that made them work so well. When the brushes go in one be sure to get the right replacements.

Ron Ginger and Roland Gaucher not only went to the NAMES show, but the week before they went to the Harrowgate Show in the UK. As we all know, Ron LIKES model engineering shows, and he reports that it was a good one. Unlike the US shows, where most of the exhibitors are individuals, all the exhibits are by clubs. The only things exhibited by individuals are the items entered in the competitions. The show also ran several days, with a couple of members at each of the club displays. In general the standard of work at the shows was very good. They met Peter Decker, who has had some of his work published in Strictly IC. The area around the show was a good one for tourists, so their wives had a good time also. Outside the exhibit hall there were about a dozen or so 2 and 3 inch scale traction engines running in the rain.

At the NAMES show Ron spent a lot of time looking at the Henrob OxyAcetylene torch. It was about $320 and he was sorely tempted to bring one home, but Norm and Roly talked him out of it. He talked to some folks on rec.crafts.metalworking after he got home. Surprisingly no one said anything bad about it (somebody somewhere on the internet seems to hate anything you ask about and be willing to tell you how bad it is.) Several people said it was a good torch, but the guy doing the demo was what made the demo so great - he could really use it.

The main topic for the night was lapping. Roland Gaucher and Larry Twaits have done a lot of lapping, and they each talked about different aspects of it.

Roland talked about circular lapping, external and internal. Lapping involves the removal of small amounts of metal. Roland's father is a big advocate of lapping, and has more patience than anyone else Roly has ever met. Roland can remember his father fixing things at home way back when, spending hours lapping something in till the fit was perfect.

Rolands favorite lap is a barrel lap. It expands in the middle so that you can slide the hole being lapped over it to produce a nice smooth round hole. A typical example of a barrel lap is the commercial version such as you can buy from MSC. The barrell is brass, and on the outside looks like a cylinder with five slits that run through the middle 80 per cent or so of its length, evenly spaced around its circumference. Inside it's got an internal thread that runs just past the slits, and then is starts to taper down to the middle. It looks the same from both ends, and when you hold it up to the light the hole and the five slits form a nice five pointed star. One end screws onto an arbor and up against a shoulder. A plug with a long taper

that's shallower than the taper in the barrel screws into the other end. It's got a couple of substantial flats on it so you can put a wrench on it and give it a little twist to expand the barrel. The taper on the screw makes contact at the smallest point of the taper inside the barrel - which is at the center of the slits so the lap expands at it's center.

Since he wants to make things, not laps, he tries to make things that match the size of a lap he already has so he doesn't have to make a lap.

When you are going to lap something experience will guide you on how close to the final size to bore your hole. What you want to do is to have the finish you want and this size you want to come in together. If you are lapping and the finish is coming up to a nice mirror shine and you've go 2 thou to go, you've got hours to go. If you'd bored that extra 2 thou out with the lathe before you started to lap you'd be done. For a 1 inch diameter cylinder 4 inches long Roland recomends leaving 1 1/2 to 2 thousandths of an inch for your lapping step.

For lapping Roly likes to chuck the lap, and then to support the outboard end with a live center. A dead center will work, but it's almost impossible to keep the compound off the end of the lap, and if you use a dead center you'll be lapping it as well as your part.

Anything will work for a lap. Even a piece of wood. The general rule of thumb for wet lapping is that the lap should be softer than the part. Than way the lapping compound will embed in the lap rather than the part. If it embeds in the part some of it'll still be there when the part is finished and in use -wearing out your assembly.

An end lap is a simple, easy to build lap. To make one, take a bar of the right diameter and thread a hole into the center of one end. Bandsaw an X across the end of the bar through the hole. Use a flat head screw thread into the hole so that as it goes in it will open up the X cut in the end. Use a fine pitch thread so that you can expand it with fine control - 0.0001 inch is the sort of control you need for expanding it. To use the end lap, chuck it up in the lathe and use it like the barrel lap, although it's a bit trickier since the largest diameter part of the lap is on the end and not in the middle.

A barrel lap is easy to make for larger diameters. Take a bar of aluminum the correct diameter and slit it through the center for about 80 % of it's length. The at the center of the bar drill and tap half way through for a set screw. Put a point on the set screw and use a fine thread. Torque the screw down a little tighter and the slit will open up the center of the slit, expanding your barrel lap right in the middle. As it wears it will make better and better contact with the part being lapped, becoming better as you use it.

