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# STEAM IN THE GARDEN


*Inside.....*

*More pages in this issue!*

**Mark II CRICKET Review**

**2007 Diamondhead Steamup Report**

**Two Logging Locos**

**A $40 Live Steam Whistle**

**...and lots more!**

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# STEAM IN THE GARDEN

Vol. 17, № 2
Issue № 92

**Gather, friends, while we inquire, into trains propelled by fire...**


## Articles



## Departments



**FRONT COVER:**

***"Voice of the Berkshires"*** 20 x30 oil on canvas by David Tutwiler OPA (C) 2006

Steaming out of western Massachusetts and the Hoosac Tunnel and charging through the New England colors of fall, the famous Nickel Plate 759 leaves an impression that captivates the artistic imagination of nostalgic Americana.

***Artist David Tutwiler OPA (signature member, of Oil Painters of America) and a graduate of the American Academy of Fine Art, specializes in subjects of the steam age of the American railroads, as well as coastal scenes of the Great lakes, and New England where he and his wife, Line', also a professional artist, have maintained a gallery of fine art for over 27 years. As well as a studio on the southern shores of Lake Michigan, in Indiana. Please visit their web site at www.tutwilerstudio.com***
***For more information, please contact him at: The Tutwiler Studio, P.O. Box 343, Beverly Shores, IN 46301 - phone: 219-879-5611 - or feel free to visit their gallery at 53 Main St., Rockport, MA***


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**Faithful Assistant**
*Marie Brown*

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Dan Rowe • Charles McCullough

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Phone, fax, e-mail or write for mailing information on items for review. Questions or comments? Phone us (Mon. - Thurs. - before 8:00 p.m. Eastern time, please) at 607-642-8119 • 24-hr FAX 253-323-2125 • e-mail address: rbrown54@stny.rr.com

**http://steamup.info**

# WHAT'S NEW?

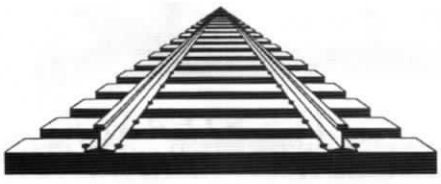
**BF Industries** – is pleased to announce that the new Electric Pump for use with the WLDS system now uses brass check valves. These valves offer greater strength and smaller size than the previous valves. They still offer adjustable, rotating output connectors which are also brass. These pumps offer high water output and can be mounted vertically or horizontally. The pumps can be immersed in the water tank by applying a sealing agent, such as silicon sealant, epoxy, or dip coatings available from many hardware stores, on the external joints of the servo. An O-ring can be used on the shaft below the rotating arm if the servo is to be completely submersed in the source water tank.


Many modelers are using R/C model airplane plastic fuel tanks for a sealed source of water in the tender to be used with the Electric Pump. These are available from many Hobby stores and come in a variety of sizes to fit in your tender space.

A new approach for WLDS probe installation has been developed in which the standard probe, with an extension, can be mounted vertically into a modified water fill plug or other plugged bushes on top of the boiler which is prevalent in many loco models. This avoids the necessity of drilling new holes into the boiler. Some custom probes are available for those who do not have the capability of modifying the standard probes. For further information, check the website www.home.earthlink.net/~bfindus -
Or Email bfindus@earthlink.net

**Quisenberry Station LLC, 3903 Quisenberry Dr., Alexandria VA 22309 - phone 703-799-9643** is now stocking popular sizes and configurations of ***globe valves*** for our models. These are all CNC machined from brass, O-rings are fitted where appropriate, and valves can be supplied with either machined or cast handles. Quisenberry is also manufacturing ***straight drain cocks*** for the blowdowns and lubricator drains on Accucraft locomotives, housings for pressure gauges, throttle handles and many other beautiful fittings that we've needed for a very long time. Contact Royce for more information and to place your order. He has these parts in stock!

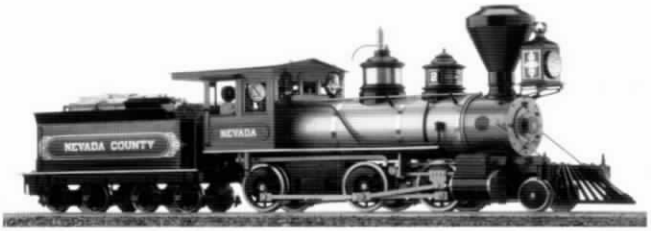
**Llagas Creek Railways is now a division of NRRR, Inc.** Gary Broeder is now product development & R & D mgr. William Mai is now sales & mfg. president. They have formed a team to bring new & improved products to markets. Expect much improved delivery of our whole product line. We now stock the following: Flex Track, Code 250 & 215, 1:20.3 brown tie & "G" black tie narrow gauge items in aluminum & nickel silver rail. Our mfg. site is www.spaceltd.com, and our item list site is www.llagastrack.com



**Catatonk Locomotive Works, PO Box 335, Newark Valley NY 13811 - phone: 607-642-8119 - e-mail: rbrown54@stny.rr.com** has a new lighter available for gas powered locomotives. This is a piezo-electric igniter, which requires no fuel or batteries. It fits neatly in a shirt or pants pocket and is as simple to use as pressing the button. Over 100,000 lights with no refueling and no batteries! Priced at just $10.95 each plus shipping. Order one or more for your toolbox or steamup kit!

**Accucraft Trains** has just released a bunch of new items, including several new steam locos and new switches in both narrow and standard gauge. First up is their new Forney 0-4-4 and 2-4-4 in live steam. These locos are 1:20.3 scale and 45 mm gauge. They are gas fired. Estimated delivery date is Winter 2007. Taking reservations now!

*Accucraft's new live steam Forney*




*Nevada County Narrow Gauge 2-6-0 Mogul.*

Check out the N.C.N.G. Mogul 2-6-0 live steam loco! 1:20.3 scale, gas fired, available summer 2007. Reserve yours now.

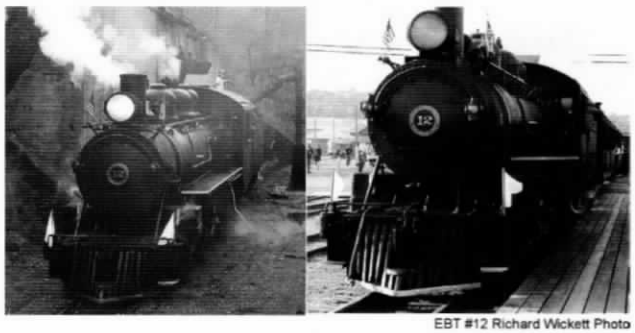
Next is the Baldwin 4-4-0 live steam series, also in 1:20.3 scale and 45mm gauge, gas fired. Available in 5 different liveries representing South Pacific Coast, Nevada County Narrow Gauge, D&RGW and unlettered. Available Winter 2007....taking reservations now.

*Baldwin 4-4-0, shown here in South Pacific Coast livery.*

EBT #15 Richard Wickett Photo

For the East Broad Top enthusiast, live steam versions of #14 and #15 2-8-2. Scale is 1:20.3, firing is by gas and delivery date is to be announced at a later date. Now taking reservations.

And if that isn't enough to gladden the heart of the East Broad Top modeler, how about EBT #12 2-8-2 in live steam? 1:20.3 scale, gas fired. Delivery to be announced - now taking reservations.



EBT #12 Richard Wickett Photo

Accucraft has also announced a code 250 standard gauge manual switch in both #6 and #8 sizes. Brass rail, and included is a brass switch stand and rail joiners. Delivery estimated for Fall 2007.

The narrow gauge modeler hasn't been left out.....#6 code 250 manual switches in both right and left hand versions with narrow gauge ties are also coming. These should be here in Summer 2007. Also included is a manually operated brass switch stand and rail joiners.

Contact Accucraft (see their ad in this issue for contact info) or your favorite Accucraft dealer to place your orders now.

**Don't forget to get started on your entry for our KONRAD Bashing Contest for 2007!**

*Les lecteurs francophones peuvent contacter Guy Ozanne pour obtenir, gratuittement, une tradauction sur un element de texte paru dans SitG. 41 rue Jeanne d'Arc, 94.500 Champigny, France.*

*tel (33) 01-48-83-62-86*
*e-mail <Guy.Ozanne@wanadoo.fr>*



# N

**(see page 11)**

# *Cricket - The Second Time Around*

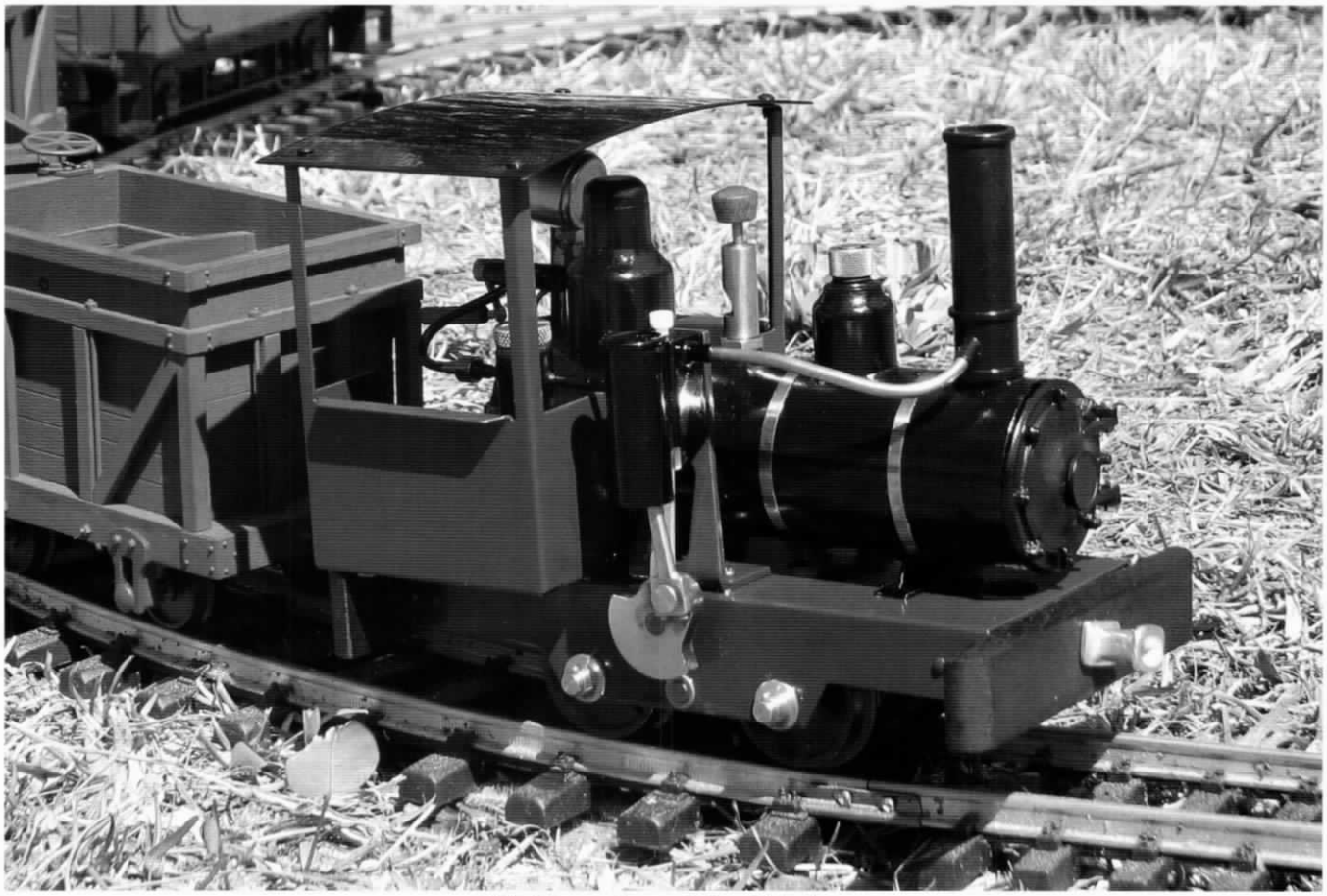
**by Mike Simpson**

## An old favorite returns...Welcome Back!

By the time I recognized what a neat, quirky engine the Berkeley Locomotives Works ("BLW") Cricket is, she was out of production. Fortunately, I got a second chance when Westminster Locomotive Works ("WLW") re-introduced Cricket last year.

Despite some teething pains, my Mark II Cricket is a very satisfactory engine, particularly for the $575 price tag. WLW No.4, handsome in black, hunter green, and brass, arrived just in time for Diamondhead. After two months and about 30 runs, she is a great engine, and improving with use.

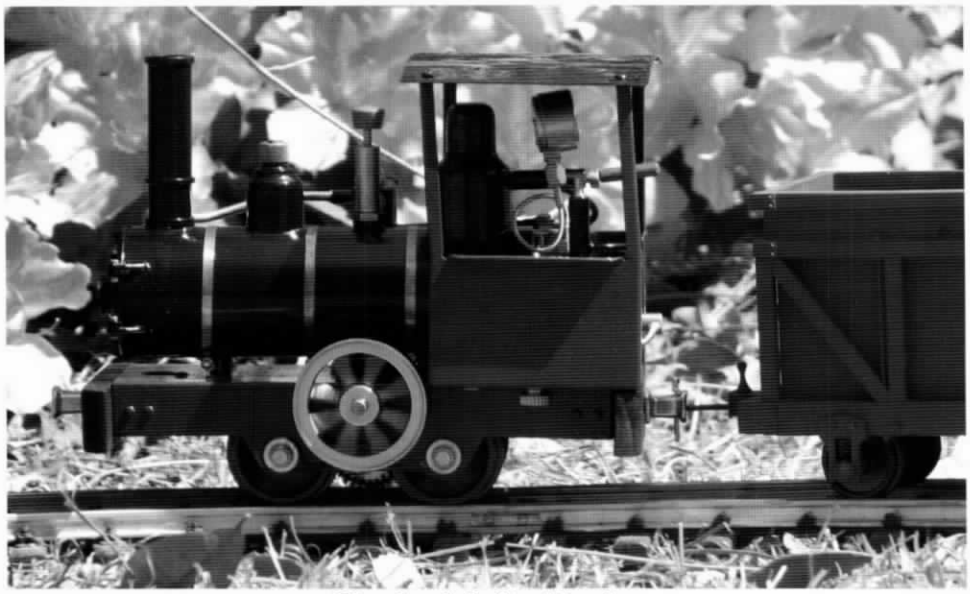
My apologies for any errors concerning the prototype and the BLW (Mark I) Cricket. The prototype was little documented. The Mark I Crickets varied widely.



***Mk II version of the Cricket.***

### John F. Byers Machine Company – The Prototype

John Byers began building construction equipment in 1873, in Ravenna, Ohio. He built at least five geared 0-4-0 contractor's engines, with one finished as late as 1906. The engine was offered for standard



***Flywheel (left) side view.***

and three foot gauges, with inside frames for the standard gauge and outside frames for the narrow gauge. Both models discussed here represent the narrow gauge engine.

With limited information available, Mike O'Rourke believed that the prototype had a single cylinder, mounted on the right hand side and balanced by a flywheel, and built the Mark I model to match. An 1896 article from Engineering News shows that the prototype actually had cylinders on both sides. Nonetheless, the WLW MK II remains single-cylinder. If not prototypical, the result is powerful, economical, and delightfully different.

The prototype had a Tee boiler, leaving little room in the cab. The Byers was 12 feet 2 inches long, with a wheelbase of 3 feet 4 inches and a loaded weight of 11,000 lbs., appropriate for the light, temporary track and tight curves typically found on construction projects. This weight included 250 lbs. of coal and 280 gallons of water. With a 3:1 gear ratio, Byers said the engine would pull 250 tons on straight and level track, at 6 to 8 miles per hour. He claimed to operate on minimum radii of 25 (narrow gauge) and 30 feet (standard).

For more prototype information, see http://www.gearedsteam.com/byers.

