

The **NEMES** NEW ENGLAND MODEL ENGINEERING SOCIETY INC.

Gazette

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

Next Meeting

Thursday, September 8, 2016 7 PM

Charles River Museum of Industry &

Innovation

154 Moody Street

Waltham, Massachusetts

Directions are [Here](#).

Speaker for September:

Through the generous largess of Howard Gorin, the CRMII has two (that's right, two!) linotype machines. For the September meeting, we will have a talk by Ray des Champs, one of the few remaining expert linotype operators. The talk will be augmented by a video and a live demonstration.

Deadline for submitting articles is two weeks prior to the next meeting.

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Searching for Speakers

Bob Timmerman

It's always tough to find speakers for our summer meetings. Bob us working hard on it, some future possibilities include visiting an organ building factory, a talk on novel braille reading devices for the blind, and a company that makes horse shoes. Diversity is our middle name!

If you have an idea for a speaker or a pet subject you would like us to have a presentation on, please tell Bob. He will make it happen.

From the Museum

Dan Eyring

If you like working on old machine tools, bicycles, cool old fashioned manufacturing machines, clocks and watches, steam engines and engine models, communication equipment and much more, please think about signing up to work one half day a week as a Museum volunteer. If you want to know

more, go to the Museum web site at crmii.org. Or contact me (daneyring@rcn.com) or the Director Bob Perry (director@crmii.org).

Shop Talk

Max ben-Aaron

Lee de Forest's Audion

[Lee de Forest](#) (1873 – 1961) had a tumultuous career — he had over 180 patents and he boasted that he made, and then lost, four fortunes. He was tried (and acquitted) for mail fraud, was also involved in several major patent lawsuits and spent a substantial part of his income on legal bills. Although he had numerous jobs related to his education and interest in electronics, he preferred to be 'his own man' and never worked with any one company very long, preferring to think of himself as an independent inventor.

After receiving a Ph.D. from Yale in Physics and Electricity, he spent the decade between 1900 and 1910 improving the wireless telegraph, but he quickly tired of its limitations of sending coded messages. His entire life was devoted to the invention of media technology primarily based on sound. A pioneer in the development of sound-on-film recording used for movies, he supplied the missing voice to radio and film and could be considered to be the father of the [Talking Motion Picture](#). Between 1920 and 1930 he invented, patented and improved upon a system of recording a sound track on a strip of film, thus allowing accurate synchronization with the picture.

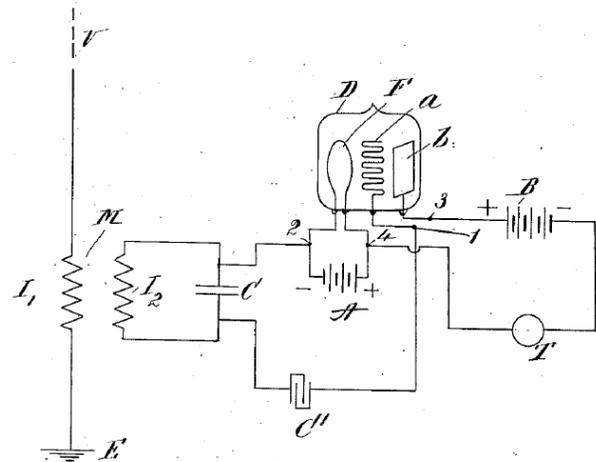
Radio captivated the public interest in the early years of the Twentieth Century, much as the Internet did early in this Century. de Forest was intrigued by the possibility of sending music into homes by wireless. If he was not the first broadcaster of entertainment-based audio, he was an early adopter, interested primarily in broadcasting opera music. Newspaper accounts tell of him transmitting the voices of opera singers to members of the press stationed at receiving sets, as a way to promote the medium of radio, which was still in its infancy. He started several radio stations.

(Broadcasting got its start in 1909 when [Charles Herrold](#) began transmitting in San Jose CA. Like Lee de Forest, [Reginald Fessenden](#) and other better known inventors, Herrold was interested in inventing a radiotelephone system that would make him rich and famous. Although his contributions to the technology of the radiotelephone were lacking in scientific originality, his device did allow him to broadcast. He received six U.S. patents for the technology he employed — DC arcs burning in liquid, modulated by a water-cooled carbon microphone.)