How fast should you turn your lap? Set the speed so that as you go side to side with the part being lapped that the crosshatches formed by the lapping compound are at a 60 degree angle. Two things to do before you start to lap in your lathe. First, be sure to take the tool post off so you don't stab yourself in the elbow. Second, put down a good layer of newspaper to protect the bed so you don't lap the carriage down into it when you're done lapping and turning the next part.

Lap your part, turn it end for end on the lap, and lap again. As you progress the new lap and the part both become rounder, and the area of the lap that makes contact with the part increases as both become rounder and closer to the form you want.

Roland starts with 320 grit Clover brand Silicon Carbide compound. It goes a long way as you don't use that much. He has a one pound can of it, and he says he hopes he lives long enough to use it up, because it's going to take a LONG time. Clover makes compound in a whole range of sizes, but 320 is the only one he uses. 320 is coarse enough for good metal removal when it's freshly applied, and since silicon carbide tends to break up into smaller pieces (that are also sharp) as it wears you can get a mirror finish using 320 grit by not adding fresh grit and tightening the lap to apply more pressure with the finer grit that has been produced by wearing down the 320. When you want to get the finish, wipe the part and the lap to get the coarser particles out of the way and keep going. You can get a mirror finish with time and care.

Lap the part, turn, lap again. Move it back and forth evenly, don't stay in any one spot longer than any other to keep things even. (If you feel increased resistance at some point along the movement from end to end slow down so you spend extra time on the high spots till they've evened out.) Wipe the compound back into the middle of the lap when you turn the part so there's compound at the high point were the lap does it's work.

A lap works because it's solid - it doesn't give like a piece of emerycloth being used to polish something up. It hits the high spots and ignores the low spots until things even out. Emerycloth follows the high and low spots. You get a nice shiny surface but you haven't done anything to make it rounder.

Dick Wells showed us a lap he'd made for use on a blind cylinder in his White steam car. It was based on a piece of iron pipe, with cast lead for the working surface. Dick says he likes lead laps because lead is easy to form and soaks up the abrasive.

Lapping is a slow process - you aren't going to make any money doing it. For that you need a Sunnen Hone. The Sunnen Hone has a series of arbors that take a stone and push it out of the slot in the

hone to remove metal from a bore under controlled pressure from a foot pedal (it pushes a tapered gib in the arbor that matches one on the bottom of the stone.) Stones come in a variety of grades, and an arbor will cover a much larger range of diameters than a single hone can (the range depends on the diameter.) With a Sunnen Hone you can take a 4 inch bore cylinder, hone it out 0.010 over in 20-30 minutes using a coarse stone, then put in a fine stone and in another 20 minutes get the whole thing within 0.00025 to 0.0005 for diameter and taper. When you install a new stone you dress it and break it in by honing a cast iron dummy cylinder made special for dressing new stones.

When he made his Bently BR2 Roly lapped all the cylinders. Since then he got his hone. It came with about 20 arbors. If you ever decide to get one, be sure it comes with arbors because they'll cost more than the machine if you have to buy them separate. Arbors go down to 1/16" in size. George Luhrs uses a hone on all of his little engines, with a hardened piston.

Lapping came up a few months back, when Norm Jones was working on the crankshaft for his Merry Engine. Roland suggested that he lap it to finish the journals. For lapping a shaft take a disk of aluminum and drill a hole to size in it, then cut a slot across the disk through the hole almost to the other side. Put it in a holder with a set screw to hold it and to squeeze it shut across the slot. Make the outside of the holder smooth so that if the lap catches on the shaft it won't hurt your hand.

Lap the shaft the same way as the hole on a barrel lap, but now it's the shaft you care about. Lapping up to a shoulder can be a problem (it is with grinding too) so put a little recess at the end so you aren't actually lapping to the shoulder. Don't dwell anywhere while lapping, and turn the lap to keep it wearing evenly. Lapping is the perfect way to get that thumb push fit of a ball bearing onto a shaft.

Polish a shaft with emery, then lap it and see how bad it really was. Emery gives good looks, but is not good for fit.

One thing you can't do with a lap is make a taper arbor - it'll come out straight with a lap.

Larry Twaits learned about lapping from his father as well. He passed around copies of a chapter from a post WWI book about lapping. It says there are four aspects to lapping. Abrasive, Lap Material, Fluid, and Technique. He's never found anything in a book that talked about technique.

Larry likes to start with 500 grit Silicon Carbide. It's good as it's hard and crumbles as it breaks down.