### Berkeley Locomotive Works – Mark I Cricket

Berkeley Locomotive Works produced about 130 Crickets between 1994 and 1999. Prices were in the $400-500 neighborhood. Ads in old issues of *Steam in the Garden*

***A peek into the cab from the rear. From left: gas control valve, pressure gauge, throttle and displacement lubricator.***

show three variants: standard with piston valve, an economy oscillator, and the English model, with piston valve but a different cab. Crickets came in both Gauge 1 and Gauge 0, and at least some were gauge adjustable.

BLW Crickets were built with little side tanks, big side tanks, and no tanks at all. Crickets came with different stacks, several different burners, and varying backhead fittings. Most boilers appear to have been straight, horizontal ones, but Marc Horovitz has a Cricket with a prototypical Tee boiler and Vickie Marie Ward's French Cricket has an extended boiler (for extended runs).

And they came in more colors than Baskin-Robbins has flavors. O'Rourke and his apprentice, Kevin O'Connor, seem to have delighted in making no two engines alike. Extreme examples include the Horovitz Cricket (which also sports two cylinders, a bell, a sight glass, and a blow-down), the Ward Cricket (Vive la difference!), and Rick Chiodo's Isle of Shoals Cricket, now up-scaled to 7/8".

The original Crickets had a "J-tube" – a burner flue that turned upward 90 degrees and joined to the smokestack, with no smokebox. This was good, in that the boiler held more water. It was bad, in that the J-tube dumped condensate back onto the burner. Frequent burner cleaning was needed for good operation. BLW used a true smokebox on some late engines.

BLW ended production when O'Rourke decided not to compete with Accucraft's Ruby. More information about the BLW Cricket is in Scott McDonald's review in *Steam in the Garden* #24 and in O'Rourke's article linked to the Sidestreet Bannerwork's website.

**Westminster Locomotive Works – Mark II Cricket**

All of the BLW Crickets share a serious flaw – I don't own them. That oversight was corrected by Mike, the man behind Westminster Locomotive Works.

Mike bought up the BLW stock of parts, made some design changes, and is now shipping the Mark II WLW Cricket. He has enough parts for 40-45 engines and has taken reservations through http://purkeystoytrains.com . All the current reservations are taken, but there is a waiting list and the possibility of another run. (If anyone wants out of a reservation, please let me know – I'd like to have a red one too.)

I had several lengthy telephone calls from Mike during the building of my Cricket. He impressed me with his concern for quality, despite the amount of work and limited profit involved. He expects to ship the reserved engines throughout 2007. If he makes another run, the price is likely to increase.

***Specifications:***

General: 0-4-0 geared contractor's engine, with outside frames, wheels adjustable between Gauge 1 and Gauge 0, but not insulated.

Scale: 1:20.3

Dimensions: 6 3/4" long buffer to buffer (7 3/4 inches with couplers). 4 1⁄2" wide. 5 1/4" tall. 2 1/16" wheelbase. 2 lbs. 15.5 oz. (empty weight).

Boiler: Gas-fired, horizontal, single flue with poker burner. Tested to 100 psi. Opening smokebox door. No superheater. Offset left to balance cylinder assembly.

Cylinder: One single-acting 10.9 mm (7/16") bore x 9 mm (3/8") stroke, vertical Teflon piston. Balanced by plated brass flywheel.

Valve gear: Teflon piston valve, reversed by slip eccentric. Double reduction steel gears reduce output to 1:5.79.

Min radius: Two feet (or less).

Fittings: Mike Chaney safety valve set to 25 psi. Mamod whistle. 100 psi PM Research pressure gauge. Steam regulator. Displacement lubricator. Trackside Details brass link and pin couplers. Wooden end beams.

Accessories: Steam oil, gear lubricant, two Allen wrenches, syringes for lubricator and boiler, gas filler extension.

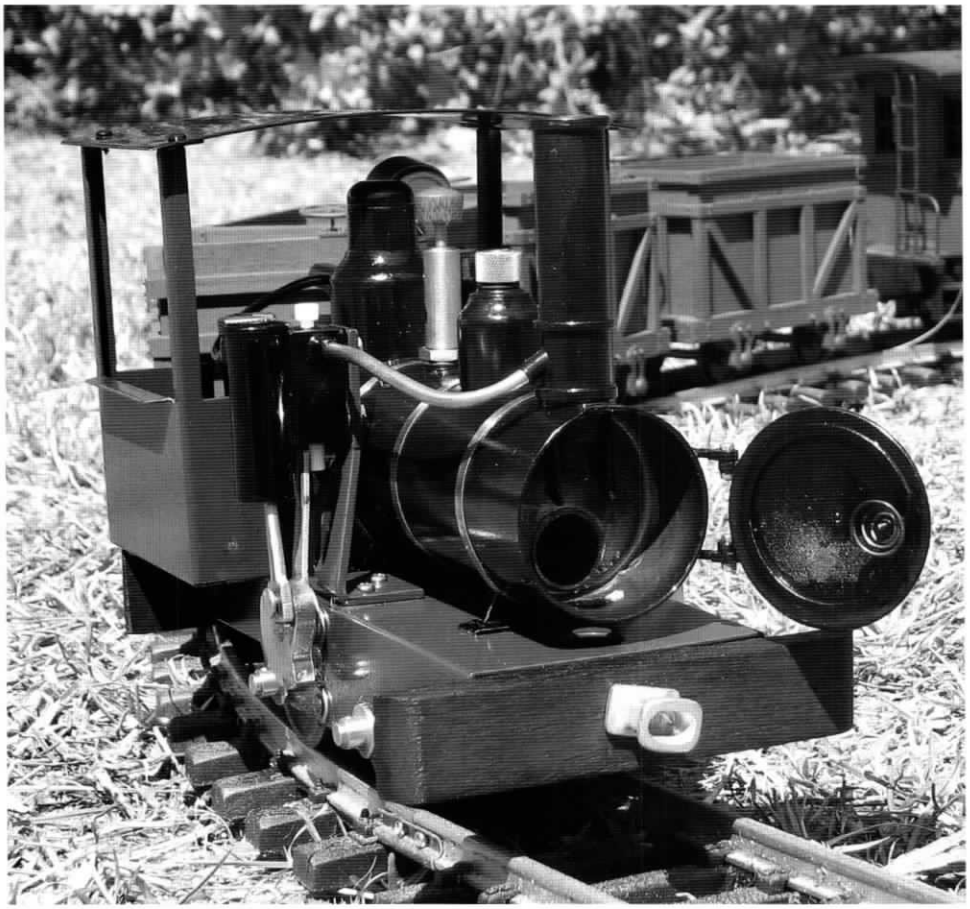
The paint is a hard powder coat, which appears quite durable. I haven't managed to scratch it yet. The 26 pages of instruction are wordy, but comprehensive.

The cab is well-made, if plain. The curved roof sits on four corner posts, held on by Allen screws. The side walls bend outwards at the tops, forming armrests. An opening in the middle of the rear wall provides access for your engineer.

The cab has a rectangular gas tank along the left

wall, with a tall throttle pillar at the rear and a self-venting filler valve at the front. A special, thin, gas filler extension is used to reach through a small hole in the roof to fill the fuel tank.

Cricket invites details. I have an air tank to go under the cab and a headlight for the top of the smokebox. A tray on top of the gas tank would disguise it as a coal bin.



***With the smokebox door open you can see that the author has removed the exhaust condensate tube for easier lighting and better reliability of the burner (see text for details). The manufacturer has implemented this and other changes on all current production.***

The gauge syphon is mounted to the boiler end at about 10:30. The steam regulator handle is wooden, permitting pain-free throttle adjustments. (Wooden end beams are likewise appreciated when moving a hot Cricket.) The gas, pressure syphon, and steam lines are unusually thin, adding to the delicate appearance of the engine. The lubricator stands on the right side of the cab, with a knurled top and an unnecessary coin slot.

As on a Shay, the right side is the interesting one. The cylinder is mounted outside from the piston valve and drives a crank mounted on a jackshaft. The jackshaft drives a lower geared shaft, which drives both axles. The valve piston pops up through the top of the piston assembly. Steam runs into the top of the assembly from the rear and exits to the smoke stack base at the front. The Mamod whistle will emit both a peep and much of your steam.

The engine will not run on air, because it depends on Teflon's expansion when heated to seal. The slip eccentric reverser is not suited to remote control.

Check your gears before and after running. They need gear lube and will collect grass, hair, twigs, and small reptiles. Otherwise, preparations are routine. I find it easier to remove 35 ml from a full boiler, than putting the recommended 85 ml in an empty one. This leaves about 30 ml at end of run.

Mike avoided the J-tube problem by using a traditional flue and a true smokebox. He ran a vertical tube, 1/2" in diameter, and open on the front side, from the stack to the smokebox, to send condensate out the bottom of the smokebox.

And here my problems began. At Diamondhead, after two good runs, Cricket proved impossible to light in front of the largest possible audience. (Apologies for my language.) The gas would light, but the flame would not go back into the flue.

Fortunately, Diamondhead is a gathering of experts, including Vickie Marie Ward (with her French Cricket), Dion Dostaler (another Cricket owner), and Sal Martocci (lots of Accucraft burner repairs). Collectively, we...

– blew the gas lines;

– blew the jet (repeatedly);

– removed the screen from the jet holder (a debris trap);

– unwrapped and re-wrapped the burner; and

– adjusted the position of the jet in the holder.

At this point, Cricket would run well once the flame went into the flue, but it might take 20 or 30 lightings to accomplish this. In despair, I used a Dremel tool to amputate the drip pipe in the smokebox. Eureka! The fire now retreats reliably into the flue and my temper has greatly improved. *(Mike says that he will omit the tube in the future)*

There is a lesser problem with the pressure gauge syphon. This attaches to a fitting which rests on a rubber O-ring. The assembly unscrews during runs until the gauge tilts out the left-hand window. I am trying washers to tighten things up.

My safety valve began backing loose, releasing at 10 psi. If re-tightening, be careful not to overset it or to gouge the meeting surfaces.

The Trackside Details couplers turn into holes in the end beams. Given the engine's pulling power, it may be possible to pull them right off the beams. I hope to find nuts with which to fasten them more firmly.

Mike suggests that you wrap the steam lines with cotton twine, for appearance and insulation. I started out with 12 minute runs, but now routinely get 17 minutes, and have a personal best of 19 1⁄2. The twine might get me to 20 minutes.

You set the eccentric, and the direction of travel, by turning the flywheel. Once pressure is up to about 25 psi, flip it sharply in the desired direction, with a motion like spinning a top. Usually, my first attempt warms the cylinders and, after pressure builds, Cricket runs on the second try.

And she now runs very well. I routinely pulled 14 two-axle cars at Diamondhead. Four to six short cars or two passenger cars look quite plausible. Cricket will run slower than my Accucraft Shay.

I've run on two foot radius track dropped on sloping ground. O'Rourke used a portable layout with 9" radius curves. This is the perfect steam engine to run for a club, a school class, or wherever space is limited. Cricket is fun to watch and she won't run away from you.


**NR**

**(see page 18)**


***Comments from the Manufacturer.....***

The Cricket will run on air but not as efficiently as steam for the reasons Mike stated. But air will suffice for stationary runs for demo or adjustments.

Flywheel is hand turned from solid brass castings, hand polished and sealed not plated. Each one is a little different. Depends on which way the light shines on them as I turn them down!

Instruction booklet designed to help new live steamers and be a little entertaining.

The vertical tube has been eliminated. Mike O and I talked about this, thinking it would help with heat retention. However, as the author has noted, it actually interferes with the flame more than helping so that modification has been noted.

Pressure gauge issue is being addressed by a different boiler bushing and union that will keep the gauge in position. I was using the original design, but see the problem as the author stated.

Safety valve will be set with high temp Loctite® to keep it from loosening.

I would like to acknowledge my son, Nicholas, who is 16. He has been a big part of the rebirth of the Cricket and has helped in many of the builds and getting the process going. We have been hooked on this rascal ever since I purchased one of the last Crickets form Mike O about 8 years ago.

I want to thank the author for his input in helping me get some of the early bugs out, and another thank you to Tom and Bob Wilson who actually purchased No. 001. They have been very patient and supportive during their break in time with the loco.

Also, a big thanks to Mike O'Rourke for allowing me to keep the Cricket alive for awhile longer and his help in getting things going.

*Mike Krionderis*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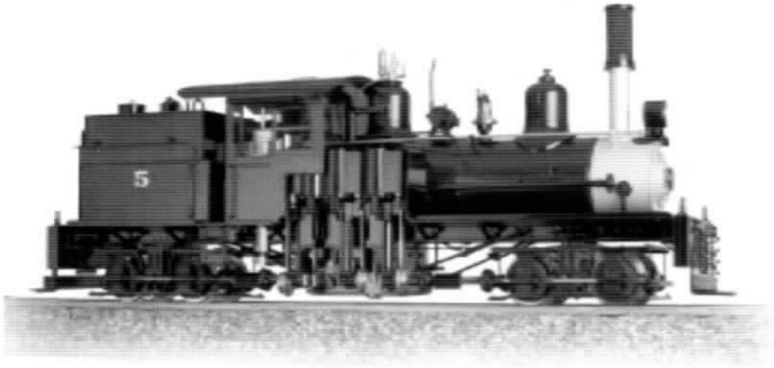


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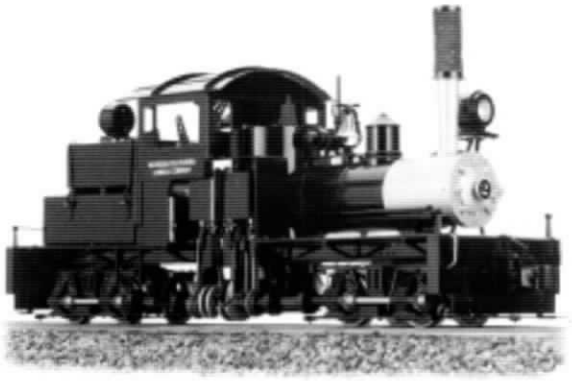

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# *Two More Logging Locos*

**by Carl Berg**

I queried our esteamed, - eh, eh, esteemed - editor as to whether it was possible to have too many articles on logging locos and he summarily dismissed the notion. As a consequence, below please find details on two logging locos that might be of interest. They are the fourth and fifth locos I've described for the magazine. My, how time flies.

Yes, they have a resemblance to the BAGRS arrangement but there were prototypes in the 1870's and '80's with similar layouts. The locos resemble each other because they are part of a construction package worked out with my friend Rich Kaczmarek. Rich wanted a logging loco so we came up with a deal where he would make the platforms and superstructure and I'd make the boilers, drive axles and wheels. Engines and other details would be up to ourselves.

Planning and R&D consisted of phone conversations and some show and tell.

The idea of getting two or more individuals together to build steam locomotives is something that, I think, should be encouraged. Rich and I belong to a large scale steam club and some members there have been working on as many as ten -1 1⁄2" scale locomotives where each makes ten of the same part and exchanges their production for different parts made by other individuals. They've been at it for years and predictably the initial enthusiasm has waned a bit as time has gone on. Recently though, one of them has had his chassis running on air and this has motivated the others to push on and get their units operational also. One way or another I believe most will succeed.

Rich suggested we make four locos. That way we'd each have one and could sell the other one to cover our expenses. I wasn't so sure about that outcome but agreed to make the parts.

Making multiple parts is a lot like having a job. On the other hand, it gives you a sense of fulfillment lining all the parts up on the work bench as the project develops. Inevitably you make parts that are common to a lot of projects...things like valves or ferrules, for example. It's not a bad idea to make more than you need because you will be using them eventually and the next project will go quicker having the ready made pieces on hand.

So, I started making the boilers. Originally we had talked about boilers that would be 2 1⁄2" in diameter. Thin wall 2 1⁄2" tubes for the boiler are a little hard to come by. I offered to roll .030" 2 1⁄2" tubes. I even showed Rich "Grenada" and "Grenadier", a pair of very interesting boilers I'd made previously. Unfortunately, Rich gets a little nervous about some things and we concluded that even though 3" was a little big, we could get thin wall tubing that size, so that would be the size of the boilers.

Getting a reasonable size piece of thin wall 3" tubing wasn't so easy. I ended up with a piece 20 feet long...of which I have 19 feet left.