On October 25, 1906, de Forest filed a patent for a vacuum tube [detector](#) (a [diode](#)), that was granted [U.S. patent number 841387](#) on January 15, 1907. In 1905 to 1906 he developed various configurations of glass-tube devices, which he gave the general name of 'Audions', describing them as a 'detectors of sound'.

de Forest traced his inspiration for the Audion to 1900, when, while experimenting with a spark-gap transmitter, he thought, briefly, that the flickering of a nearby gas flame might be a response to electromagnetic pulses. Further tests soon showed that the cause of the flame fluctuations actually was due to air pressure changes produced by the loud sound of the spark. Still, he proposed that, properly configured, it might be possible to use a flame or something similar to detect radio signals. After finding that an open flame was too susceptible to ambient air currents, he investigated whether ionized gases, heated and enclosed in a partially evacuated glass tube, could be used instead.

de Forest's breakthrough came in late 1906 when he reconfigured the control electrode, changing it from outside the glass to a zig-zag wire inside the tube; he positioned the zig-zag wire in the center between the [cathode 'filament'](#) and the [anode 'plate'](#) electrodes. Supposedly, he called the zig-zag control wire a '[grid](#)' due to its similarity to the gridiron pattern on American football playing fields. Experiments, assisted by [John V. L. Hogan](#), convinced him that he had discovered an important new radio detector, and he quickly prepared a patent application which was filed on January 29, 1907, and received [U.S. patent number 879,532](#) on February 18, 1908.

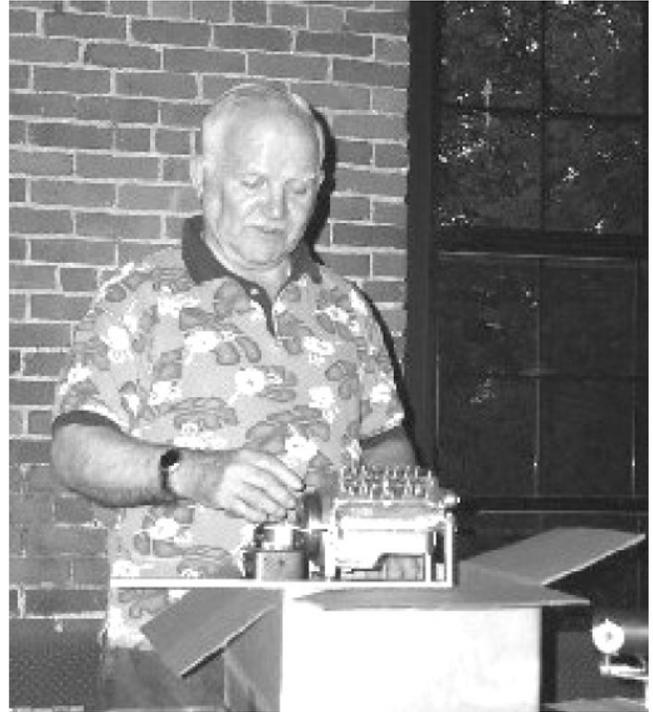


Although he had only a limited understanding of how the three-element 'grid Audion', worked, he soon invented an arc-based radiotelephone transmitter and Audion receiver. The 'grid Audion' was the first successful three-element device — a [triode](#) — to amplify electrical signals. The triode planted the seed for the development of an immensely important technology — electronics — and resulted in a whole zoo of vacuum tubes and related devices.

From the Gazette Archives

Ed Rodgers' 1/4 scale flathead V8

Ed Rodgers gave a talk about the 1/4 scale 1940 Ford Flathead V-8 motor that he is building. He has the real thing, which he disassembled and has for reference. He made a sketch of the engine on the back of a 1988 Cadillac calendar.



