The NEMES Gazette

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The Newsletter of the New England Model Engineering Society
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Our next meeting is at 7:00 PM on Thursday
2-Nov-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 letterhead).

This Months Contents

From the Editor's Desk

By Kay R. Fisher

Ed Kingsley created the design for the NEMES logo used on the back cover of the Gazette. I apologize to Ed for taking so long to get this into the newsletter.

Howard Evers is writing an article for HSM/MHW about decals for machines. He has to use only full size decal sheets because partial sheets won't go through the copy machine correctly. If you need an easily applied decal for any of your equipment, (such as a name, logo, insignia or directions (forward-reverse; STOP)) please call him at (508) 987-0654. He needs is a full size, clear, clean copy of what you need.

Kay

The President's Corner

By Ron Ginger

November Meeting

Our November meeting will be a “project talk”. This project is a bit unusual in that it was a group project, and is made of wood. The group was the “South Shore Woodturners Club”, and the project was a fully functional model of a Gnome Rotary engine. Malcolm Partridge will bring the model and tell of how it was constructed, and a bit about the organization of the group.

December Meeting

We will return to the Jet engine theme, this time it will be a more historical view by Dave Carpenter who was the plant historian for GE in Lynn. This should be an interesting talk.

January Meeting

It has become the tradition for January to be a 'Poster Session' where everyone gets to bring something and talk. We may also work in some stuff on stepper motors and CNC.

Bus Trips

CABIN FEVER 2001

We have a good start on the sign up for the Cabin Fever trip - about 27 names already. If you want to go and don't get to meetings, let our treasurer Rob McDougall know, he is keeping the list this year. Just as a quick review. This year it will be in Lebanon Pa., about 20 miles from the place in Reading where it's been the last few years. A busload of NEMES members will be going to the show, leaving from the Riverside T station at 10:00 AM on Friday 26 January 2001. We will get to the Lebanon PA area in time to unload and setup at the show and still have a relaxed evening. There will be a hospitality suite for all the show people. We will be staying at The Quality Inn in Lebanon Pa. Rooms are $59 a night each for 1 to 4 people. You MUST reserve a room if you're going, the sooner the better. When you call 717-273-6771 to reserve your room tell them you are with NEMES to get the group rate. The bus will leave from the show at 1:00 PM on Sunday and should be back to Riverside by 7-8 PM. The new site for the show has four times the floor space, better food service, and a wing devoted to seminars. It should be a good trip. The bus fare should be about $75, maybe even a bit less if we get more riders.

NAMES-2001

NAMES is the North American Model Engineering Show in Detroit Michigan not NEMES the New England Model Engineering Society (us). A couple years back NEMES organized a busload of people who went to Detroit to see the NAMES show in Wyandotte (a suburb of Detroit). This year we may do it again. On the last trip to Detroit we drove straight through from the Riverside T station to Detroit, and then from Detroit we drove straight through the night on the way back. The overnight bus ride on the return trip did a lot of folks in, so this time we'll try something a little different. There was considerable interest in another bus trip to NAMES, but with a bit more of a "vacation schedule" than the last trip.

The bus would leave on Thursday morning, and go to Niagara Falls where we will spend the night on the Canadian side, and get to do a bit of sightseeing. Friday morning it's off to Detroit to get there in time for the Friday setup (noon). We will leave the show Sunday afternoon, and return to Niagara Falls. A bit less tourist time, but it will be a break to the travel. Monday morning the bus returns to Riverside. Besides this schedule being more fun, it will actually cost less since we won't need to have 2 bus drivers to meet the legal time limits for a driver.

This is the last chance to visit the NAMES show at the Yack Arena as in 2002 it will be moving to Toledo and a larger venue.

We don't have enough signed up yet to be sure, but we did get enough that I think we can make it. So, give it some serious thought, and sign up with Rob if you want to go.

Ron

Connections

By Max ben-Aaron

The whole argument over the exact start of the 21st Century is moot. If you are interested in the 'clock turning over' phenomenon you will pick January 1 2000. If you are a purist who believes that there was no year 0, your choice is January 1, 2001. Either way, this is a good time to review the history of the past century in terms of making swarf.