Trueing the ends of 3" diameter tubing pieces is a little problematic. They won't fit the steady rest on the lathe and I wasn't motivated to make a larger steady rest or make plugs, so I used the disc sander. It's a little noisy and eats up the sanding disc but it works.

I chamfered the edge of the trued up ends with an Xacto knife and a #11 blade. I really like this tool when working with copper and K & S Tubing. Use care if you try this yourself.

The flanged boiler ends were made up over a wooden form. Holes for the various ferrules were drilled and sized. I used a 1⁄2" copper end cap for the steam dome. I borrowed a Sievert torch to silver solder the boilers. Boy, those things are good! The boiler has a single 1⁄2" flue a la Larry Herget's "Dunkirk".

The alcohol burner is the bottom 1 inch of a Progresso Soup can. Any can with a seamless bottom could be used. It's filled with fiberglass insulation material and covered with a cap of steel screen. The steel screen prevents the fiberglass from melting in the heat of the fire.

The top and sides of the boiler are covered with ceramic insulation material from Sulphur Springs. I fold layers of aluminum foil over the bottom edge of the insulation so the fire won't hurt it. Lagging is aluminum sheet.

By this time Rich had completed one of the platforms. I like his work. The deck has individual hardwood planks decorated with tiny brass nails and the coal bunker has an authentic look to it. He also made functional truss rods and rolled a nice curve in the roof. Rich has scale sized figures on his models.

Wheels for the drive axle are aluminum and 1 3/8" in diameter. They have ten spokes. It's possible I sucked it up and bought some wheel castings from England a while ago and they might have found their way on to a board which, oddly enough, was suitable for use in a foundry class I attended at the time. The interesting thing about the class was that the other members always got there early and grabbed the larger casting boxes to make larger castings. Nobody used the smaller boxes except me and I used all of them so it's just possible, again, that I have a few bags of wheel and other castings to keep me busy for awhile.

Each logger uses six axle boxes. I soldered a 4" piece of brass tubing to a 4" brass strip and cut off slices for the axle boxes. Four of the axle boxes go on the wooden truck, construction of which is based on details picked out of pictures of prototypes. Truck wheels are the Bachmann

small metal ones.

Engines: Each logger has a different oscillating steam engine. One is made up from castings and the other from bar stock. The logger with the casting engine is far and away the crowd favorite. The castings are from Speed King of Pulaski, NY, a place where the winter snowfall is measured in meters. The owner, Art DeKalb, has a website: www.Precisionserv.com.

Mr. Dekalb's oscillating engine casting set offers a choice of three flywheels. Two have curved spokes and otherwise differ in that one has a thicker rim than the other. The thicker rim might offer better engine performance because it makes a heavier flywheel. I find the thin rim a little more attractive. The casting purchase includes a copy of a magazine construction article from the 1930's and a drawing for a jig to drill the steam ports in the engine frame.

I should probably do an updated article on making an engine from castings. I don't know if I could add anything to what others have written already, though. Maybe later.

Anyway, the engine is about 3/8" bore by 7/16" stroke. Originally, I'd set up the model to run in just one direction. Then, I got the idea to try switching operations, so I retrofitted a rotary reversing valve. To make it easier to run I made a gate or slot for the valve lever so I could swing the lever from one end to the other, forward to reverse, so it was less tricky to operate. If you put the lever in the center it's a stop valve. Through operating it I've found that intermediate settings are effective as a speed control. But I'm getting ahead of myself.

I ran the exhaust up to the roof, but that made a mess so I constructed a condensate trap. Since I was running out of floor space I made the trap out of a long piece of 1/2" pipe standing on end rather than a short piece of 3/4" pipe. I could probably have hung the trap horizontally under the roof but the way it worked out seems satisfactory.

Drive is by ladder chain to an intermediate shaft with an overall gear reduction to the axle. I set the sprocket outboard of the flywheel. My friend Rich put the sprocket inboard so the view of the curved spoke flywheel is unobstructed on his engine. The resulting power/drive unit has a nice busy look to it.

The 3" boilers have lots of bushings as Rich wanted a pressure gauge and water glass. I use a variant of Charlie Mynhier's safety valve to close the fill hole. With an "O" ring as a washer it seals against boiler pressure just by finger tightening.

Operations with the 3" boilers revealed a very modest performance. I tried a single loop super heater for the small engine logger and a three loop super heater for the bar stock engine one. They would each pull one or two cars. I got the bright idea of double heading them and I was able to pull six cars. Running two locos, even simple ones, simultaneously, is a little ***too*** much fun, especially on an up and down track...so I tried other things.

To get a little more heat I made a ceramic burner 2 1/2" in diameter but couldn't seem to get the flame evenly distributed without the jet being some distance from the chamber under the ceramic material. A burner like this isn't a very useful retrofit because the space needed for it to work would have to be one of the first things considered when designing a loco. Another problem was the seal around the edge, I had buttered the edge of the ceramic material with high temperature silicon when I installed it and it was burning.

I had an opportunity to speak with John Synnestvedt at the Stapleton's steamup, and he said he put a piece of screening folded like an accordion bellows in the chamber under the burner as a way of insuring a more complete mixture of the air and butane. With the screening in place you didn't need to have the jet so far away.

The burner had to come apart anyway, so I tried his idea. The folded screening had the additional advantage of supporting the ceramic material. On reassembling the burner this time I put a bead of high temp silicone around the edge of the metal cup and nested the ceramic material in it for sealing purposes.

The burner worked much better and the silicon didn't burn.

Alas, the improved burner didn't improve the boiler output. I mounted pressure gauges to both boilers. Pressure varied between four and eight lbs over the course of a run. Individuals commented they didn't know you could run a loco on 4 lbs. of steam. I've noted in the past that you can get a lot of work out of less than ten lbs. of steam. To which Murray Wilson pointed out you can get even more work if you put a vacuum on the exhaust.

One advantage of having two similar locomotives is that you can experiment with one and still run the other when you feel like it. This is also a disadvantage because you are constantly modifying them both.

I had a 2 1/2" boiler with (5) 1/4" fire tubes that I had made previously but hadn't installed in anything. It was a matter of a few modifications to install it in the cast engine loco. One of the modifications was to use hardware cloth (large mesh screening) as a platform for the boiler & burner. This was a pretty good idea.

It ran very well, pulling six cars (24 axles) for 11 minutes. I repeated this performance several times.

Did I mention that this loco will negotiate 2 1/2' radius curves? As a consequence I took it to some shows with a small portable track and four cars. It ran well on the small track in both forward and reverse.

Spring came again and I went down to Pennsylvania Live Steamers. Took the Heisler and the cast engine Logger. The Heisler will run when it's cold, rainy and windy and I wasn't sure if the Logger would work in a breeze. There were times during the day when the air was still and then a breeze would pick up. Sometimes this would happen as I was getting underway and I had moments of concern that the breeze would pull the fire out of the air holes and incinerate my little wooden locomotive.

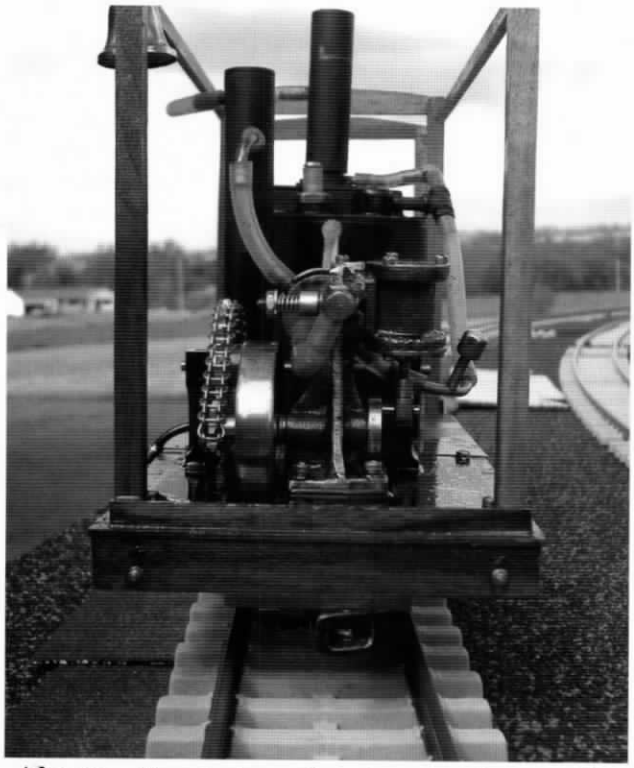
Not to worry. It handled the weather very well. I was able to negotiate my way out of the yard, back and forth through the switches. It was a little fast in the yard and using the reversing valve as a speed control was a little touchy. I could probably arrange some linkage so that the linear distance between the forward and reverse positions on the valve could be doubled. That would make it easier to finely adjust intermediate positions for speed control. Hmm.

Duration was 4 1/2 laps of Mike Moore's track pulling four cars. Consumption was 40cc alcohol to boil 70cc of water into steam. Temperature was in the 70's.

On to logger #2. I had made a bar stock engine with a 5/8" bore 1/2" stroke. The reversing valve is better integrated into the design and the flywheel has the curved spokes with the heavier rim. It has a miniature roller chain and sprocket driveline. The replacement boiler is 2 1/2" in diameter, has nine 1/4" tubes and will vaporize 130 cc $H_2O$ on 35cc alcohol. All this to turn one axle. Wheel spin is a problem. I should put some lead weights on the deck just to see how many cars it can pull.

Seriously though, I think I've achieved overkill, which is a useful thing to know. I really don't need this much power in a primitive logger. On the other hand the engine / boiler combination would work well in a Dunkirk or Class A Climax as there are more driven axles to get power to the ground. Something to think about.

As to the redundant three inch boilers...all is not lost. I saw Norm Saley's coal fired vertical boiler Shay which has given me an idea. I've made up a firebox for one of the boilers and I'll try firing with charcoal. From what I've been able to learn, charcoal fires don't last very long which could be an advantage. The boiler can hold a large volume of water so there's a possibility I could have a charcoal fired run without having to add water to the boiler. In keeping with our motto, ***Never leave anything to chance***, I'll make up a Goodall valve just in case! Instead of a sight glass I think I'll have a water column with a couple of try-cocks. They could be 4-40 screws with tapered ends and easy to use handles. Which leads us to another subject. If you ever have an opportunity to observe the members of the live steam fraternity who like long steaming sessions, it's interesting to see their practiced movements with the locomotive controls. Part of this is coordination and part of it is the design and placement of the controls themselves. If the charcoal boiler works I think I might explore the possibilities. Hmmmm. Uh, there's something I want to go and try. I'll write again later.



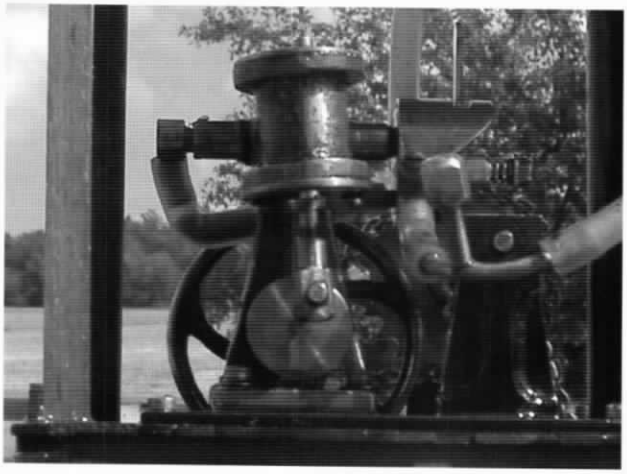
**Above:** ***Front view of cast engine logger. Note safety valve on boiler above the engine. Pocket coupler is used when double heading with the other logger.***

# NRR

**(see page 41)**

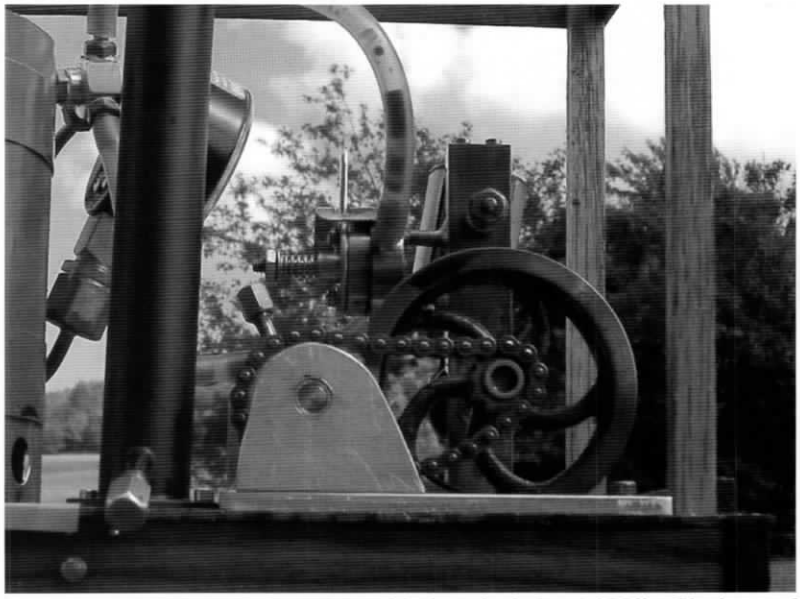
**Above:** ***Cast engine-drive side. I dressed up the jack shaft supports. Note gate for reversing valve and cap of condensate tank drain.***

**Below:** ***Cast engine - cylinder side. The Tee shaped fitting in front of the jackshaft support is the oiler.***

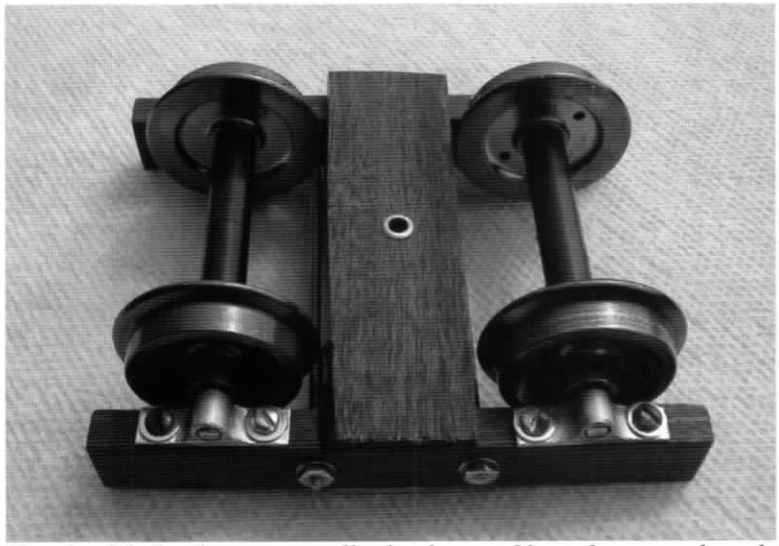


**Left:** *Note prototypical scorch marks under boiler. Filling and lighting this loco demands care and attention.*

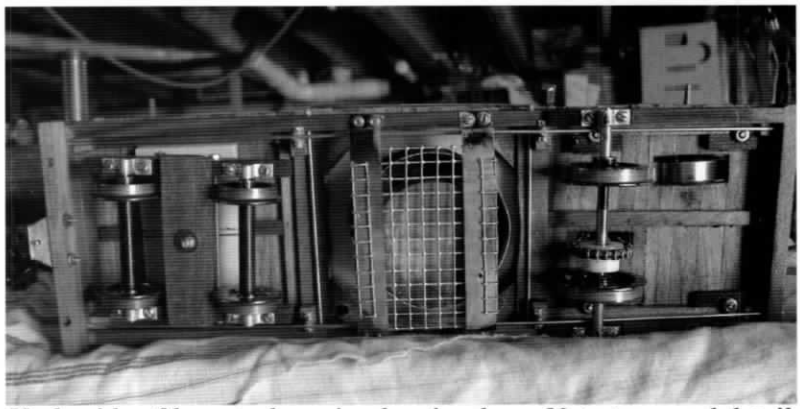
*Bar stock engine. 5/8" bore, heavier flywheel. Pulled 32 axles.*



*Bar stock engine. Drive side. Chain pitch is .1475". Chain and sprockets are pricey but neat.*