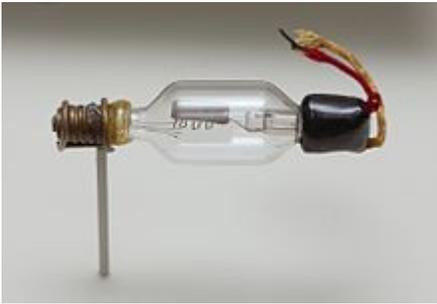
He has not been able to get it to run yet, probably because the valve springs are too relaxed. He has found more suitable springs, but the valves guides have to be shaved by .005" for them to fit.

"I have a small horizontal miller, made in 1924 (so it is as old as I am) and an 11 1/2" SouthBend lathe made in 1925. The 3-jaw chuck that came with the lathe had to be replaced. I got another one from SB when they still had a parts place in Woburn, but I had to make a custom back plate because of the strange thread on the spindle (1 5/8 by 13 tpi.)"

"Figuring that the crankshaft would be the hardest part to make, I started on that first. I carved it out of rolled round stock, and it turned out to be much easier than I thought it would be. I made a hollow 'bell' center for the tailstock and an off-center fixture that fitted in the 3-jaw chuck and had the right 'throw'."

The block was milled out of a block of aluminum. The cylinders are inclined at 90°, so it fit the block when tilted. "I assumed that the valves would be parallel to the cylinders, but this was a mistake; the valves wouldn't seat. The valves are inclined at 92°."

De Forest gave a presentation of his work to date to the October 26, 1906 New York meeting of the American Institute of Electrical Engineers; it was reprinted in two parts in late 1907 in the *Scientific American Supplement*. de Forest insisted that a small amount of residual gas was necessary for the tubes to operate properly, however, he also admitted that he had not arrived, as yet, at ". . . a completely satisfactory theory as to the exact means by which the high-frequency oscillations affect so markedly the behavior of an ionized gas." Between 1910 and 1920 he improved his Audion as a detector, an amplifier, and later a transmitter of radio.



De Forest grid Audion from 1906.

The grid Audion was the first device to amplify (even if only slightly) the power of a received radio signal. Some observers suggested that de Forest had done nothing more than add the grid electrode to the [Fleming valve](#), an existing detector configuration, which also consisted of a filament and plate enclosed in an evacuated glass tube. de Forest passionately denied the similarity of the two devices, claiming that the Fleming valve was merely a rectifier that converted alternating current to direct current. His invention, he said, was a relay that amplified currents, and he objected to his Audion being referred to as a 'valve'. The U.S. courts were not convinced, and ruled that the grid Audion did in fact infringe on the Fleming valve patent, now held by Marconi. Marconi demurred, admitting that the addition of the third electrode was a patentable improvement. The two sides agreed to license each other so that both could manufacture three-electrode tubes in the United States. (De Forest's European patents had lapsed because he did not have the funds needed to renew them). The grid Audion was rarely used during the first half-decade after its invention because of its limited uses and the great variability in the quality of individual units.

Exactly a century ago, in 1916, de Forest broadcast the Hughes-Wilson Presidential election returns. He also fostered amateur radio, making broadcasts for hams to receive. In the 1950's he became very vocal, expressing remorse over what had become of his invention — radio broadcasting. He felt that it was corrupted by second-rate jazz, sickening crooners and constant interruptions by 'sales talk'.

After I fixed this, the valves seated.”

“The back end is partly circular, so it needed an interrupted cut for the valve housing and the flywheel cover. They were mounted in a 4-jawchuck, counterbalanced. I used the same setup for the oil pan and the block. I line-bored the main bearings and then reamed them out with a reamer I borrowed.”

“The camshaft was made from 3/8 round stock. I used the 3-jaw chuck with a fixture to hold the shaft with the appropriate eccentricity. I made the cams with the same profile as the lobes on a 4-stroke model airplane engine. There were 10 setups for each of the 16 lobes and a disk soldered onto the end.”

“I have an old collet lathe that came out of a submarine. It has a wheel with 180 detents so it can be used for indexing. I also have a rotary table, but it is too big to fit on any of my machines. I use it to help in laying out the cams.”

“The secret of doing a job like this is to design jigs and fixtures to make the machining easy and tools to help in the assembly. I had to make miniatures of the kinds of tools that auto mechanics regularly use - a valve spring compressor, an oil pressure gauge, and a ring compressor.”