I propose, for the sake of argument, that the most significant advance has been the electrification of the workshop. Even if we just take the 'heavy current' approach (i.e. not count electronics == 'light current') a good case can be made. If we include electronics, the case is overwhelming. Of course the fact that I am an unfrocked electrical engineer (heavy current option) is beside the point.

The trend toward electrification was started when Michael Faraday demonstrated in 1821 that passing a current through a wire immersed in a magnetic field could produce a continuous rotary motion. For a long time the search for a practical electric motor was fruitless. These early attempts failed because expensive and inefficient batteries were the only electrical power sources available at the time.

During this time, machines, especially metalworking machines, were powered by belts driven from lineshafts driven by either water or steam power. The legacy of this era is the multitude of massive old mill buildings here in New England. The construction had to be massive to absorb the stresses and strains engendered by the lineshafting. Because coal was cheap, steam was king.

In the 1870's a number of experimenters discovered the principle of the self-excited direct current generator. Almost simultaneously, in 1873 the French engineer Hippolyte Fontaine discovered that the action of a generator and motor were reciprocal when a worker in his laboratory mistakenly wired two generators together.

If you would like to see a machine of this vintage, go to MIT. On Albany Street, in the foyer of the building opposite the cyclotron, there stands an actual generator, which was installed in an Edison plant in 1886. It has two very large field coils and a relatively small wound armature, complete with commutator, which is quite recognizable as a forerunner of modern equipment.

By the 1890's the technology had advanced considerably. More rugged mechanical designs and improved magnetic circuits led to a proliferation of small DC motors to power fans, sewing machines and to perform similar light tasks. An amateur machinist though, more often than not had to rely on a treadle-powered lathe.

Mb-A

Treasurer's Report

By Rob McDougall

As of 9/30/00

Balance 8/31/00	**$3,133.51**
Dues Received	80.00
Interest Income	2.05
Part reimbursement for books + videos on Scraping	100.00
Less:	
Gazette expense	
- Copies	-81.18
- Stamps	-50.38
Balance 7/31/00	**$3184.00**

Note: I will collect the sign-up names for members who wish to take the bus trip to Cabin Fever and/or N.A.M.E.S. There will be a sign-up sheet at the meetings or you can contact me directly. These will be GREAT trips. If you have not done one before – I highly recommend it. Spouses and friends very welcome too. (Amish country and antique heaven is very near Cabin Fever.) - Rob, Ph: (781) 647-0689.

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Rob

The Meeting

By Stephen C. Lovely

The Meeting, 5 October 2000

Ron Ginger got things going a little late, about 7:15. The first thing discussed was the Cabin Fever Show coming up at the end of January. See details in “The President’s Corner”.

Next up was a discussion on the NAMES bus trip. Again see “The President’s Corner” column above for details.

Dave Piper is going to be organizing a program to collect info on who has specialized tools that they are willing to share. He has a #5 Jarno Taper reamer that he bought and used once to get the list of tools going. If you want to be part of the list and to get a copy of the survey results contribute something to it. Dave would like to get the lists of what people have next month.

Howard Gorin announced that he is selling his South Bend Heavy 10 Lathe, which is in good condition. If you are interested check with Howard.

Last month someone was here with a wooden model of a Gnome Rotary engine. They will be speaking about what went into making it at the next meeting. For the December meeting Ron has lined up a Jet Engine Historian from General Electric to talk to us. Ron feels good having two speakers lined up in advance, this seems like a first. If you have a suggestion for a speaker let Ron know so we can keep having interesting talks planned ahead for our meetings.

John Wasser volunteered to refurbish a screw machine for the museum a while back, and he's got it finished and it now produces parts. It's supposed to make a knurled nut, but the tap and the knurl are missing so what it makes is a sort of a brass spacer.

The main speaker for the evening was Denis Edkins. Denis is not a member of NEMES, although he has brought models to our shows and most recently brought the steam power plant from one of his model boats to the poster session we had last summer.

The first half of his career he was involved with Aircraft Gas Turbines. When he first became involved with gas turbines he was appalled. Gas turbine engineering is "engineering that's damned near impossible."

He has been involved with jet engines since the beginning in 1934, and not many others who were involved at the beginning are still alive.