A couple of years ago he got a Linley Jig Borer. A nice machine that he can't get collets for. He made a lap to do the internal shape of a collet chuck to use on it. The lapping that we've talked about so far has been "wet" lapping where the abrasive is used as a slurry in the fluid. The abrasive rolls around between the lap and the part, wearing away at both. Since Larry wanted to form a specific shape he wanted his cast iron lap to stay the shape he formed into when he used it, so the part would end up the right shape.

So, he used a steel roll (roughly 1/16" wide, 1/2 or 5/8 diameter, mounted in a slot cut into the end of a piece of 1/2" or so drill rod) to push diamond dust into the cast iron lap, charging the lap with diamond embedded into the iron. Then the lap is carefully cleaned of loose abrasive. He used purple diamond, which is about 60 micron in size. The old books recommend gasoline as the perfect fluid to flush things with when "dry" lapping (it's dry because the abrasive is embedded in the lap and there isn't any loose abrasive rolling around between lap and part.) He wasn't too keen to use gasoline, and kerosene smells bad (not good for public relations) so he used lamp oil. It works well and comes in your favorite smell.

A flat lap is used to make things flat. Larry likes to use 11L41 leaded steel. It's easy to machine and hardens up well. He had three pieces of it that he'd hardened up and surface ground. One was lapped as well, and was like a mirror. One was lapped a little and marked with compound on a surface plate to show how flat it was compare to the one that was just surface ground.

He has a flat lap he got used. It's got a 3/16" cross hatch on it. It's charged with diamond, and once charged it's hard to grind through it with a surface grinder. Dry lapping on the flat lap keeps the lap flatter longer than if you wet lapped with it, as dry lapping wears the lap much less than wet does.

He had a 1/4" copper rod he'd turned to 6mm. then drilled a hole in. He used it to lap two holes about an inch apart into alignment for 2 bearings. He charged the rod with diamond so the lap wouldn't wear to get the holes to line up. Making laps is tedious, and they don't have to be fancy.

He wants to make holes, not laps. So, enter Timesaver Abrasives. They break down into harmless stuff quickly so you can use them in an assembly and not cause damage because the abrasive stays in. Larry is working on a relieving tool with Geoffry Brown so that they can make gear cutters for non-standard gears for clocks. He passed around a part of it with two dovetail slides. One treated with Timesaver and one not yet done. The treated slide was noticably smoother. Larry thinks it works great and more people should try it.

Diamond tools don't work on steel, so why do diamond laps work so well on it? There are two theories. At high temperatures the carbon in the steel

affects the diamond. It's a bond thing, the steel pulls the diamond out of the wheel.

TIPS AND TECHNIQUES
Ed Kingsley

REDIAL "M" FOR MICROMETER

Last month I put a pretty much one sided "dis" on calipers. So now, in the spirit of fair play and true bipartisanship, I feel compelled to make a full disclosure of my own personal assets in this regard. I own 15 calipers -- little ones, medium sized ones and one pretty big one. I have English and Metric. I have Dial, Vernier and Electronic.... I was totally seduced by the dark side.

Can we all say, "tool junky?"

I admit once again. They ARE convenient. They are fast! They are easy to use and cover large measurement ranges. They have many cool attachments, and I do use them constantly. I even use them to check that I've read the micrometer correctly, and didn't "drop" a decimal place, a tenth of - or an entire inch. At these tasks they're great. Sometimes they can easily measure spaces virtually impossible to get at with any kind of micrometer. Hell, I love the damn things, but love (as we know) favors myopia, and that's why I proposed the caveat on their use. If you remember the old Russian proverb (that 1st Chipster Reagen) often quoted, "Trust, but verify", you will be OK. Just my opinion.

The First rule of Holes: If you're in one, stop digging!

GREY LADY DOWN (a memoir)

Luck favors the foolish. Or, how I ...

1. Found 'my' Bridgeport
2. Managed to clear out enough space to put it in, - and -
3. Actually got it down into my cellar - with both of us still in pretty much one piece (each).

Of these three, far (far) and away, the most difficult was the second.

I have been working along side someone who has been trying to make his own shop a going operation for several years. We had spoken a number of times about the machines he had, and I had the impression that he used a horizontal milling machine. A month and a half ago he decided to throw in the rag, and sell off his equipment.

I dropped by the shop to see what treasures I might pirate, and discovered that, in addition to a Cincinnati horizontal mill; he also had a J_head Bridgeport. Da dah! Coincidentally, I had been in an "acquire-a-bigger-mill-mode" for several months, but BP's have always intimidated me - the size and weight thing -- and I had been pursuing a Rong Fu, RF-45PF, the great white whale of imported milling machines, with - characteristically - very little (no) luck.