“After I made the aluminum pistons and a tool to cut the grooves for the rings, and installed the pistons with the rings, I found that everything was too tight, so I took the rings out and lapped the pistons and the cylinders instead.”

“The rings were made of cast iron. After turning you put the ring in a vice and rap it with a hammer so that it cracks cleanly across. Touch up the crack slightly with a points file. To give the rings spring, put them in a sealed crucible with a small piece of brown wrapping paper and heat red-hot.” The paper will scavenge the oxygen and when cool the rings will have the spring you need.

“The semicircle on the top of the con-rods was machined by mounting the small end on a pin and feeding by hand into a milling cutter.”

“The cylinders are fitted with steel liners. The liners distorted slightly (chuck jaws) and had to be lapped. Each liner was screwed in with a 40-tpi thread at the bottom.”

“I made a simple cardboard template to help spotting the locations of the holes for the valves.”

“I used a tool post grinder to make the cam for the points. It needed 8 flats so I used a 24 tooth gear for the indexing, 3 teeth for each flat.”

“For the timing gear I went to Boston Gear. They had just what I wanted.”

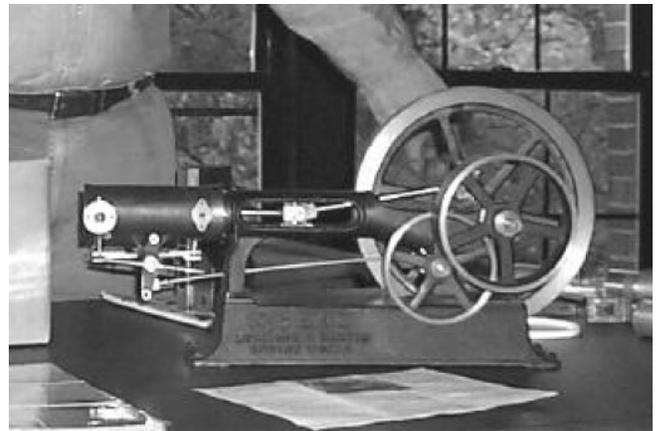
“I used some 1940 vintage Champion plugs - V-3's, with a 1/4"-32 thread.”

“The 1940 Ford flathead V-8 put out 85 HP. This model, at 1/4 scale will never put out 20 HP. I will be happy if it puts out enough power to run smoothly. “

When he finishes the Ford he plans to start the Offy engine from Ron Colona's book.

Norm Jones' Mery

Then Norm Jones showed the Mery 6-cycle explosive engine he is building. He saw the engine at a show next to a running engine and loved the unique sound it made, so he bought a set of castings. The castings were done in 1994, and they were expensive so not many were sold. The book with the drawings is available separately from the casting set, and if you buy the casting later the money you paid for the book can be applied to the entire package.



The engine was patented in 1895. It is somewhat like a double-acting steam engine, in that explosions take place on both sides of the piston, but it is 6-cycle. It has intake valves that open in response to the pressure of the air against the vacuum in the cylinder that is caused by the piston going down. This seems like a pretty inefficient way to clear the cylinder, so it gets done twice before the final intake for the explosive stroke.

The original was about four horsepower and was used to pump water. It had a narrow escape, and was on the verge of being smashed up when an enthusiast who happened to be in the scrap yard at just the right time rescued it at the last minute.

The engine used as the basis for the model is the only one known to have survived, and at some point in its history was converted from igniters to spark plugs. As a result all the existing models have spark plug ignition. Norm is planning on using igniters in his, and also to put a functioning governor on it. Both of these things will be firsts for the model, but he wants his model to be as close to the original engine as possible.

Norm started out with the body. It was too big to swing

on his 9" South Bend, so he built a fixture (out of aluminum jig-plate) that enabled the casting to be bolted to the saddle, replacing the compound. The fabrication of the fixture took more time than anything else. He happened to have a length of ledloy bar, just the right length to make a boring bar.

The fixture turned out to have many uses: Angled, bolted to a vertical plate, it allowed all the necessary operations to be performed on the casting.