Two different men developed the Jet engine separately and independently. Whittle patented the jet engine in England in 1930. His engine first ran April 12, 1937, and it's first flight was May 15, 1941. The first operational aircraft was the Meteor in 1944. Von Ohain patented the jet engine in Germany in 1937. His engine first ran in April 1937 and the engines first flight was August 27, 1939. The first operational aircraft to use it was the Me262 of 1944.

Both Whittle's and Von Ohain's engines first ran in 1937. Neither man knew the other or was aware of the others work. Whittle's development was funded by venture capital raised from private enterprise, while Von Ohain had the backing of Heinkel Aircraft. As a result Von Ohain's efforts moved more quickly than Whittle's.

During World War II the Germans built 6000 jet engines. These engines were built with steel turbine blades due to material shortages however so the individual engines did not last long.

On the British side the third generation Whittle engine went into production by Rolls Royce and powered the Meteor. The Meteor was operational in 1944 and was used against the V1 flying bombs.

In 1941 General Hap Arnold had a jet engine sent to the General Electric plant in Lynn Ma. and it was the start of the GE jet engine program. A fourth generation Whittle engine was the start of the Pratt & Whitney Jet Engine program.

There are various kinds of jet engines. The turbojet is the simplest. It consists of four basic parts: the compressor, the combustor, the turbine, and the jet nozzle.

At this point there was a slight delay in the program as Jeff DelPappa used his leatherman to disassemble the overhead projector and to discover that the spare bulb had burned out previously. The search for a good bulb was called off when Dave Piper arrived with a second overhead projector and the talk continued.

All of the oxygen in a jet engine is not consumed in the combustor. So for more thrust you can add an afterburner. This requires that the jet nozzle be opened up for higher volume flow and this adds additional thrust while consuming considerably more fuel.

A turbofan engine is more efficient than a turbojet engine at lower flight speeds. A second stage turbine drives a fan in front of the compressor that moves a great deal more air than goes through the "core" of the engine. The turbo fan has additional complexities over a turbojet as the fan and the second stage turbine are connected by a shaft that is co-axial with the shaft connecting the compressor and the first stage turbine.

The Bypass Ratio is the result of dividing the "bypass air" by the "core air" where the "bypass air" is the air moved by the fan and the "core air" is the air that goes through the compressor – combustor - turbine "core" of the engine. For a turbofan engine the bypass ratio can vary from .1 to 10 depending on the engine. For a turboprop engine the bypass ration is about 60, and for a helicopter the main rotor moves about 2000 times the air that the turbine core does. For a turbo prop engine the nozzle might be utilized to provide some thrust in addition to the thrust from the propeller, but for a helicopter the nozzles are opened wide so there is no thrust. A turboshaft engine is similar to a turboprop engine in that the main power output from the engine is rotational rather than jet thrust, although it goes to something other than a propeller.

The Compressor

The aerodynamic speed in the compressor goes down as the temperature goes up. As the air is compressed it gets hotter, so the aerodynamic speed goes down. Since the compressor is all one piece, the front of the compressor and the back are all running at the same physical speed, 100%. Aerodynamically however, the front is at 100% while the hotter back may only be running at 60%. This means that the front of the compressor is pumping more air than the hotter parts can take in. This leads to compressor stall. So, in order for the compressor to work, stage matching is required. This can be accomplished in a variety of ways.

1. Bleed off some air. (This is inefficient)

2. Have a single rotor with variable stators to cut down on the flow at the inlet end.

3. Have a dual rotor compressor with a dual rotor turbine. The two separate compressor/turbine units are self-adjusting for balance.

4. Rolls Royce went to three separate compressor/turbine rotors for even more self-balancing at the cost of even more complexity with 3 separate co-axial shafts for the engine core alone.

However you do it, you have to handle the issue of stage matching or the turbine will stall or surge continuously and won't run properly. If you know what speed a compressor will be running at you can design it to run properly at that speed, but at any other speed it will have problems. One engine, the T-56 used in the Lockheed Electra and Hercules turboprops is designed this way. The propeller pitch controls maintain the engine at a constant RPM at all power levels.

Tip speed for the turbine blade of the front stages are held to about 1700 feet/second. For temperatures up to about 700 degrees F Titanium is used. At higher temperatures nickel alloys are used. With current turbines running at about 40 to 1 compression ratios (about twice the ratio of the typical diesel engine) the air in a modern turbine compressor section reaches 1300 F.