When, in desperation, I wrote directly to Rong Fu, they told me that - they didn't have a dealer any closer than NJ, and when I persisted, actually suggested that I should, "Maybe buy Bridgeport, or other brand machine". OK, I can go with that, but, there's still that problem of 2000-odd pounds of cast iron and steel to deal with. And the size - this chunk of steaming funk conquers and occupies a 5'-3" by 7'-6" piece of territory, minimum. Add another 4' to the right, if you want to remove the table (or put it back on). The Rong Fu, on the other hand, is a mere 730 lbs., tiny by comparison, and an easy cellar stuffer. Heck, put it in the living room. A coffee table should support that, easy. "Fast feed the caviar over to our guests, dahling." But, I digress.

And, so I hesitated, and almost blew it, before realizing I was passing up an in-my-face-opportunity. The clincher came when a friend "volunteered" to pick it up, move it to my house and cram it through the bulkhead with his forklift truck. I still wasn't sure I could really do it, but at this point my brain was on fire, and I couldn't think straight anymore.

My cellar is about as full as a cellar can be and still contain enough oxygen to support life (and, with the rust, that's always iffy). In order to make enough room for the BP I was going to have to, gasp, actually throw some things away! As I pushed, 'cleaned', shoveled and compacted stuff for the forth day, one thing became very clear. Never leave the furnace guy down in the cellar alone. I excavated five partially filled containers of old fuel oil, three mostly empty pails of hardened furnace cement, a half dozen grizzly rags and two clogged-up line filters. Not in any one place, mind you, but carefully ferreted all over the damn cellar.

I will spare you the worst of this process. Suffice it to say that my cellar is like one of those puzzles we played as a kid -- the square frame with four rows and four columns of flat, square, numbered pieces that slide horizontally and vertically. You remember, one square was missing, and the object was to rearrange the pieces into correct order by a long process of "substitutions". Put this one there and move that one up, then another over and the first one down ..... well, that's how my cellar had to be rearranged to accommodate the mill. God, I hate doing that. Stuff I finally found after 20 years - gone again in seconds. It was like an iron enema.

So, that's one and two. Three - went much better than the SouthBend, but I don't want to talk about the SouthBend. I still get a painful twinge now and then .... No, this went much better. We brought the mill around the back and hauled it off the truck. Ear-

lier, we had taken off the table (I had it in the back of my station wagon for a day, but I don't want to talk about that, either) and the motor, and tilted the head over, to get the lowest profile. The cellar door is only 63" above the 2x12 and plywood ramp the mill would "slide" down on into the cellar, and the shortest we could make the BP was 62 5/8". I am "between" stairs in the bulkhead. (rotted set removed, pile of 2x's leaning on the fence) This is normally annoying, but on moving day it was a great advantage.

The former friend, with the lifttruck, brought one aluminum and one steel plate, each 3' square, and we placed them atop the plywood, the steel plate closest to the cellar. We took a stout bar of CRS and clamped it to the ends of the forks. He screwed an "eye" in the threaded hole in the ram, (behind the head) and ran a chain through it, and then around the bar a few times. He then picked someone who would climb down into the bulkhead to "supervise" the lowering-in from below (me), and lifted the mill up, clear of the threshold. He drove the forklift forward about two feet, and I steadied (yeah, right!) the mill to keep it from swinging (through the kitchen window), as he lowered it down onto the aluminum plate. We only smushed the aluminum siding in one really small place. It was hardly noticeable to me, although my wife spotted it immediately, from the far side of the neighbor's yard.

The ramp was on about a 15˚ angle, and the mill slid easily on the metal plates, with just a bit of persuasion from a long prybar. When we reached the bottom, we slipped a pair of rollers under the back edge of the base (it went down backwards) and (sort of) eased the front down onto the floor. We pried the front end up with the bar and put the third roller under that edge. Then, by "aiming' the wheels, it was a simple matter of two of us pushing the mill around into the spot I had shoveled out. The fact that this was immediately inside the cellar door should not be overlooked.

He then lowered the table down onto a dolly, and I slid it (rode it) down into the cellar (whee!). While we were at it, we also moved in a surface plate and dragged out some flotsam (that had come with the house), which had to go to make room for the Mill. ;-(I still don't know what it was, but I know I'll need it next week.

Total time: 2 hours and fifteen minutes, including a long break. Rong Fu, "digest your heart over".

Now, as soon as I figure out to make the motors run, I will fill up any nooks and crannies, which still remain in my cellar, with chips. My thanks to Messrs. Charles and John, for making it all possible, and almost easy. Well, OK, a lot easier than the SouthBend, but the less said about that, the better.