The cylinder is sleeved. The sleeve is made from a chunk of cast iron. It was turned to a 2 thou interference fit and frozen in liquid nitrogen. When inserted, it got stuck before it was all the way in. Fortunately, it could be extracted and the operation was tried again with an interference fit of 1/2 thou and the body heated.

The fuel is natural gas and the engine fires at both ends, and has 2 purge cycles. The cycle is: Induction -- compression -- power -- exhaust -- purge in -- purge out.

Norm will make the points for the igniters out of "meteor metal" which is a high nickel alloy that he has had good success with in the past when making points for his models.

Norm made extensive use of laps when making the engine, which is not quite complete at this point. To lap the bore he made an aluminum lap. He put the lap in the 4-jaw chuck and the casting in the saddle fixture he made to hold it during the lapping.

The crank he machined from the solid, as he doesn't care for built up cranks. When he got close to the final dimensions it started to chatter, so he used laps to take off the last thou or so on the crank journals.

He also made an aluminum lap that goes between centers on his lathe that he used to clean up several of the holes in the casting and the center of the flywheel.

The flywheel was too big for his 9" South Bend, so he went over to John Rex's shop and used John's 17" lathe to do the flywheel so that it would look more like an engine when he brought it in to the meeting.

He brought it to the NAMES show in Michigan in April and was on the bench next to a completed version of the same engine. The castings cost \$490, and so far they've kept him busy for two winters. He saw a bunch of other nice casting sets in Detroit, but they had 11 1/2" flywheels that were too big for his lathe so he managed to resist them.

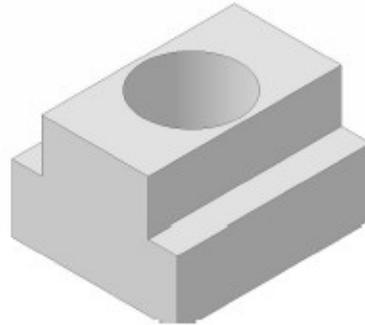
Ron Sparber Project

A "C-nut" for Clamping on a Mill/drill, version 3

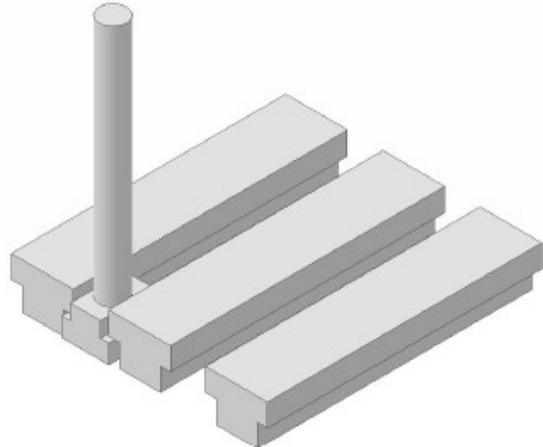
By R. G. Sparber

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Let's start with what should be familiar. This is a T-nut. The hole is threaded to accept a stud. The T-nut slides into a T-slot cut into the table of a mill.



When used for clamping, there is an upward force that lifts the T-nut until it makes contact with the underside of the lips.

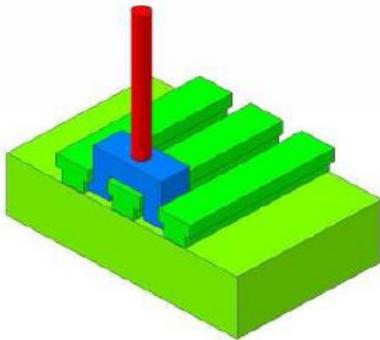
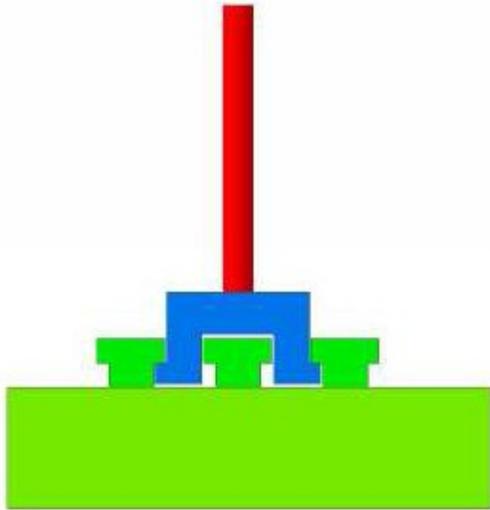


Here is a typical application of a T-nut, threaded stud, support block, clamping bar, and hex nut. The closer the stud is to the part being clamped, the larger percentage of the force is applied to it.