*Truck with Bachmann small wheel sets. Note: homemade axle boxes, pivot bushing. Nuts are for rods holding the wood in compression.*



*Underside of bar stock engine logging loco. Note truss rod detail, boiler support, drive axle, cut out in floor for flywheel.*

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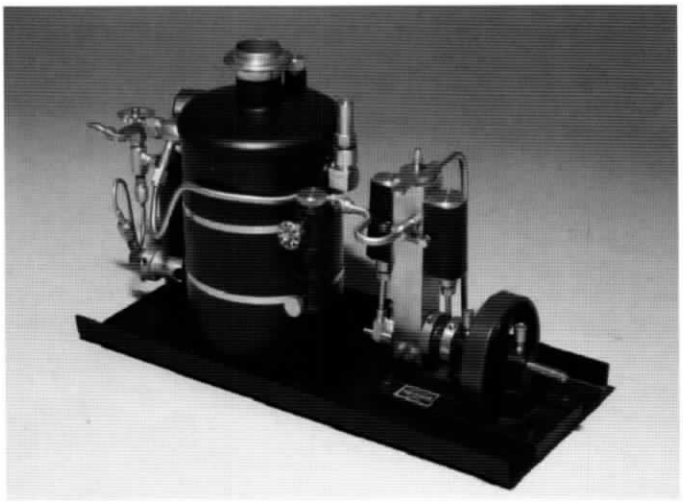
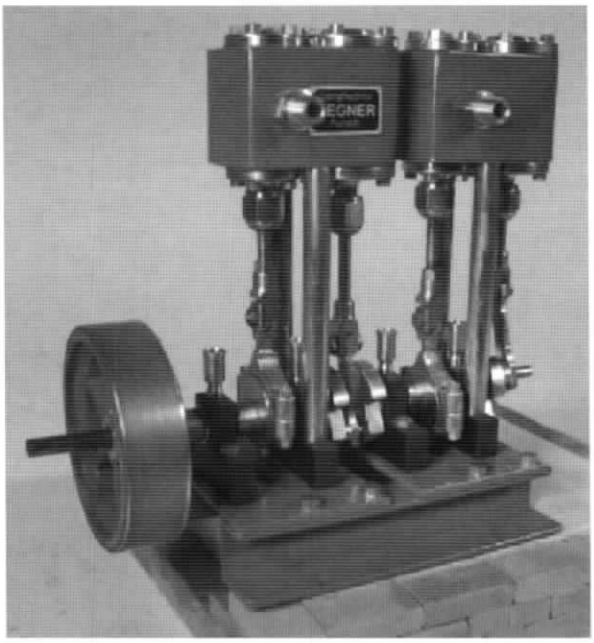
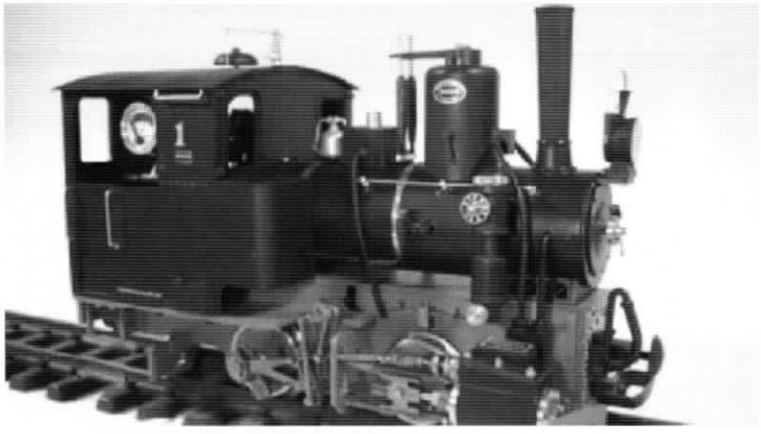


MINI R-T-R $658.00



JUNIOR KIT; $409.00

## 1:22.5 LOCOMOTIVES



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# *A $40 Live Steam Whistle Installation in 15 Minutes*

**by Carl Weaver, SA 138**

Here's an inexpensive, easy and fun project for you if you have a European type locomotive.

Regner of Germany sells a European type live steam whistle kit through the Train Department (http://www.traindept.com) for $39.95 plus shipping and handling. It's a bargain and very easy to install. I installed a whistle kit under the roof of the cab of my Roundhouse Billy in less than 15 minutes with no soldering required. It could just as easily be installed under a boiler walkway or frame of another locomotive.

## INCLUDED PARTS

The whistle kit (Regner identification: Dampfpfeife Bestell Nr. 20209) comes with the items shown in the picture. The long, soft copper tube at the top goes from the valve to the whistle. The two small items on the left are a compression fitting that slides on the valve end of the copper tube and a compression nut to secure it. No soldering is required for these type fittings.

The next items on the left from bottom to top are the valve, a sealing washer, and an adapter (reduction nipple) to mount the valve in a larger hole like the one in the Billy back head. The adapter mates M5x0.5 to M6x0.75 threads. If you don't have such a hole in the back head or manifold, you may have to use a T-fitting, which is not included in the kit.

The item in the center of the picture is not used for this particular installation, but can be used to mount the whistle directly to the valve. Two sealing washers are included for mounting the whistle in this manner.

The items on the right from left to right are the whistle sealing washer, the whistle, a compression fitting and compression nut for the whistle end of the copper tube.

## TOOLS YOU'LL NEED

All you will need for this installation is a 6mm open end wrench (1/4-inch is a good substitution), an 8mm open end wrench (5/16-inch alternative), a flat bladed screw driver, a small tube bender (not necessary, but good to prevent kinking) and a tube of Teflon paste sealant.

## INSTALLATION PROCESS

1. Use the screw driver to remove the overflow plug in the boiler back head. It's a hollow bolt with a drain hole for indicating a properly filled boiler when you don't use a siphon to withdraw water for a steam space. If you've been using this plug for steam space estimation, you'll now have to use the siphon method.

2. Remove the O-ring that is on the plug and set it aside for use later. If it's in bad shape, replace it.

3. Clean the surface of the hole. A cotton swab is good for this.

4. Use a sealing ring and a small amount of Teflon paste on the threads before installing the adapter on the end of the whistle valve. A cotton swab is also good for putting Teflon paste on small threads. Tighten the adapter to the whistle valve with a 9mm wrench.

5. Put the O-ring on the end of the valve adapter and add a little Teflon paste to the threads.

6. Screw the valve adapter with the whistle valve attached into the hole in the boiler backhead. Do not over tighten or you'll damage the O-ring. The reason for using the O-ring instead of the sealing ring is so the valve can be positioned properly with the activating lever pointing down. If a sealing ring were used, the valve might seat catawampus and fail to seal because the receiving fitting is cupped for the O-ring. (Note: If your Billy is radio controlled, you should have enough clearance between the whistle valve as-

sembly and the control rod from the servo to the steam valve lever as I did. If you don't, note the position of the screw and rod on the steam valve lever, loosen the screw, and free the rod. Don't forget to reinstall it later when the whistle installation is finished. Bend and adjust the control rod if you need more clearance.)

7. Use the tube bender to shape the copper tube to go from the approximate position of the whistle valve attachment, under the burner, behind the lubricator, up the left front corner of the cab (be careful not to have it seen through the front window) and pointing across the top of the cab parallel to the roof. You can figure this out by looking at my pictures of the tube connected to the valve and the tube connected to the whistle.

8. Carefully wiggle the tube into position. I did it without disconnecting anything. Close is very good and you can make final adjustments after the valve and whistle are connected.

9. Slide a compression fitting and then a compression nut on the whistle valve end of the copper tube.

10. Put a little Teflon paste on the threads, add a sealing washer, then use the 9mm wrench to tighten the compression nut to the valve.

11. Slide a compression fitting and then a compression nut on the whistle end of the copper tube.

12. Put a little Teflon paste on the whistle threads and add a sealing washer.

13. Keep the whistle clear of the fuel tank filler valve. Also, make sure the whistle hole is pointing down so any water in it can drain, then use the 9mm wrench to tighten the compression nut to the whistle.

14. Do not secure the whistle or the whistle end of the copper tube. Let it float free so its vibration is not dampened. The copper tube is strong enough to hold it.

15. Make any final positioning adjustments necessary.

## CHECKOUT

1. Service your locomotive and boil some water.

2. When steam pressure is up to 30 psi, check for steam leaks.

3. If all is okay, have fun blowing your whistle. It's a typical European, high pitched single chime sound that can be heard all over the neighborhood.

(See page 25 for photos)

# *Reflections upon Fourteenth Annual International Small Scale Steamup Diamondhead 2007*

**by Jim Pitts**
**photos by Carol Jobusch,**
**with some help from Jim Pitts,**
**Kevin Schindler & Bob Chatham**

Literally across the years and around the world, the International Small Scale Steamup is simply identified as **"Diamondhead."** This is the January pilgrimage point for veterans and novices whose passion is miniature live steam trains.

Amidst post holiday blues and the cold of midwinter, Diamondhead is a once a year gathering that is literally a warm spot of fun and fellowship, inspiration and encouragement. In the countdown to Mardi Gras, Diamondhead for the Gauge 1 live steam community is literally where the good times roll!

Because of Hurricane Katrina, the 2006 International Steamup was cancelled. Last year's winter routine was out of rhythm and the inspiration of being with kindred spirits was sorely missed.

Despite news reports, the full fury of Katrina on the Mississippi Gulf Coast was not fully appreciated by many of us until we viewed it up close and personal. A casual tour of the region revealed more than we could have ever imagined.

In some ways the storm's aftermath left a landscape of "third world" rubble and ruin. Living in a weather war zone is disorienting and depressing. Basic utilities of power and water, the security of home and employment, along with familiar landmarks were flooded and blown away.

The Diamondhead Resort (formerly the Ramada Inn) was bruised and battered. Despite wishful thinking by management, underscored by our commitment that "the show must go on"; reconstruction is still "a work in progress." Once we were oriented to the larger community context, our hearts went out in appreciation for the service staff, who faithfully reported to work in providing hospitality for their guests.

While never "first class", the motel is our winter steam retreat. This is our place to "boil water" and blow off steam. Here there is permission is pass butane gas, burn coal and light alcohol fires. All with the purpose of recreating the tried and true technology of live steam.

Whether our fuel of choice is alcohol, butane or coal, there is an ecumenical spirit of acceptance. Friendships are established that span geography, culture and even language.

At Diamondhead 2007, we once again had opportunity to put names with faces, see the latest locomotives, secure supplies and to simply enjoy being in each other's company. Our table fellowship moved to new locations with familiar restaurant names serving the cuisine for which the Gulf is famous.

There was a chorus of "Thank You, Jerry Reshew," for not only initiating, but also for sustaining this annual celebration of all things steam. The 14th Annual International Small-Scale Steam Up was once again a wonderful reunion of enthusiasts and friends.

As stated in big and bold billboard letters, "Welcome to Mississippi; it's like coming home!" Yes, it was good to be back home with our extended family in Diamondhead! Already we have marked on our calendars, January 18-20, 2008 as our time to be together again.

# *International Small Scale Steamup 2007 Wrap-up*

## by Jerry Reshew

Where to start ? We spent almost two weeks at the hotel , part of the time grousing , but more of the time smiling. Those wonderful Canadians arrived three days after New Years and were chomping at the bit to get the tracks put up. Carol Homuth , Ed Cook , David Hamilton , Emily Kaldestad , and Bob Maas came down to make sure that we all had a track on which to play , and Diamondhead's own John Hickson pitched in as well.We had everything tuned and ready to run on Friday , a full week before the advertised dates. The Michigan Live Steamers showed up en masse and put the Simpson track together to round out the atrium. With all of the Katrina warts , it still looked good.

Because of the slow recovery from the storm , we had people staying in three back-up hotels , but it didn't seem to make us any less jovial. The number of smiles and the hugs were beyond my ability to count , but it was a major feel good event by any measure.

The Clack Valves and Cornets Steam Band concert was well attended , and Joe Hall was our bandmaster . We topped off the concert with our Saturday Night at the Movies , hosted by Vance Bass. It was a Saturday for the Arts and the rails took second place for a few hours .

The Steam Flea Market was a huge draw and Carol and his assistants were busy most of the time. The total number of locomotives and associated stuff changing hands was significant and it really added a sense of bazaar to the surroundings.

***Here are some numbers for those of you who enjoy this sort of arcana :***

We had 214 steamers show up and about 40 spouses came along. The 32 no shows would have had us setting a record if they had arrived.

We used :
81 gallons of water
9 gallons of alcohol
14 cases of butane
8 pounds of rags

We came from 34 states and 5 countries to play with our trains over a period of 9 days . The following tabulation does not include walk-ins , but it does give one the feel of it all :

| **US** | | **INTERNATIONAL** | |
|---|---|---|---|
| Florida | 17 | Canada | 16 |
| California | 13 | England | 14 |
| Michigan | 10 | Trinidad , WI | 1 |
| Louisiana | 9 | Mexico | 1 |
| Texas | 10 | Japan | 1 |
| Georgia | 7 | | |
| Washington | 7 | | |
| Colorado | 9 | | |
| Illinois | 5 | | |
| Maryland | 6 | | |
| Missouri | 5 | | |
| South Carolina | 4 | | |
| Mississippi | 4 | | |
| Pennsylvania | 4 | | |
| Tennessee | 4 | | |
| New Jersey | 4 | | |
| New York | 5 | | |
| Virginia | 6 | | |
| Utah | 3 | | |
| New Hampshire | 3 | | |
| Alabama | 5 | | |
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| Arkansas | 3 | | |
| Ohio | 3 | | |
| Iowa | 1 | | |
| Arizona | 2 | | |
| Kansas | 1 | | |
| New Mexico | 1 | | |
| Kentucky | 1 | | |
| Indiana | 1 | | |
| Maine | 1 | | |
| North Carolina | 3 | | |
| Wisconsin | 3 | | |
| Massachussets | 2 | | |

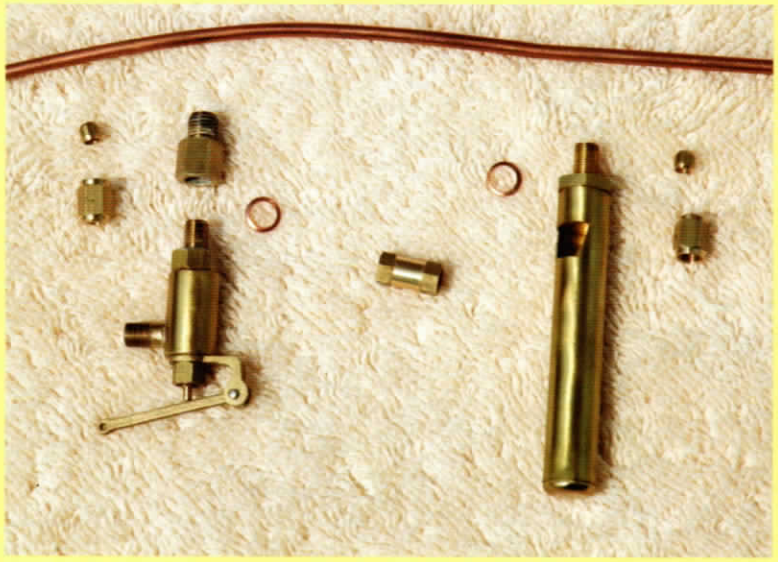
We also were visited by the California track cleaner monster, courtesy of Sonny Wizelman If you missed this demonstration it means that you were out of the hotel - it was amazing ( and loud )!

The local economy was boosted by our patronizing the restaurants in the area. It seems that the relocation of many of them made them even better that in the past. Our Saturday brunch was a smash from all of the reports and we'll do it again next year. Having our brass quintet play during the luncheon was over the top !

The bad news is that the Steamup will cost you more next year. The increase in the registration fee has not kept people from registering early and it is needed in order to cover the ever increasing costs that we incur, this without diminishing the event as we have come to know it.

Thank you for coming to Mississippi , and I hope that you get back here for 2008.