Compressors are of two basic types, centrifugal or axial flow. A centrifugal compressor is machined from one piece of metal. Air enters in the center and flows to the outside. An axial compressor can be made up in several different ways. Separate disks and blades can be assembled, a single drum can have multiple grooves for more than one row of blades, or blisks can be used (blades and disks machined all in one piece.) Air enters the axial compressor at one end and flows along the axis of the compressor to exit at the opposite end.

In an axial compressor each turbine blade is a tuning fork and has a natural frequency. When the flow of air through the compressor excites the natural frequency of a blade a quick failure follows as a result of high cycle fatigue. The onset of this resonance is detected by telemetry of signals from strain gauges attached to the blades while the engine is running in the test cell. It's a very tricky business to get things smoothed out so that the engine will run without instantly tearing itself apart.

Tip speeds for all turbine rotors are the same, so the shaft speed is proportional to 1 divided by the diameter. A rotating shaft has critical speeds where it tends to resonate. At the first critical speed the two ends remain still and the entire shaft between the two ends vibrates up and down. At the second critical point the two ends and the center remain stationary while the shaft vibrates between the nodes. Very much of this vibrating can cause damage and lead to shaft failure. For larger diameter engines (over about 2 feet in diameter) this is not a problem because they don't run at a high enough rpm to reach the first critical speed. Smaller engines, however, run with supercritical shafts. This means that the operating speed of the engine is such that the shafts are running at above one or more of their critical speeds. Small engines can operate at above both the first and second critical speeds, which means that as they are started up they go through both of these critical speeds.

Since no matter how well you balance a shaft it will always be slightly out of balance, some sort of damping is needed. So, on small engines one end of the shaft may not be mounted directly to the engine frame. Instead the bearing is held in a squirrel cage of spring fingers. The fingers are attached firmly to the engine frame at one end and at the other end surround the outer race of the shaft bearing with a small gap that is kept filled with pumped oil. At running speed the oil film is even all around and the spring fingers are idle, but as the engine comes up to speed they provide just enough damping to keep the engine from self-destructing. This sort of a damper is only needed on small engines that run at supercritical shaft speeds.

How do management worries enter into things when you are designing and engine? In 1967 Denis was in charge of developing the T700 for General Electric. One of the members of upper management was scared of two bearing rotors. As a result they designed the engine with an extra bearing. The shaft had one front bearing and a pair of rear bearings. They built the prototype this way, which made upper management happy. Once the prototype was built they took out the "extra" rear bearing and all was fine for thousands of production engines.

The rolling elements in the bearings of a jet engine can be turning at 5000 revolutions per second - which is 300,000 RPM. They have used synthetic oils in turbines now for 30+ years to meet the needs of this kind of service.

In order to keep the high pressures in where they belong in gas turbines they use a piece of technology borrowed from the steam turbine, the labyrinth seal. This is composed of a bunch of sharp tips turned on a shaft that reaches up very close to a soft casing. As the high-pressure gas leaks past each stage of the seal the pressure drops. After enough of the stages have been leaked past the pressure is down to what it is on the low-pressure side and the overall leakage is very low. The difference in pressure between any two stages is low, so none of the stages leaks very much.

Turbines are 90-92% efficient, while compressors are in the 80% efficiency range.

The Combustor

Whittle had a vaporizing approach to the combustor originally. It used to be sheet metal, now is precision machined and film cooled. In order not to blow out the flame, the air velocity has to be reduced to 80 feet per second by expanding passages. Stochiometric combustion, where the fuel and the air are combined to exactly use all the oxygen gives a 4000°F+ flame temperature. This temperature is reduced by air dilution. Early jet engines had separate cans for the combustion, although now a single annular combustion chamber is used. (To keep NOx production down some recent engines use two or three annular combustion chambers.)

The J-85 combustion chamber is 24 inches in diameter (with a hole in the middle for the shafts to run through) and 18 inches long. At 8 atmospheres of pressure it puts out enough heat that it could heat 200 typical houses. At 1 atmosphere it would put out enough energy to heat 25 houses. The combustor is typically 99.9% efficient, except at idle.