This arrangement permits the user to position the stud anywhere along the T-slot. The problem I run into is when I need the stud to be located between T slots. That is where the "C-nut" comes in.

Here is an end view of a C-nut engaged into a pair of T-slots. The C-nut is blue, the stud is red, and T-slots are green. The C-nut straddles what I call an island formed by two T-slots.



The upward force passing through the stud lifts the ears of the C-nut and applies pressure to the lips of the T-slot. Ideally, the forces are identical to a T-nut. In practice there will be some bending of the C-nut so the ears are expected to bend slightly. This will put more force on the ends of the lips. I plan to run a test to see if this is a problem.

Just as the T-nut simply slides into the T-slot to provide an anchor point for the stud, so does the C-nut except that it slides into two T-slots.

A few variations to this design have already been proposed. John at the valley metal yahoo group suggested having 3 tapped holes to provide more choices for stud location. As John and I kicked around this idea, we realized that the part of the C-nut above the surface of the table could be taller to give more

strength. The holes could be straight across or staggered. This depends on how wide the island is on a given mill. The Bridgeport I saw had rather wide islands. My RF30 mill/drill has narrow islands.

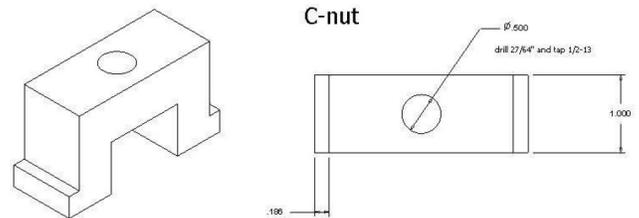
There are many ways to make the C-nut. The first is to mill it out of a block of metal. T-nuts are often cut from 1018 steel but if we used 6061 aluminum, it is possible that the C-nut would fail before it could damage the T-slot. This assumes that the user is severely over tightening the nut that pulls up on the stud. Originally, the ears pointed inward making this a difficult machining task. But William from the mill_drill yahoo group made the brilliant observation that pointing the ears as shown above simplifies the milling task.

Another means of making the C-nut would be to use steel and weld three parts together. The parts sitting in the T-slots would still need to be machined but there would be far less waste.

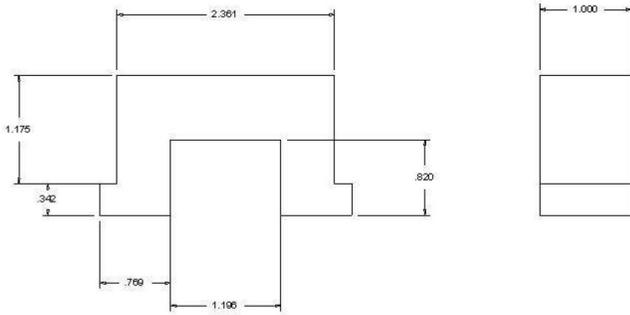
A variation on welding is to bolt the parts that fit into the T-slot to the horizontal part. If one bolt was used on each side, it would be possible to let the parts that contact the T-slot lips to pivot slightly. This would eliminate any problem with poor contact between ears on the C-nut and lips on the T-slot.

And finally we could cast it out of aluminum. It should be possible to even cast in the threaded hole. Then a clean-up cut on the ears and maybe a quick run through with a tap would complete the job. There would be no waste with this approach and it would be easy to make a number of them at once. Cast aluminum is weaker than rolled aluminum which might be an advantage if the user is concerned about breaking out a T-slot

The next step is for me to make a C-nut that fits my mill/drill.



I will adjust the 1.175" dimension to fit the stock I have on hand.