*Jerry*

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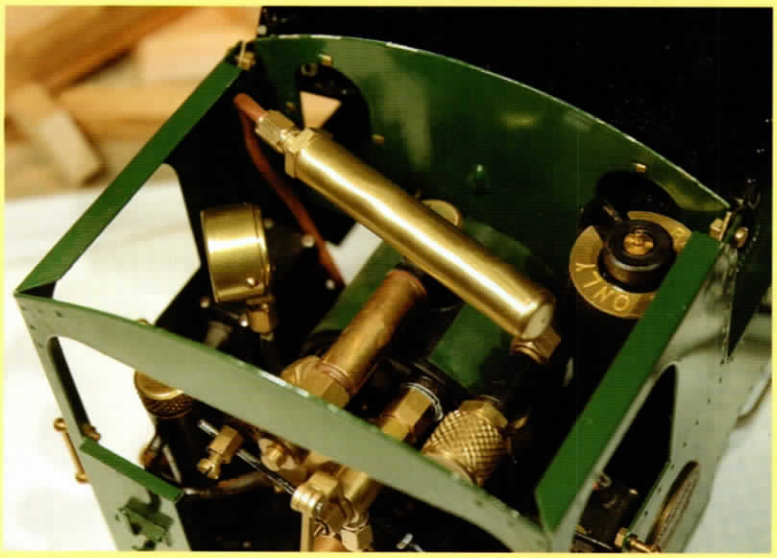

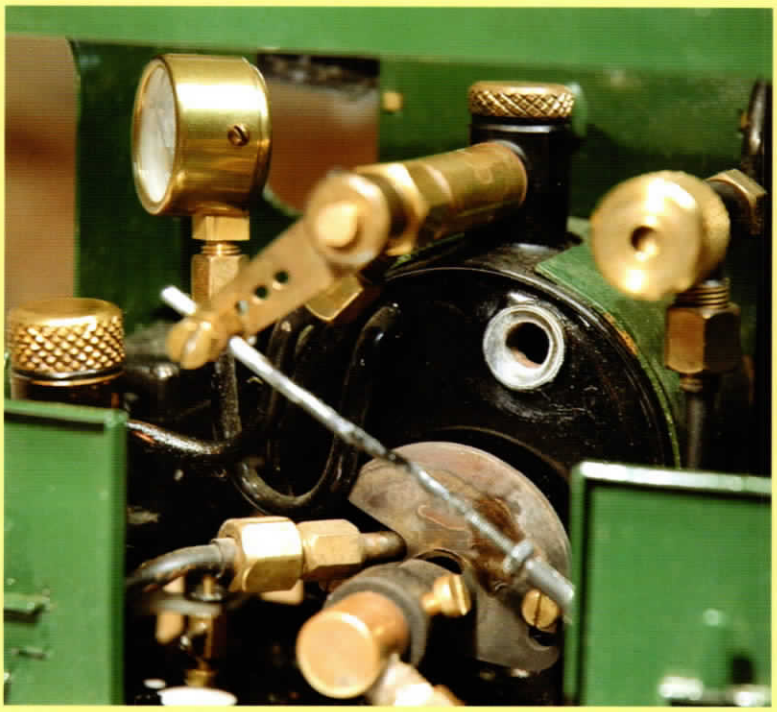

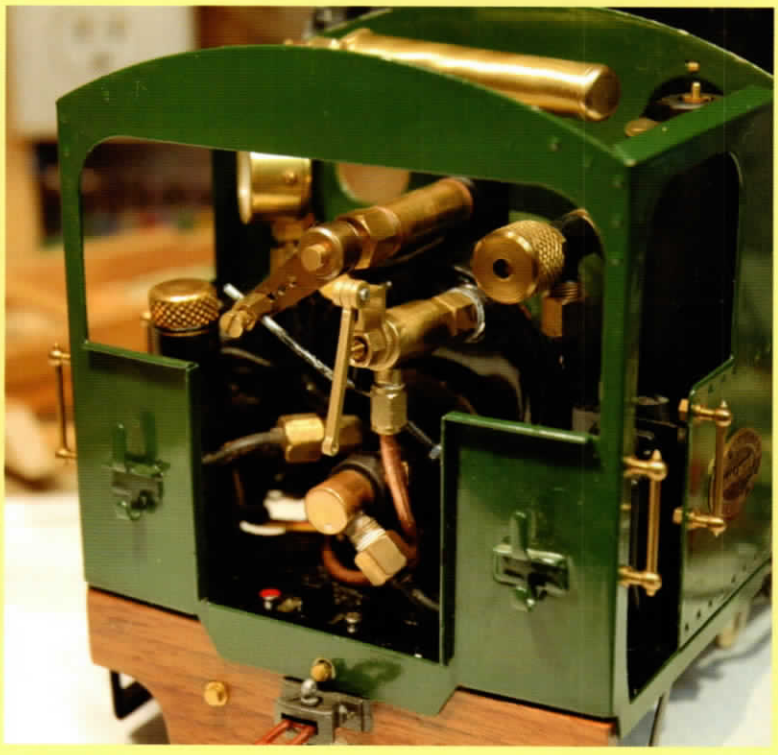

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  ART84102 Santa Fe
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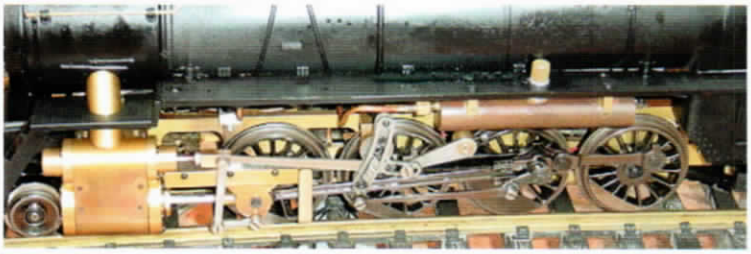
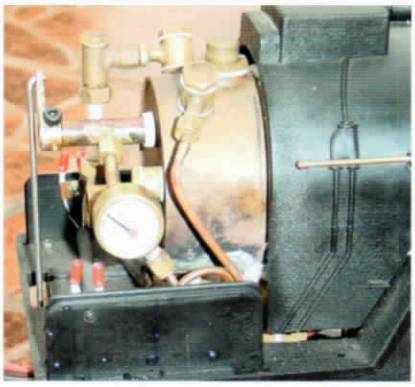
**Transmitter batteries not included





Photos are of Engineering Sample. Appearance of production model may differ. Cylinders, under frame & many other metal components will be blackened.

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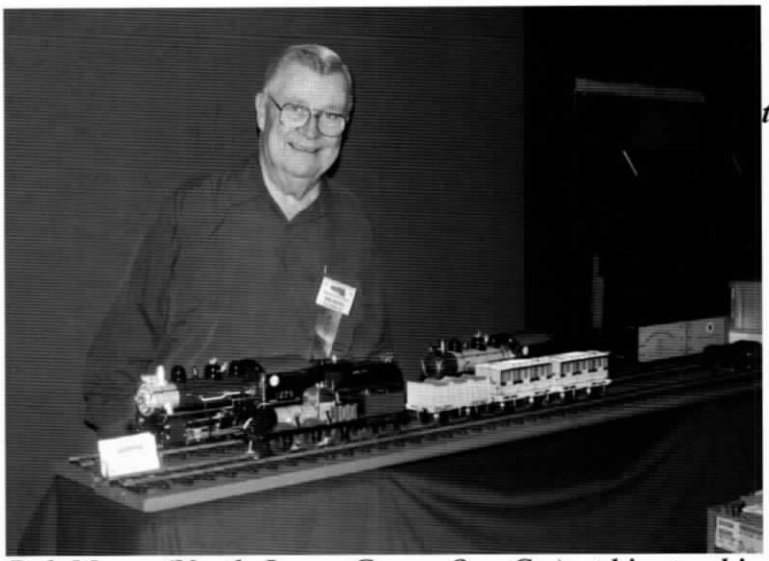
Top: The sign welcoming us to Mississippi were the first indication o what was to come.

Above: The Gang's all here!

Below left: Torry Krutzke (l. (CO)) and David Bailey (England) pre pare for a doubleheader.

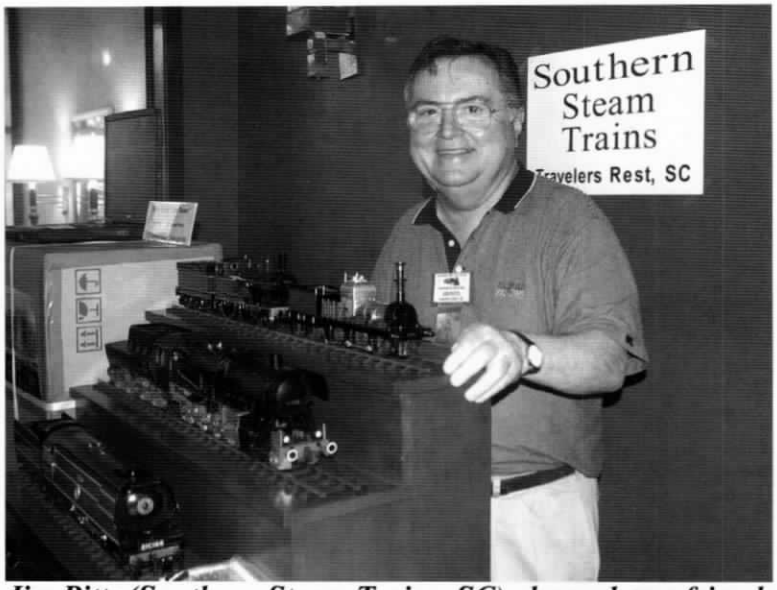

Pilot model of Accucraft's new Canadian Pacific Royal Hudson.



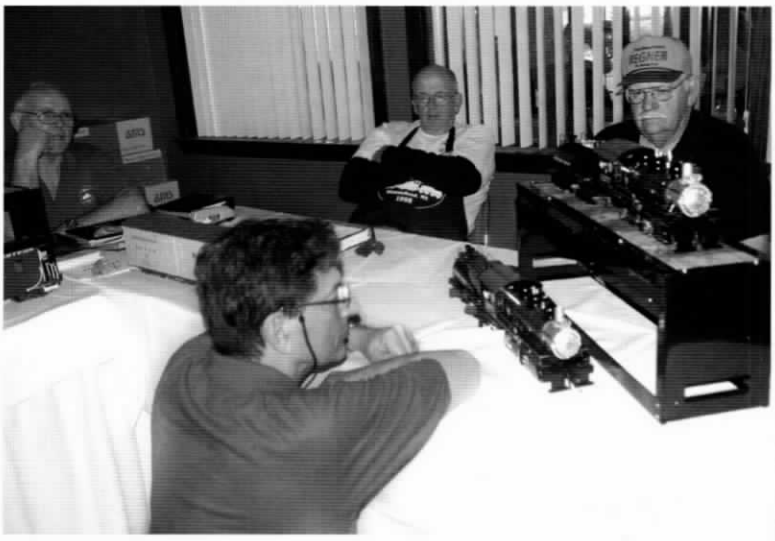
*Bob Moser (North Jersey Gauge One Co.) at his stand in the dealer room.*


*Some of the activity in the dealer room. This is always a very popular place.*


*Richard Longley (Brandbright, England) helps a customer at his stand in the dealer room.*




*Jim Pitts (Southern Steam Trains, SC) always has a friendly smile and excellent service to offer his customers.*



*Peter Jobusch (foreground, MD) admires a new Accucraft S-12 Switcher on Bob Pennock's (OH, Cross Creek) stand in the dealer room.*

*Bob McHale (l., NJ) peruses some of the goodies on the Swap Shop tables as Swap Shop Head Honcho Carol Homuth looks on.*

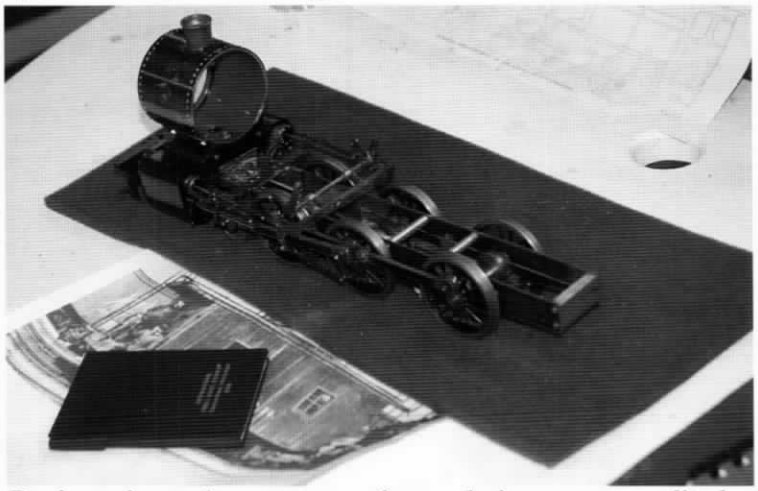
*Clack Valves & Coronets Band did a magnificent job again this year.*

*Overview of the activity at one of the smaller tracks. As usual, something was going on 24 hours a day.*

*Bill Burgess (l., Canada) and Emily Kaldestad (Canada) pay close attention as Ken Roach points out something on a steam loco.*

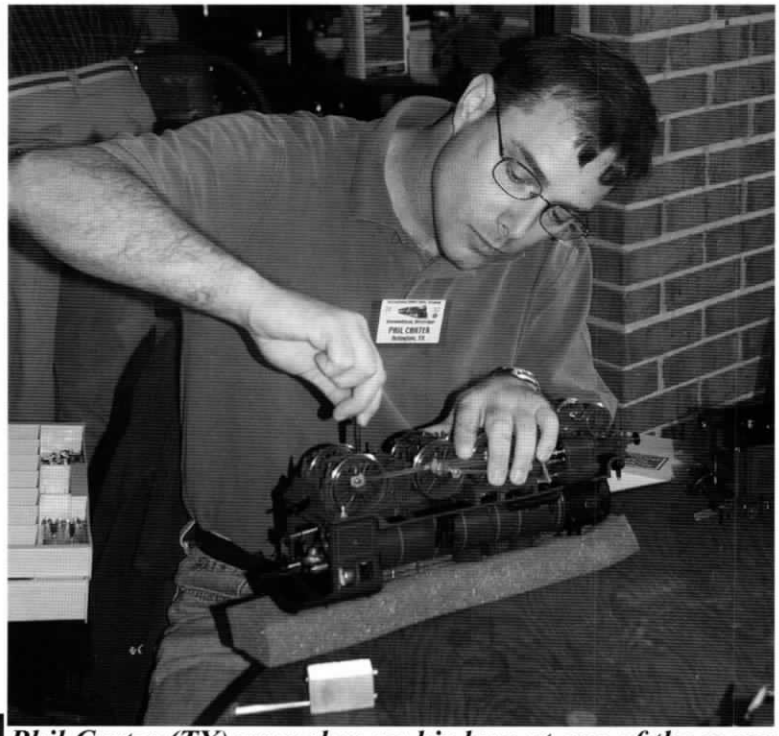
*Mr. & Mrs. Brown.....your room is ready! This is how our room looked the day before we arrived. Work continued on the Diamondhead Resort all during our stay. Finding workers to handle the job seems to be the biggest problem in this area that was hit so hard by Hurricane Katrina, but they are slowly recovering.*


*Construction materials and furniture were piled in the hallways, but that didn't slow down the steamup activity.*



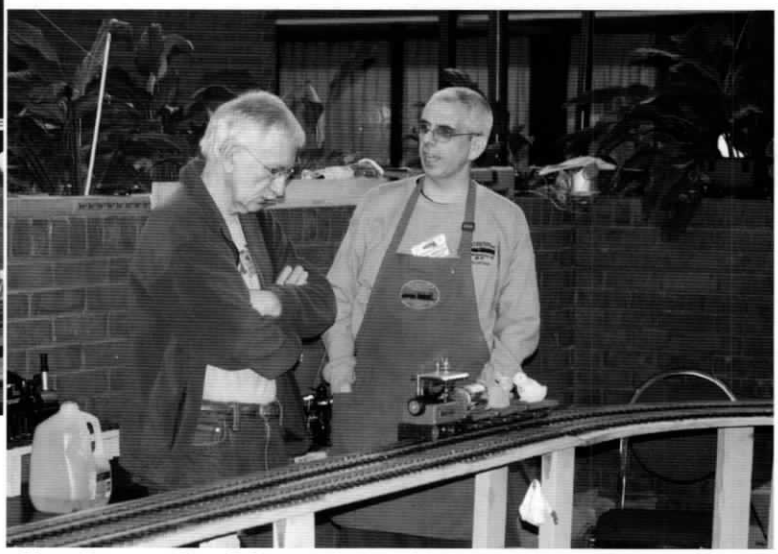
*Projects in various stages of completion were on display everywhere in the atrium.*