Moral: Be not confounded by imposing mass, nor girth, but get thee two stout comrades, one of whom possesseth a lifting carriage, another one not too bright; some stout timbers, a half dozen ales, and goforth unafraid.

Or, as Click & Clack might suggest: unencumbered by the thought process!

--Ed

With the discussion of lapping to get a good finish to the correct size at the meeting in May, Don Strang reminded me that he had put something into the August , 1998 issue dealing with abrasive particle size and surface quality. His idea was that I should perhaps include some of it again since it went with the subject of the current meeting. Well, the way that things worked out with the layout for the issue I didn't need to decide what to cut out of it, because the whole thing fit just right, and here it is.

Surface Quality and Abrasives
by
Don Strang

I have been looking into surface quality vs abrasives. We live in the two worlds of Metric & US/ UK dimensions. (If we call it Imperial we can blame it on the Brits.)

First: some dimensions. Metric uses the meter as the length standard and we use the Yard, Foot, Inch etc. In the early 1900's the ratio of the millimeter to the inch was revised so that One inch = 25.4 mm EXACTLY! So: the meter = 39.37 inches, call it 40 (1.6% error) for talking purposes.

In machining we tend to work in inches, typically using thousandths of an inch, "thou". Metric would use 1/1000 of the meter = l mm. We get 1mm = 40 Thou.

If we get smaller, say millionths, Metric would use 1/1,000,000 of the meter = 1 micron (u). We would use millionths of an inch which we call the microinch (u"). Similarly the u = 40 u". (I had thoughts of coining new names of Thinch and Minch for Thou and u" but decided it was a bad dream)

Back to the main topic: We produce a surface by proceeding from cutting to grinding to lapping/ honing to polishing. The abrasive materials we uses are rated in grit size where the grit is in parts per inch. Grinding wheels used after cutting range from 60/80 grit to finer. We then use abrasive grit in various forms such as cloth, paper, paste, etc. 3M paper goes down to 2000 grit,Clover compounds go from 50 to 600 grit and can be an oily paste or dry.

To go finer we get into the realm of diamond grit. Here we find that they are dimensioned in microns and these range from 300 down to 0-1/2. Using the 40 factor 300 becomes 12,000 u" which is 12 Thou (about 80 grit) and 1/2 becomes 20 u"(about 50,000 grit).

Finer than this is available in the forms of various polishing compounds, rouges etc. I did not have much luck in finding equivalent grit sizes of these products (but see below).

When we get in the polishing region we enter the world of light wave dimension. Yellow-green light has a wavelength of 0.55 microns which is 22 u". To get a good reflection (image) from an electro-magnetic wave the surface roughness should be 1/10 wavelength or better, this is 0.055u or 2.2u".

If you look at some of the surface roughness comparison plates at the supply houses the good ones go from 1/2 u" up to several hundred u". You get a good reflected image from the finer ones but the image gets blurry at 4 u" and definitely so at 8 u".

What happens is that the light rays begin to scatter as the roughnesss gets too much and the image breaks up. In practice good optics are about 5X better than the 1/10 criteria, so the roughness is 0.011 micron or 0.44 u". You cannot see this directly as it is so much smaller than the wavelength but it shows up indirectly in differential or relative comparisons.

Time to go to the smallest extreme. Atoms are pretty much the same size and the space between them (interatomic-spacing =IAS) is about 0.008 u" so 1 u" is about 125 atoms long and the 0.44 u" noted above is only about 55 atoms tall (or deep). You can see that in polishing optics, etc. it becomes the removal of atoms (say tens of them) in the final operations.

An optical scientist (F. Twyman) about 1916, discussed the correcting of a telescope mirror where they had to remove about 10 u" of glass. Using a very fine cloth pad with rouge paste he found it removed about 1/10 u" per stroke, so you can see what this gets into, delicate but also slow so that you can be delicate. The stroke or 1/10 u" took off about 12 atoms of glass.

As machinists we go from using boulders to the fractional light wave rouges used in polishing. A lot of the above is approximate but it is in the right region of dimensional values.

A final word about my favorite topic-Jo Blocks-. Their surface is a good mirror (look at the end of one) and the best blocks claim to be about 1 u" in flatness. Since this is over some 1.5" (width) it is clear that the surface roughness is much finer than 1 u". They are of hardened special alloy steel and ground/lapped to size and then polished as a final lapping. Johannsen never explained how he did this although his wife did the final lapping on a converted Singer sewing machine in the 1890's. I find this rather amazing!

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