802-234-9170

email: glasswaresandy@aol.cin
<http://www.vermontgasandsteam.com/>

Sept. 23 - 25, CAMA Fall Festival

HOURS: 10:00 AM to 4:00 PM each day for spectators.
 ADDRESS: CAMA museum grounds, 31 Kent-Cornwall Rd. (Rt. 7), Kent, CT

I welcome your comments and questions. All of us are smarter than any one of us.

Rick Sparber

Rgsparber@aol.com

Coming Events

Errol Groff

Sept. 2 – 3, Vermont Gas and Steam Engine Assn. Stockbridge Show

Intersection of Routes 100 and 107

Contact: Gary Howe, 1 Mountain Ave, Randolph, VT 05060

802-728-9350

email: gary05060@gmail.com

www.vermontgasandsteam.colil

Sept. 9 – 11, (The Legendary) Dublin Gas Engine Meet's 45th Year!

Rt. 101 in New Hampshire (1/2 mile east of Carr's Store)

Sept. 11, 2016 Yankee Yesteryear Car Show

Brooklyn Fairground, Brooklyn, CT, Route 169 south of Route

Sept. 17 – 18, Tobacco Valley Flywheelers Gas and Steam Engine Club 36th Annual Show

Haddam Meadows State Park, Rt. 154. Haddam CT

Contact: Russ Bengtson, 646 Bear Hill Rd., Middletown, CT 06457;

860-347-5774 www.oldengine.org/members/tvf

Sept. 24, Vermont Gas and Steam Engine Assn. East Burke Show

East Burke Off the Belden Hill Road by Dishmill Forrest Products

Contact: Jack Manning, 63 Sandhill Rd., Bethel, VT 05032

Machines for Sale

In early August, Mr. Glock of New Jersey contacted CRMII, offering a Rivett 608 Lathe set up. That is, lathe, bench, overhead drive pulleys and motor, etc. Since the Museum already has a 608 (find it next to the fire engine4 in the main gallery. I am posting the information here. If you are interested, contact Mr Glock at:

dglock9@gmail.com

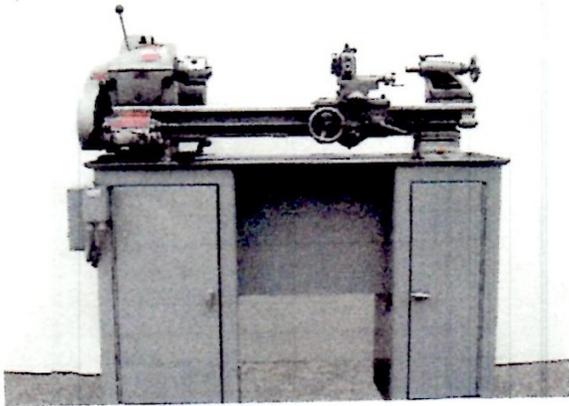
(201) 398 – 3365

Mr. David Barbuto of Tilton, New Hampshire has a number of machine and wood working machines for sale. Dave offers “Free Demo – Loading and Local Delivery”

Contact Dave at

(603) 387-6551

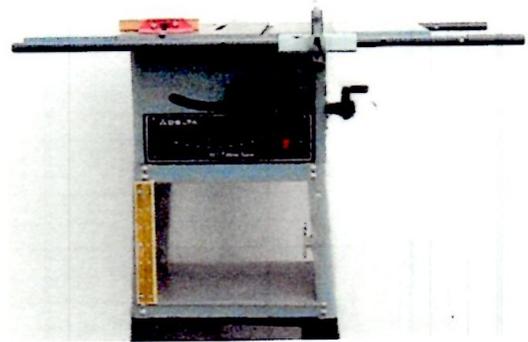
barbuto@metrocast.net



**9' X 30' South Bend Lathe
Cabinet Base with Tooling
Great Shape Best Offer**



**15" JET Wood Planer
6" Max Thickness 230V -1 PH
Like New 4500 RPM**



**10" Delta Table Saw
22' x 40" Table Direct Drive
Runs Good 120V 1 P.H.**



**Miller Spot Welder
Model MSW-41T Style JG-8
Opens 4" 120V 1P.H.**



**9" x 42" ENCO Miller
Good Condition Runs Nice**