*Chris Sortina (LA) opens the throttle on his Accucraft K-28.*



*Phil Carter (TX) wrenches on his loco at one of the many tables set up for steamers in the atrium.*

*A schedule board (right rear) kept things moving and gave everyone ample opportunity to run trains.*

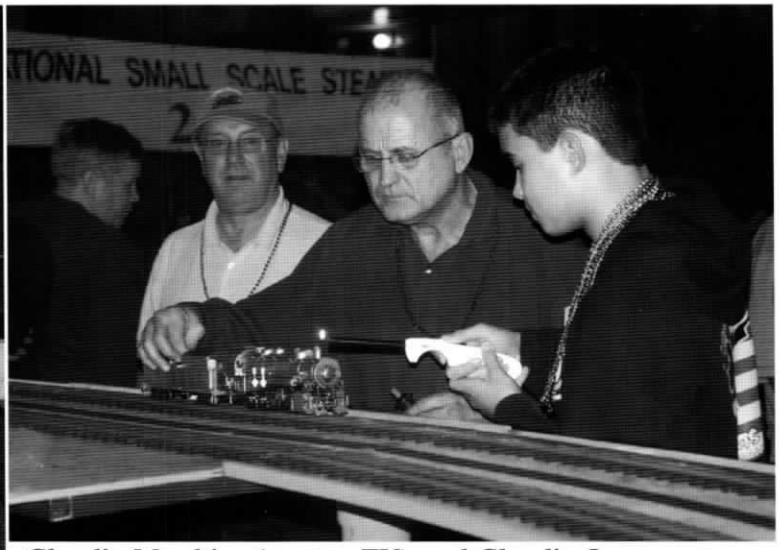


*Jim Reyer (l., CO) and David Hamilton (Canada) talk about steam, oil and metal.*

*Bob Simpson (FL) pumps some water into the boiler on his wife Carol's Aster Duchess. The coaches are by David Leech.*

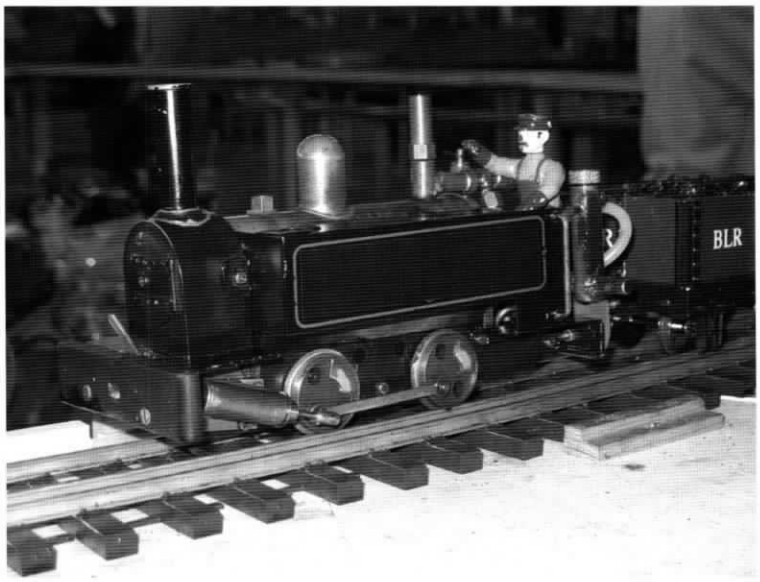
*Pete Olson (WI) coaxes his Accucraft Beyer Garratt into action.*

*No one has more fun at a steamup than Caleb Roberts! (TX) And no one stays up later running trains, either.....*



*Charlie Mynhier (center, TX) and Charlie Jr. operate one of Charlie Sr's works of art.*

*Caleb Roberts (TX), John Garrett (MO), Ryan Bednarik (NJ), Jim Hadden (UT) and Carol Paule (MO) watch as Peter Comley's LMS Streamlined Duchess class number 6243 'City of Lancaster' roars past.*



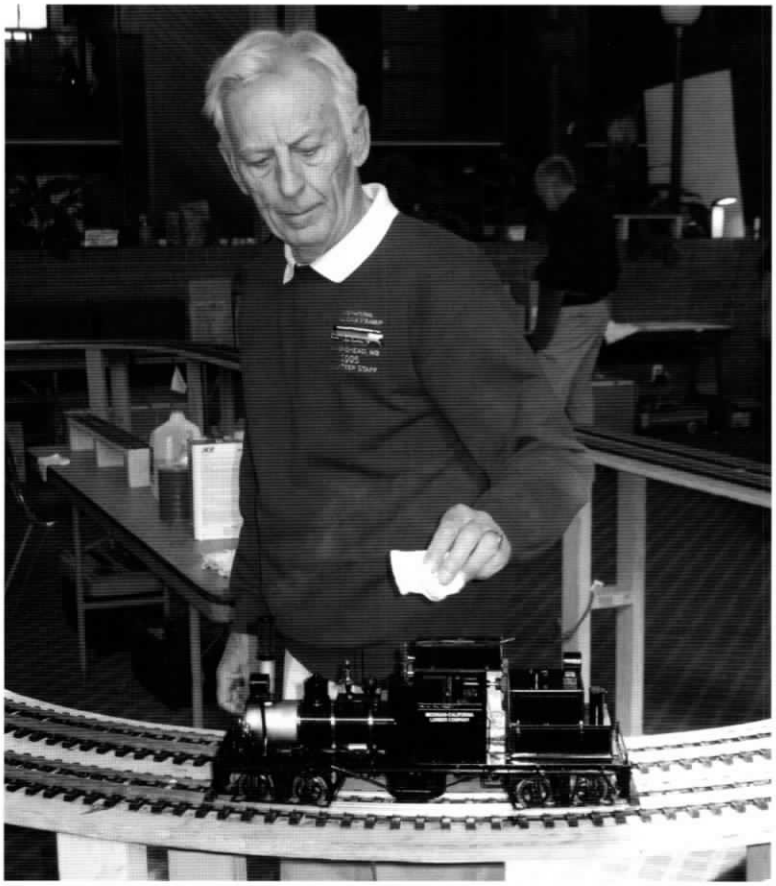

*A Mamod, once a familiar sight at steamups all around the world, is now rarely seen.*

*Jo Anne Stapleton (VA), Carol Krutzke (CO) Vi Homuth (Canada), Marie Brown (NY), Valerie Nichols (MD), Jerra Matticks (TX) and Ginny Morris (AZ) do all the hard work while the guys play with trains.*

*Bill Shipp (Canada), Alan Walker (England), Jeff Young (Canada) and Richard Longley (England) participating in one of the many trackside bull sessions.*


*Murray Wilson (PA) applies the turkey baster to one of his antique steamers.*

*Looks like both parties to this deal are happy about the outcome. Mike Simpson (l., FL) is the proud owner of a new boiler, and Larry Herget (MO) has added heft to his bank account.*



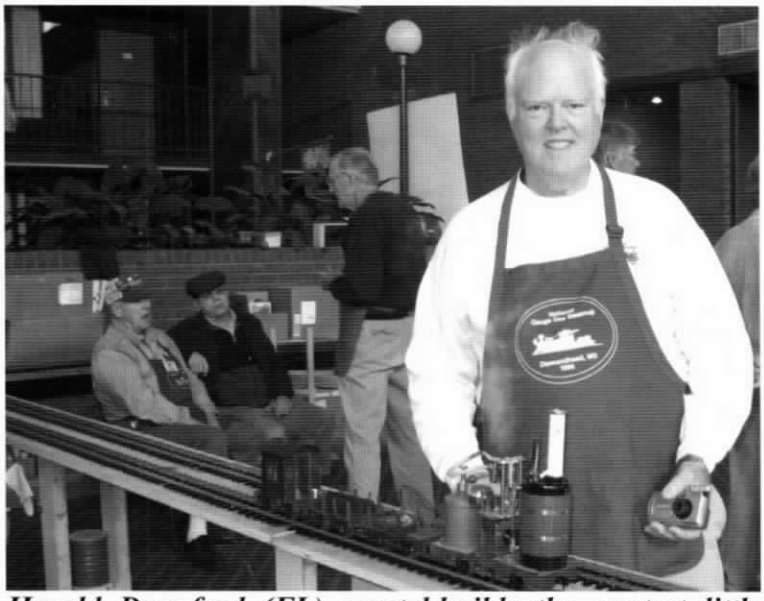
*John Hickson of Diamondhead, MS. Described by Jerry as "An intrepid helper in the more arduous tasks that are part of all of the fun."*

*Carol Jobusch (MD), Official Diamondhead photographer, gets a low-level shot of Bill Payne's (KS) Aster Silver Link.*

*Mitch Mitchell (AR) and his friend Bruce Stockbridge were set up right outside our room, so it was very convenient to pester them constantly.*

*Jim Stapleton (VA) is partially obscured by the steam from one of the Accucraft Garratts.*

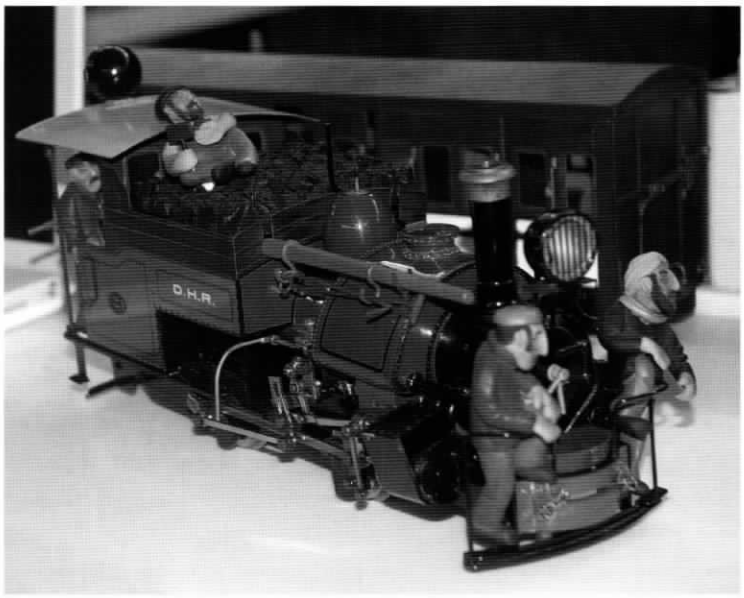
*Rob Cooley (TX) and our Diamondhead host Jerry Reshew (MS) are obviously getting a kick out of this 7/8 scale logging train.*



*Harold Dunsford (FL) scratchbuilds the neatest little backwoods locomotives and trains. They are always loaded with interesting details.*

*Have shop, will travel. Norm Saley (FL) takes on projects of every kind whether at home in Orlando or at a steamup.*

*Another bull session at the track. Peter Foley (Canada), Vance Bass (NM), Ken Roach (Canada) and Torry Krutzke (CO) put in their 2 cents worth.*



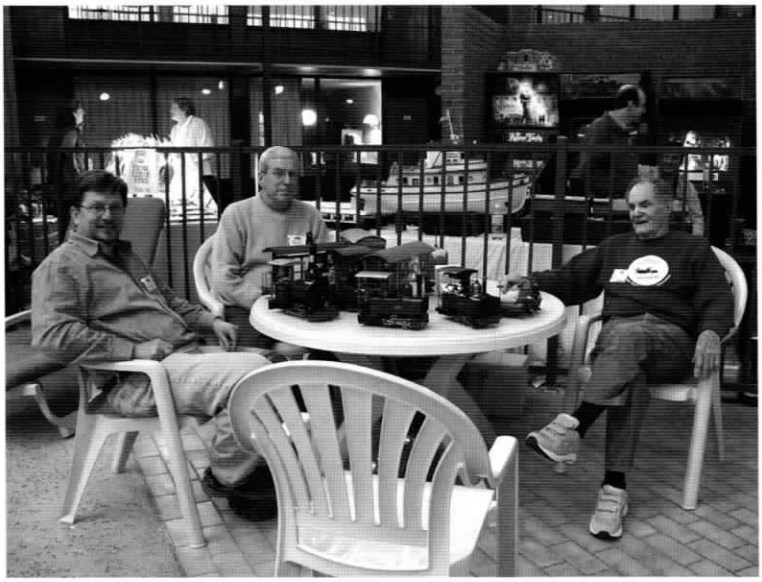

*Carl Malone's Roundhouse Darjeeling loco has a full crew of whimsical Indian figures.*


*Bill Payne (KS) keeps a close eye on his Aster Silver Link. A beautiful locomotive!*

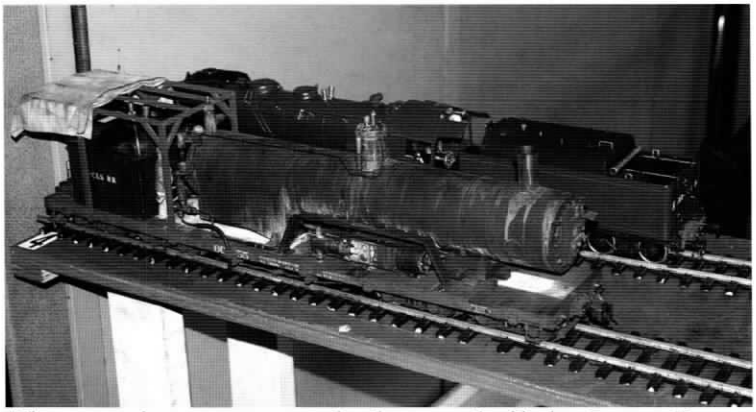

*Bill Ford (l., FL) and John Riley (FL) carefully study their Diamondhead handouts.*

*A couple of hard working railwaymen take a break.*

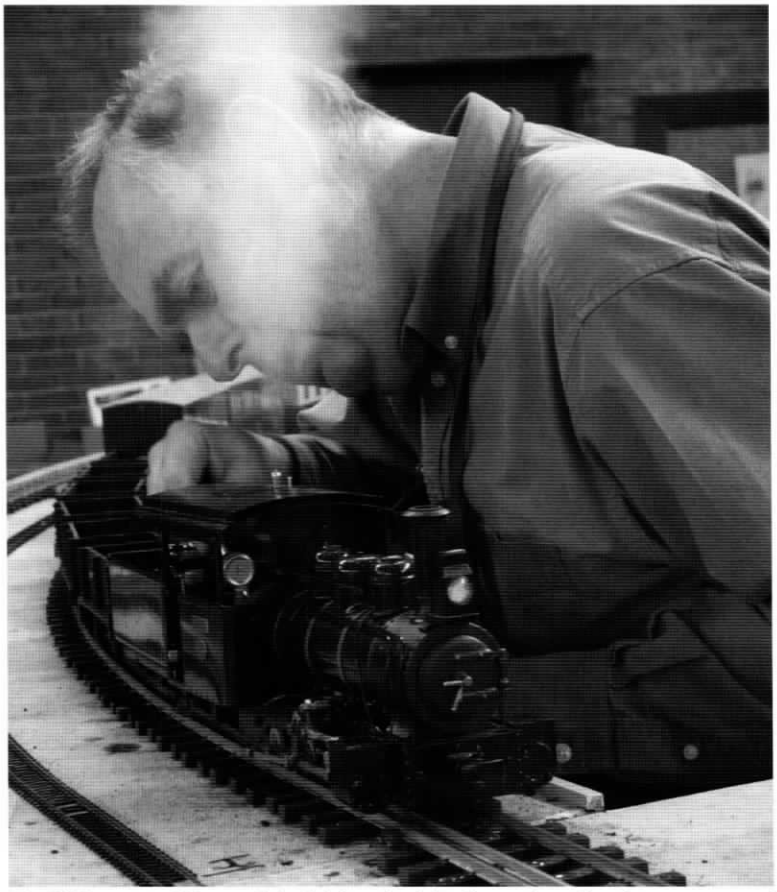
*Left to right...Wayne Sorenson (IL) stops at one of the tables to chat with Hans Huwyler (Aster Hobbies USA - SC), Ross Schlabach (NC) and Paul Lator (GA).*



*Carl Malone (l., TX), Dave Graley (SC) and Geoff Spenceley (CA) take a few minutes out to discuss the merits of 7/8 scale.*



*The amazing steam track cleaner, built by Larry Bangham and brought to DH 2007 by Sonny Wizelman, went to work with a thunderous roar and a huge cloud of steam.*



*Jeff Young (Canada) hides behind a cloud of steam and smoke as he feeds the hungry firebox on his John Shaw-modified, coal burning Roundhouse Fowler.*

*Affable John Coughran (CA) is a familiar sight at all the Diamondhead steamups, and most West Coast steamups as well.*

**DIAMONDHEAD!**

# *The Nuts and Bolts of Shays*

## *Bevel Gears*

### *by Dan Rowe*

The last component needed to get the wheels to turn on a Shay is the bevel gear. The geometry of these bevel gears is so complicated that it had defied all attempts to devise a machine capable of making them accurately and quickly until 1876, only four years before the first Shay was built at the Lima Machine Works. Gears have always appealed to me because they are pure mathematics in metal.