The Turbine

Turbine blades exposed to 1900 F hot gasses need to be cooled. For film cooling the blade has a hollow core and many 0.007 inch holes along the leading edge of the blade. These holes bleed 1300°F air from within the blade to flow around the blade and keep the 1900°F surrounding air from damaging it. In cooler parts of the compressor conventional cooling is used. There are holes running radially in the compressor blades for cooling gas to flow through. Cooling is needed because the gas temperature is above the melting point of the metal used to make the blades in parts of the engine.

Holes in the blades can be cast in place, laser drilled, ECM'd (a negative plating operation,) or EDM'd.

Air discharged from the compressor goes through fixed vanes.

Blade clearance between the tips of the blades and the casings is an issue. Both centrifugal forces and heat stretch affect blade clearance.

What is the load on a turbine blade? Take the T-700 as an example. It's a small engine with a turbine about 1 foot in diameter, and it runs at 42,000 RPM. The G-force on a 2-ounce turbine blade is 300,000 Gs. That means that there is a force of about 19 tons trying to rip that blade apart – all while it's red hot. So, it becomes obvious that attachment of the blades to the hub needs to be good.

Whittles original engine ran about 17,500 RPM with a temperature of about 1400°F.

The turbine sees considerable thermal stress. Gasses come out of the combustor like a 3000°F blowtorch and strike the vanes. So, 2800°F gasses impinge on the turbine blades. Within seconds of going to full power the turbine blades reach their max temperature of 2000 – 2200°F. Going down into the disk there is a large temperature differential. The disk will never get as hot as the blades and since it is much more massive it takes minutes to reach steady state where as the blades reached steady state in seconds. As a result of the time difference to reach a steady state the hardest part of a turbine's life is when you first go to full power and take off.

What does it take to qualify a jet engine? An engine qualification program is an expensive undertaking, involving 16 engines and 10000 hrs of testing. Tests include endurance running, accelerated power cycles, inlet distortion, bird strikes, performance (including altitude tests in a special test chamber,) rapid acceleration and deceleration, and many other elements. Completing the tests takes a long time.

The bird strike test is particularly difficult. Rolls Royce designed an engine with composite compressor blades. They failed the bird strike tests and had to be replaced with Titanium blades. The whole process was very expensive and almost destroyed Rolls Royce as a company.

Jet engine technology is rocket science. A modern jet engine will spend 20,000 operating hours on the wing before it needs to come off. After those 20,000 hours what needs replacing? The compressor blades have been eroded by dust, the labyrinth seals need replacing, and oxidation will have done some damage in the high temperature areas.

Originally the control systems for jet engines were all mechanical and had more parts than the engine did. Now all the controls are electronic.

The high temperatures in the engines are not measured directly. Ordinary thermocouples are used downstream from the hot spots where things have cooled down some.

Starting a turbine doesn't require all that much power, although they are not self starting. Whittle was using a 10 HP engine to start his turbine and it was later found that the starter motor for the 10 HP engine would start the turbine fine by itself. You need to spin up the engine, atomize fuel, and then hit the spark.

What about ceramic blades? They are brittle and as a result won't yield. Hence they don't conform to the dovetails in the disk.

Higher and higher temperatures are the current driving forces for better performance. The other big thing is to get better compressor differential so that fewer stages are needed.

Accessories are run from the turbine with reduction gearing.

Subsonic flow is required at the entrance to the compressor, although flow may not be subsonic at all points within the compressor.

Was Whittle's work based on some previous work of others? No, Whittle was an original genius who went to the Royal Air Force engine college. The engine design was all his.

Is there any other type of jet engine that would be simpler? A ramjet would be simpler, it doesn't have a compressor or a turbine. The inlet shape replaces them. Ramjets only work at very high speeds though, typically needing a rocket boost to get going. Pulsejets work but have poor performance and fuel consumption.

scl

Junkyard Wars Marathon

The Learning Channel (TLC) is showing several episodes of Junkyard Wars. Find out for yourself why our own Jeff DelPapa formed his team called the NERDS to challenge the English. The following was cut from a TLC web page:

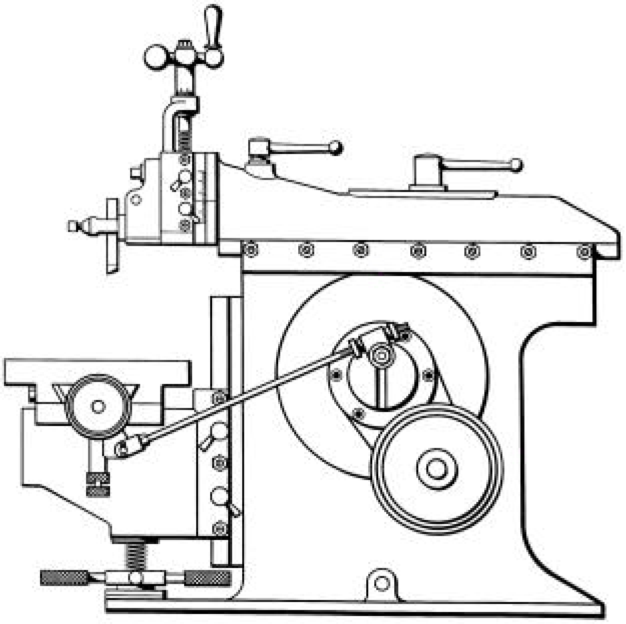
Gather the family 'round the T.V. and watch Thanksgiving in the Junkyard — a Junkyard Wars marathon — beginning Friday, November 24, at 12 p.m. ET/PT!

It's early morning and you're standing in a junkyard, surrounded by acres of scrap and about as many tools. Here's the challenge: Can you and your teammates build a contraption that can fly, or a vehicle that can run on land or water? In 10 hours? Meanwhile, in the same junkyard another team is scrambling to find the best bits of scrap before you do. They want to build a better machine, because both teams will ultimately fight each other in a junkyard showdown …

Junkyard Wars is the perfect forum for those who believe they can build anything out of junk. The teams consist of three friends who share the belief that their mechanical skills, ingenuity and teamwork are second to none. A total of eight lucky teams will travel to a ready-made junkyard in London. They'll then compete, two groups at a time, to build complex machines. And that's not all! We'll then put these machines through their paces in a scrap showdown. The coveted crown will be decided in the grand finale, when the two best teams hunker down for the mother of all junkyard wars.

Need some more inspiration? Check out the British version of Junkyard Wars on the web at: http://channel4.com/scrapheap/

Or meet the NERDS (New England Rubbish Deconstruction Society) — the first American team to compete on Junkyard Wars on the web at: http://www.the-nerds.org/



Metal Shapers

By Kay R. Fisher

One of the most frequently asked questions is: How much does a good shaper cost? In the northeast in general you should be able to find a nice 7 to 9-inch shaper in the $300 to $500 range. You can get them cheaper if you just wait it out and look for a bargain. For reasons I will never fully understand on the west coast you should expect to pay double.

As a case study consider the following recent purchases. I traded a small lathe that I was trying to sell for $300 for my 9-inch "no name brand" shaper. At the annual Orange Engine show I purchased a very nice Rhodes 7-inch shaper for $150. When I told this to some club members at the next meeting I found out that on that very same weekend one fellow also purchased a 7-inch Rhodes for $75 at an auction that was primarily wood working tools. I obtained a 7-inch Logan for $250. I got a 6-inch shaper casting kit (saved it from the scrap heap) for $50.00. Rob McDougall found a 7-inch South Bend for $300 that had rust but no wear. Steve Lovely got his 16-inch Potter and Johnson recently for $40. Then he went on to spend double that amount just for the wood necessary to mount the beast in his pickup bed. A 24-inch shaper was recently advertised here for free. On the high end I've seen a 7-inch South Bend advertised for $1,450, and I think it sold for that. On the low end I've talked to several guys who have had their shapers given to them.

Usually the bigger they are the cheaper they are. Most amateurs are looking for the 7-inch shapers. From a used machinery dealer you should expect to pay somewhere in the $500 to $1,000 dollar range. Is it worth the extra expense to purchase through a dealer? Only you can decide that. The dealer is not getting rich on small shaper sales and he is taking the risk and making sure you get a good machine. They will stand by their sales and make sure you are a satisfied customer. Having a dealer you know and trust can be helpful when later you want him to watch for some special accessory. On the other hand the "Rust Hunt" is something that many of us enjoy. Pulling out a sad looking shaper from under age-old debris and spending the next week with WD40 and Scotch Brites is very rewarding.

Alternatives

Consider a bit of travel. Imagine that you get a line on a good shaper 1,000 miles away. For the cost of two motel rooms and a great adventure you can go pick one up. I did precisely this when I purchased my lathe. I am always amazed to see how unwilling people are to travel a few hundred miles for something they have been looking for all their life.

Consider building one. The Gingery shaper is a nice one and its plans are available in book from Lindsay Publications. It is a bargain and several guys have made shapers to this design.

Consider joining a club and let your desire for a shaper be known there. It didn't take Rob McDougall long to find a shaper after he asked. Along those lines remember that most shapers spend their days collecting dust. In a large club like NEMES you will see guys selling off the shaper that they had to have two years before. Some times because they got a bigger one. More often because they found they were not using it.

Kay

Calendar of Events

By Bill Brackett

Nov 2, 2000 Thur 7PM NEMES Club Meeting
Waltham, Ma.
Charles River Museum of Industry 781-893-5410

Nov 4, 2000 8:00 am - 2:00 pm
Quinebaug Valley Engineers Association
Fall Swap Meet & engine show
Plainfield, Ct
Dick Babbitt 860-376-0863
Larry Dudek 860-376-2306

Dec 7, 2000 Thur 7PM NEMES Club Meeting
Waltham, Ma.
Charles River Museum of Industry 781-893-5410

Dec. 9 Frostbite Show
Boylston, Ma
Roger 508-869-2838

Jan 27-28 Cabin Fever Expo
Model Engineering Exhibition, Leesport, PA
Gary Schoenly 800-789-5068

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

Convex Knurling

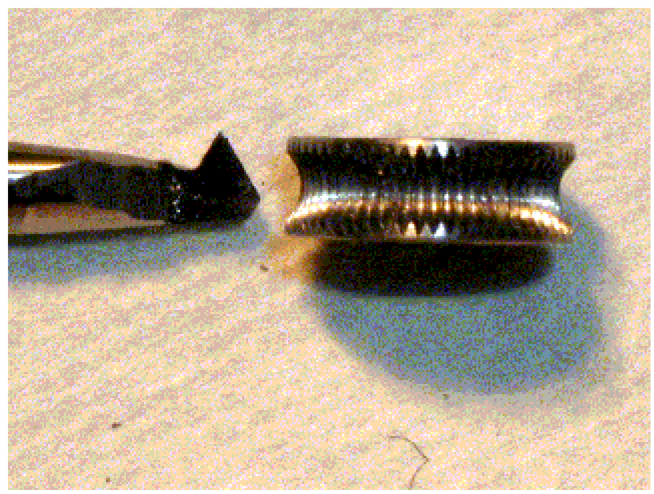
Larry Twaits

I attended the Ornamental Turners Semiannual meeting this fall; their wonderful work includes not only decoration, but also recreation of early machinery and new accessories for ornamental turning.

A display that caught my eye was a very nicely finished elliptical cutting frame made by Richard Ketchen. One of the details that made it special was the convex knurling on its thumbscrews. We are accustomed to seeing knurling (or strictly speaking "coining") as straight lines applied to the surface of a cylinder so these curved lines pull your eye to them.

This prompted a discussion between Richard, Dave Sobel and me about how these features are formed, and the bottom line is that while these knurls were once common, they are impossible to find today. Of course with this group a challenge to try to reproduce one was the next obvious step…