The contact between the teeth of power gears has to be a rolling surface with no slip or the gear will wear out rapidly. Almost all modern gears use an involute curve to achieve the rolling contact. This is a fancy name for a curve that can be drawn by wrapping a string around a soup can as illustrated in Fig 1. Tape one end of the string to the can and tie a pencil to the other end. Keep the string tight and the curve drawn as the string unwinds is known as an involute curve. This curve continues to spiral outwards until the string ends.

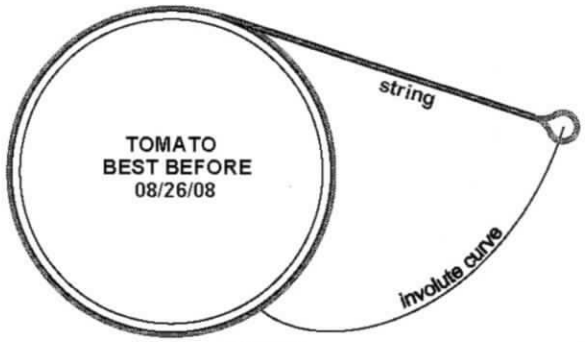



Figure 1

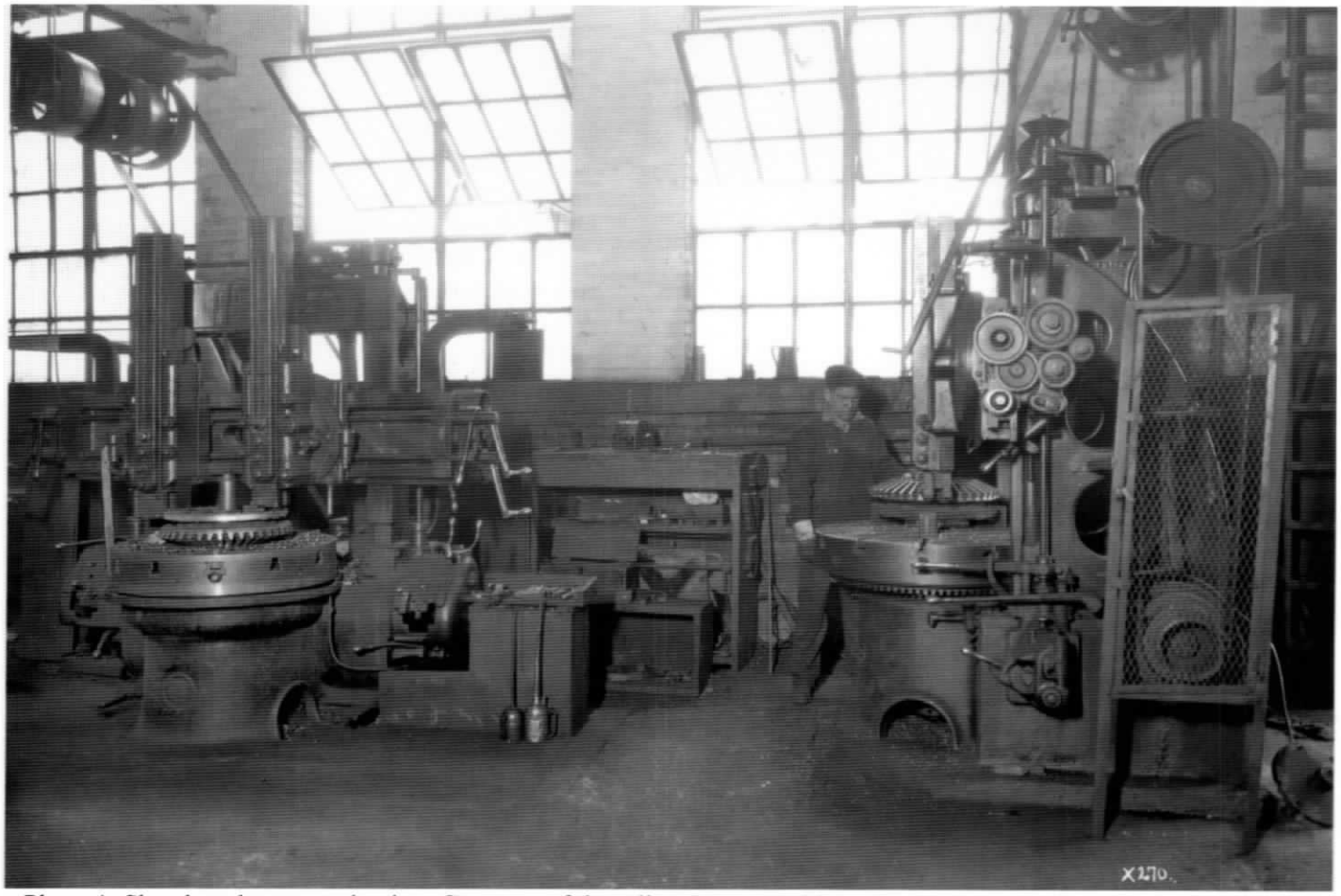


Photo 1. Shay bevel gear production. Courtesy of the Allen County (Ohio) Historical Society

The type of gear used for power gearing by most US machinery manufacturers in 1880 is called cycloid or epicycloid gearing. Its design is based on the curve formed by rolling a circular disk along the pitch line. A single point on the circumference of a circular generating disk is traced through one complete revolution along a straight line to form the curve known as a cycloid curve (Fig. 2A). If the generating disk is rolled around the outside of the handy soup can, an epicycloid curve is drawn (Fig. 2B). If the generating disk is rolled around the inside of a tube, a hypocycloid curve is drawn (Fig. 2C). This is the only drafting equipment needed to draw any set of these gears.

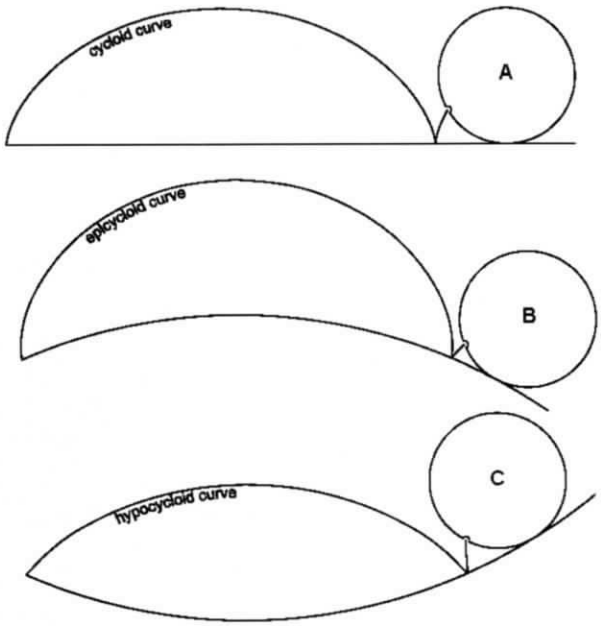



**Figure 2**

There are a lot of curves that would work for the rolling contact but the two described are easy to draw, which is why they were chosen by early gear designers. I do not want to bore the reader with a lot of theory; there are lots of books on gears available for that purpose. I studied old gear designs so I would understand the Shay bevel gear drawings. I was surprised to learn that cycloid gears are very sensitive to errors in center distance of the shafts. I have heard rumors of the Lima factory gears having a less than stellar service life. These rumors have some basis in actual fact. In order to explain the mathematical reason behind my logic I will have to briefly describe how a cycloid gear is drawn. Those who find this stuff boring can simply skip the next three paragraphs of this article.

The first thing needed to draw a gear is the pitch diameter, or the diameter of the pitch circle. This is the diameter of the wheel that has the identical motion rolling on a flat surface as the gear has rolling on a rack. Or in other words--a friction gear, like the tires of a Shay rolling on the rail. Looking at Fig. 3 it can be seen that the addendum and the face refer to parts of the gear tooth outside the pitch circle and the terms dedendum and flank refer to parts of the gear tooth inside the pitch circle. The tried and true method to draw a cycloid gear is to cut thin wood templates of the pitch circles for each gear of a pair. Each pitch circle needs an inside and an outside template. A generating disk with a small notch in the outer edge for a pencil is the only other equipment required. The face of one gear rolls on the flank of the mating gear, so the very same generating disk has to be used for every gear an interchangeable set of gears.

The faces of the tooth shown in Fig. 3 were generated by rolling the generating disk around the outside of the pitch circle to form epicycloid curves. The flanks in Fig. 3 were generated by rolling the generating circle along the inside of the pitch circle to form hypocycloid curves. If you noticed that the flanks in Fig. 3 look like straight lines you are correct. This is true because the diameter of the generating disk equals the radius of the pitch circle. The diameter of the generating disk is always the radius of the smallest gear. The straight radial flanks on the smallest gear or pinion make the draftsman s and the machinist s job just a bit easier.

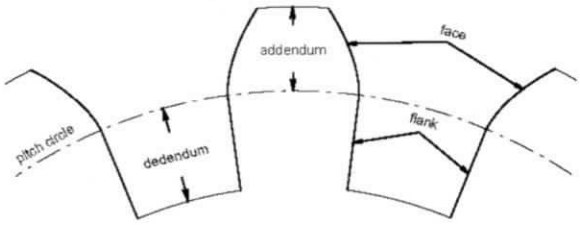



**Figure 3**

The early Shays all had rigid trucks, so in theory the pitch line of the cycloid bevel gears could be maintained. The introduction of equalized left truck bearings allowed the axle to move somewhat giving a pitch error on the bevel gear. When this happens the rolling contact at the pitch line of the tooth is disturbed, causing wear and early gear failure.

This analysis is not intended to be a criticism of the engineers working for the Lima Locomotive

Works. This might be only a minor factor compared to normal wear with open gears. The engineers were following the standard practices of the day which were not well defined because the American Gear Manufacturer Association was not established until 1916. Starting on January 1, 1922, the Lima Locomotive Works adopted a two-year guarantee for all Lima-made gears and pinions. This was after the change to involute gears, which do not suffer greatly from slight pitch errors.

The demand for mass-produced bevel gears in those days was not really for industrial machinery. It was actually for the bicycle fad that was the rage all over the world at the time. The high demand for bevel gears was because chainless bicycles were needed to allow women wearing long dresses to enjoy the new sport. The high demand for bicycles also spurred the demand for seamless steel tubing, because then, as now, light-weight bicycles sell at a premium price. The cost of seamless steel tube in the US was as high as two dollars a pound in the middle 1880s. The solution to cheap seamless steel tubing was solved in 1885 by Max and Reinhard Mannesmann, of Remscheid, Germany, who invented a skew or cross form of rolling that fractured the weakest spot on a solid round billet of steel, which is the exact center of the billet. The advantage of seamless steel tubing for boilers was not long overlooked.

The bevel gear planer invented by William Gleason in 1876 was too slow and could not make the small gears needed for chainless bicycles. Hugo Bilgram, the same man who created the valve gear diagram in issue #78 and #79, solved the problem. US patent #294,884 was issued in 1884 for the first bevel gear generator. The same gear generating process was later used to generate spur gears and is the basis for a whole class of gear-cutting machinery. This machine, in its earliest form, is a fairly simple addition to a standard shaper. Later models were fully automatic. The early machine is very interesting to me because it can be adapted to a modern shaper. These machines were most likely not used in Shay production but they might have been used for replacement gears. If anyone is interested in these machines join the discussion at:
http://groups.yahoo.com/group/LivesteamShays/.

The first version of the machine most commonly associated with bevel gears today was patented in 1898 by James Gleason, the son of William Gleason. This Gleason machine uses rotary cutters to cut both sides of the gear tooth at the same time. The relative motion between the tool and the gear blank is the same as the Bilgram machine, only the blank is rotated on its axis while the rotary cutters are guided on the correct path.

This leaves the question of what machine is shown in Photo 1 of gears being produced at the Lima Locomotive Works? The upside down gear on the vertical boring mill in the left side of the photo is set up to trim the gear rim. The reference number X270 dates the photo to around 1915. The gear-cutting machine appears to have two cutters using a planing action. That rules out both Gleason and Bilgram machines. I found a lead in History of the Gear-Cutting Machine by Robert Woodbury, which shows a line drawing of a machine that looks similar and has a vertical gear that rotates with a tracked cutter above the gear. This machine is described in Austrian Patent No. 657 of 4 July 1879, and the patent was issued to C. Dengg & Company of Vienna. This machine was only capable of cutting cycloid bevel gears, which is what the early Shays used. If anyone knows who manufactured the gear-cutting machine in Photo 1, or what principal of operation is being used, please share the information.

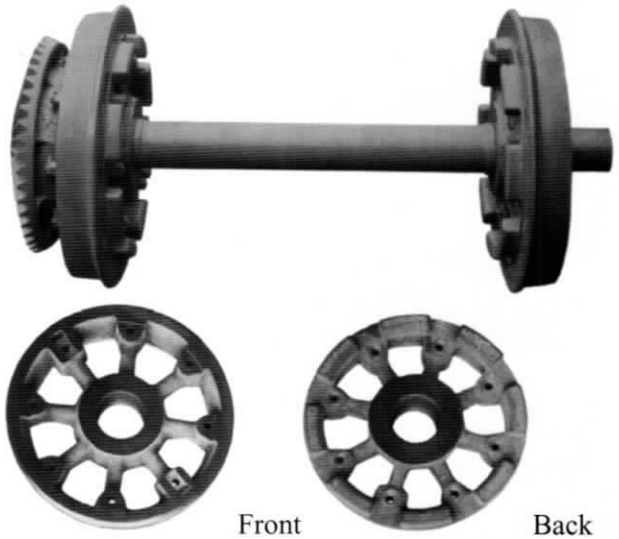



Photo 2 Courtesy Allen County Historical Society

The driving-wheel center with lugs was invented by William Woodward, and the patent (1,380,457) was filed for on May 4, 1920. This solved the problem of the gear bolts shearing off or bending during a derailment. The combination of photos (Photo 2) shows a fully assembled axle and the front

and back of one of the driver centers. The front side shows the recess for the gear rim and the radial slots for the gear keys. The back shows the lugs that protect the gear bolts.

When I checked the early drawings of bevel gears, I was surprised to find a few small errors in the pitch angles of the gear and the pitch diameter. The error was in the second decimal place and did not favor one direction over the other. I had no way to account for the error and it is a right angle problem so I knew that the draftsmen were capable of greater accuracy. The mystery was solved when I found a Boorman s patent anglegraph. This is a specialized instrument for solving bevel gear problems. They were made by Greenwood & Bately at Albion Works, Leeds, England. I can t say for sure that these were used to design the Shay gears, but some type of mechanical instrument like this was the source of error. I have studied several vintage machinery and gear design books and have not been able to locate the proportions of the tooth profiles used for the early Shay gears. The only place I found it was in the instruction manual for the Boorman anglegraph. The following proportions are copied from that source and match the early Shay gear drawings. The pitch in the table is the circular pitch, which is how Shay gears are defined on the drawings. The circular pitch is the distance measured along the pitch circle from one tooth to the next, expressed in inches. To convert circular pitch to the more modern diametrical pitch divide pi by the circular pitch.