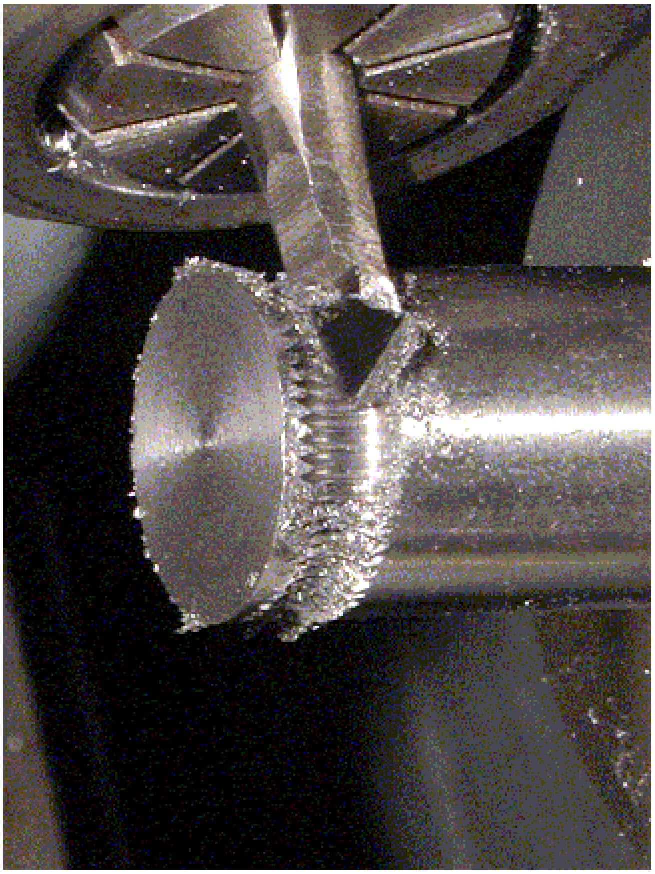
My effort started with a form tool that could cut a series sixty-degree grooves in the face of the knurl blank. It was made from a 3/16" HSS round tool blank with one end split to exactly half of its diameter like a "D" bit, then formed into a single lip (flute) milling cutter. The sixty-degree cutting face has four-degree primary relief and eighteen degrees secondary relief. This is an easy grinding on a single lip cutter grinder like the Quorn. The cutter is visible in the picture below.



Knurl tool and special cutter Photo by Larry Twaits

The knurl blank is a length of half inch O1 drill rod (I prefer small diameter knurls because they require less pressure since fewer teeth are in contact with the work at the same time.).

In the photo below you see it mounted in an index head, sixty divisions produce a finish with about forty lines per inch. Very good surface finish is important so I used cutting fluid and feed the tool very carefully.



Knurling tool being cut **Photo by Larry Twaits**

The knurl was then cut from the stock. I hardened it by wrapping it in tool wrap (stainless steel foil) heating it with a torch and quenching the package in salt water. This tool cannot be sharpened after it is hardened so guarding against surface decarb is important. O1 doesn't require the quench to be as fast as high carbon steel and with this small part the foil did not seem to be problem.

The finished tool was mounted in a simple hand held holder, and it works fine. For my next attempt I will try a ninety-degree cutter as my vintage machinery handbook suggests for brass, and perhaps a smaller radius.

Larry

For Sale

Magazines

Elaine Budlong has the following magazines for sale:

1. Strictly IC (@ 6per yr) 1988-2000 (13 yrs) $72 for the set.
2. Home Shop Mach. 97 (5)@$5, 98(6)@$12, 99 (6)@$12, & 2000 (3)@$6.
3. Model Engineer 96 (10)@$20, 97 (24)@$48, 98 (24)@$48, 99 (24)@$48, & 2000 (2)@$4.
4. Live Steam 95 (2)@$4, 97,98,99 (@6/yr) @ $12 per yr. & 2000 (4)@$8.
5. Ships in Scale 98 (1), 99 (2), 2000 (4) @ $2 each.

She prefers to sell the yearly packages together, i.e. not split them up.

To purchase call Elaine at (987) 486-3109 or for more details call Don Strang at (978) 456-3611.

Lathe

9"Southbend Engine Lathe Model "A" with 4 ft. bed and gear box threading. Very good condition. $900.00 or best offer.

David Fiejal (413) 283-7855

Web Sites of Interest

Here's a web page pointer to a fellow who has cast a sundial and some other stuff.

www.telusplanet.net/public/a_schoep/

George Britnell's miniature Ford 302

home.att.net/~d.watson2/Ford302.html

British version of Junkyard Wars

channel4.com/scrapheap/

American team for Junkyard Wars

www.the-nerds.org/

Lindsay Publications Inc.

www.lindsaybks.com

The NEMES Gazette

Newsletter of The New England Model Engineering Society

c/o Rob McDougall (Treasurer)

357 Crescent Street

Waltham, MA 02154