Proportions of Teeth Wheels.

| | |
|---|---|
| From pitch line to top of tooth | = pitch x 0.33 |
| From pitch line to root of tooth | = pitch x 0.42 |
| Total depth of tooth | = pitch x 0.75 |
| Thickness of tooth on pitch line | = pitch x 0.45 |
| Space between teeth on pitch line | = pitch x 0.55 |

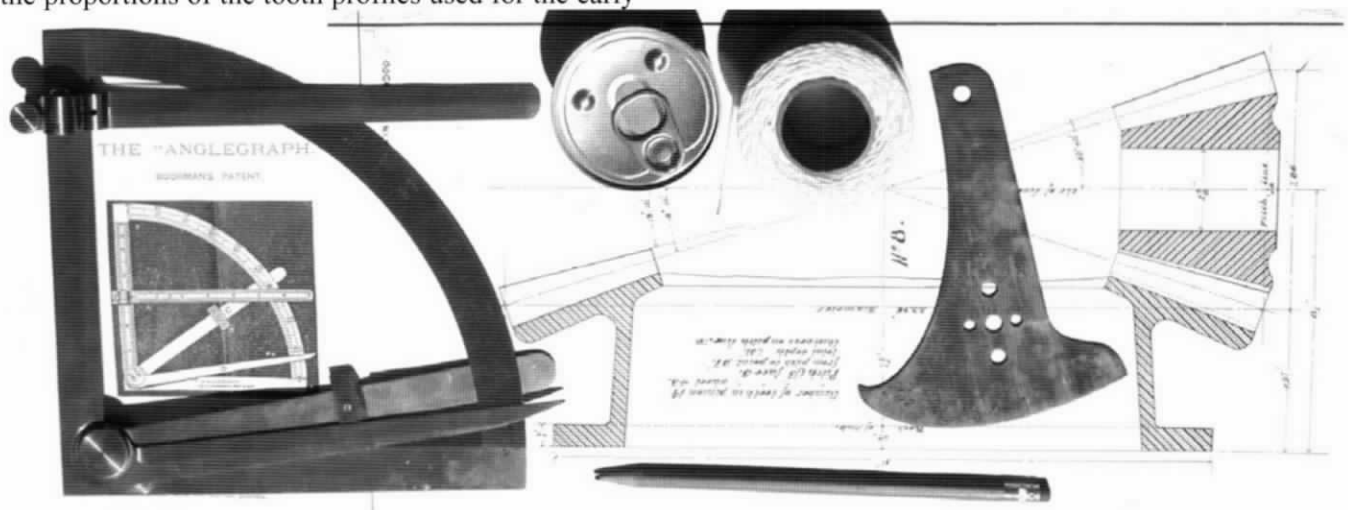



Photo 3. Bevel gear drafting tools authors collection.

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# *Valve Gear, Part VI*

**by Charles McCullough**

***The "Company Notch"...***

In the previous articles in this series, I have mentioned the efficiency of the engine. Proper setting of the valve gear not only makes the engine work, but that and proper use of it can affect the efficiency of the engine by changing the length of time the valve is open to allow steam into the cylinder. This is not used to change the speed of the engine, but rather to change how much steam is used to maintain a particular speed.

All during the Admission period, the pressure of the boiler is applied to the piston. Because of the relative sizes of the boiler and the cylinder, any loss in pressure in the boiler (as the steam fills the cylinder) is immediately replenished by the fire. At the point of cutoff, the steam trapped in the cylinder is at the same pressure as the boiler and continues to press against the piston. As the piston moves, the volume of that end of the cylinder rapidly increases and the pressure in the cylinder drops dramatically, but is still a force against the piston and performing work to move it. The longer the steam port is open to allow steam into the cylinder, the less time is left for that steam to expand in the cylinder before the remaining pressure is lost out the exhaust. Conversely, the less time the steam port is open, the less steam is used, which means less water needs to be boiled which means less fuel is used.

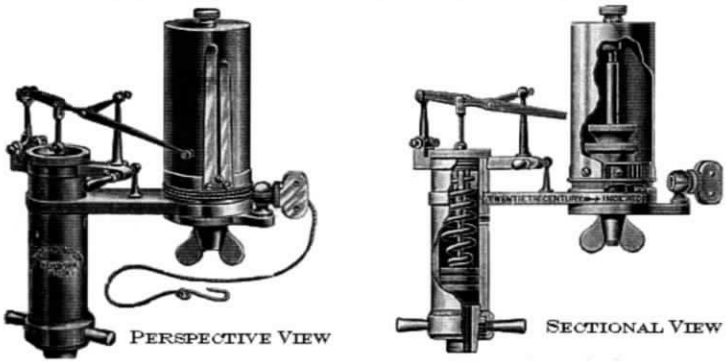
The Reverser Lever in the cab of the locomotive has a pawl that fits into any of a series of notches cut into part of the mechanism that holds the lever in the position set by the engineer. There is one notch in the center that holds the gear in neutral and a notch at each extreme to hold the gear in either full forward or reverse. Between these notches are others, sometimes uniformly spaced and sometimes not. The notch closest to neutral, but not in neutral, produces the shortest cutoff. Since the "Company" spends less money (less fuel used and fewer stops to replenish water), when the engine is running with the Reverser lever set in this position, it became known as the "Company Notch".

With both Stephenson's and Walschaert's valve gear (and many other types) the Reverser Lever can be moved to this position to shorten how long the valve is open to allow steam to enter the cylinder. However, they accomplish this in slightly different ways.

In the first article of this series, I presented a circular diagram of the significant events in the operation of a steam cylinder. Another way of looking at these events is with a Steam Engine Indicator Diagram. These are graphs of the relationship of the pressure in a cylinder to the position and direction of the piston. The graph is made in real time by a device (See Figure 18) that makes a mark representing the pressure in one end of a cylinder, on a piece of paper that is moving in synchronization with the position of the piston.

Figure 19 is a set of (idealized) Indicator Diagrams representing the pressure cycle in one end of a cylinder. To describe the diagrams I have arbitrarily numbered some points of interest.

Thompson's Twentieth Century Steam Engine Indicator.




*PRICE of Thompson's Twentieth Century Indicator, full nickel plated, with two springs, two cylinder cocks, or one three-way cock, one triangular boxwood scale, 100 sheets prepared paper, screw driver, cord, oil, oiler and a treatise on indicating and engine practice, all enclosed in a handsome, polished oak case, velvet lined,* **$50.00**

Figure 18

Around point "1", the piston is moving to the right, being pushed by the full boiler pressure.

At point "2", the valve has "Cutoff" the supply of steam. The piston is now being pushed by the residual pressure of the steam trapped in the cylinder. Note how quickly the pressure drops!

The Exhaust valve opens at point "3", and any

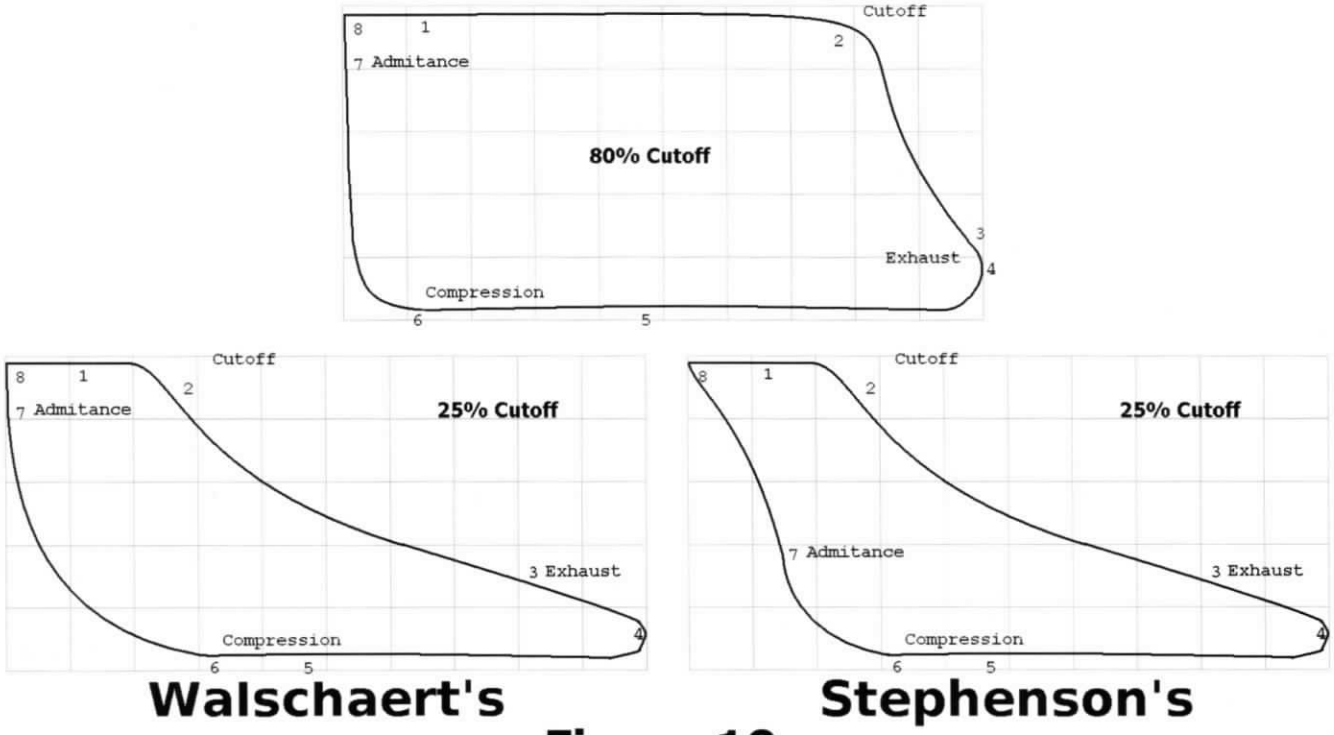



**Figure 19**

remaining steam pressure is lost up the stack.

At point "4", the piston reverses direction.

The exhaust remains open through point "5" as the piston traverses back through the middle of the cylinder

"Compression" begins at point "6" when the exhaust valve closes and the pressure starts to rise again,

At point "7", the steam port opens to begin the "Admittance" phase.

The piston reverses direction again at point "8" as the boiler pressure is again pushing on it.

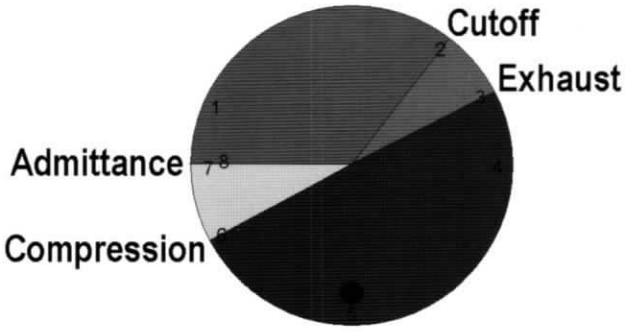
This brings us back to the arbitrary starting point ("1"), and the cycle repeats. In a double acting cylinder, the other end of the cylinder would have a similar diagram, only reversed left to right.

The top diagram in Figure 19 represents the pressure in the cylinder with the valve gear set to about 80% cutoff for both Stephenson's and Walschaert's valve gear. The other two diagrams show the differences when they are set to about 25% cutoff. Note that the major difference is the point where Admission occurs.

Figure 20 is a set of wheel position diagrams for both Stephenson's and Walschaert's valve gear showing the position of the drive pin for the major events when in full forward gear at 80% cutoff, and with the Reverser Lever "notched up" to set the gear to about 25% cutoff. The numbers in these diagrams are the same as the numbers in the indicator diagrams.

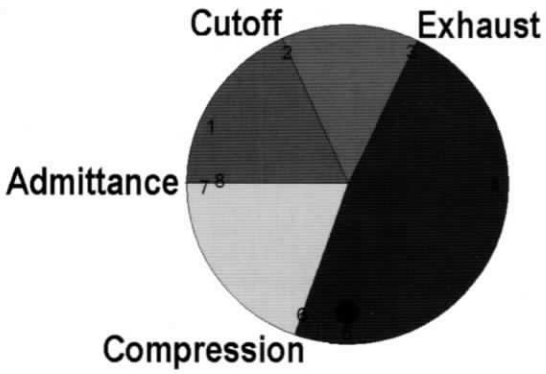
The same diagram can be used for both types of valve gear at 80% cutoff. At 25%, note the severe advance of the admission point for Stephenson's gear, and that with Walschaert's gear the advance has not changed. The advance changes because of the mixing of the two Eccentric angles at the Shifting Link with Stephenson's gear. However, it remains constant with Walschaert's gear because angle is fixed by the relative positions of the connections on the Combination Lever.

I have radio control on my Aster Mikados so I can control both the throttle and reverser lever while running. To start up, I set the gear in full forward and then open the throttle until the engine starts to move. This usually means opening the throttle completely. Once up to the desired speed, I then start backing off on the gear until it is nearly in the neutral position. I do not reduce the throttle unless the speed gets out of control or the drivers start slipping. In the run time afforded by one tank full of fuel, I notice a definite difference in the volume of water used, based on how I control the position of the reverser lever. If I run with the lever in full forward the whole time, I have to refill the tender tank at least three times, but if I

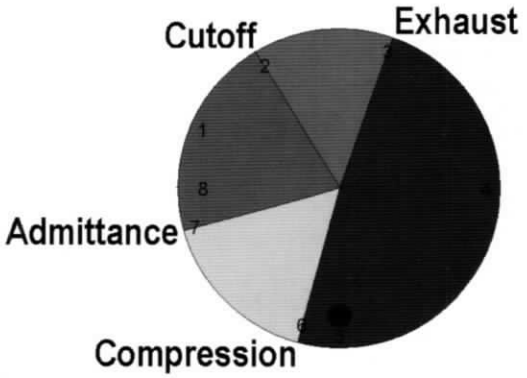



**80% Cutoff**

**Walschaert's**




**Stephenson's**




**25% Cutoff**

**Figure 20**

pay close attention to the use of the reverser lever, I can get away with refilling the tender only once! Although I do not have direct control over the flow of fuel into the alcohol burners, I can even extend the run time since less steam is blowing up the stack producing draft over the fire, thus reducing the rate of fuel burn. The run time can go from less than an hour to well over an hour and a quarter on just one tank of fuel.

Harry Wade in RPO Mailbag (Issue 88) brought up another advantage to the Slide Valve. Steam in the cylinder can condense back to water. Water is not compressible and if there is more water in the cylinder than there is room when the piston is at the end of the stroke, something has to give! In a full sized engine, this can mean the cylinder end cap is blown off, the piston rod or the main rod can bend, or the main drive pin can shear... all are bound to make the engineer a tad grumpy, even if he is still employed after the engine is towed back to the shops. Full sized engines with piston valves must have cylinder cocks (drain valves in each end of the cylinder) that can be opened to allow the water to escape until the cylinders warm enough such that little of the steam condenses, at which point they are closed so that the full pressure can be used to move the piston.

In miniature engines with piston valves, usually the engine locks-up or possibly the main rod flexes. Sometimes that flexing can become more or less permanent and the rod will need to be repaired or replaced. Miniature engines with piston valves can have enough clearance around the piston valve and the piston in the cylinder to allow water to escape past the seals. Of course, that clearance lets steam past also and is wasteful. Sometimes, manually forcing an engine to run in the opposite direction from the valve gear setting can force the water back into the steam pipes and the boiler to help clear the condition. But, this can bend or break things, especially with a Shay or other geared type engine! So, NEVER try to force a geared engine to move! It is much better to shift alternately into full forward and full reverse

many times to clear the cylinders. After a couple of cycles, you will get a quarter turn of the wheels and then after another couple of cycles, you will get a half turn. A few more cycles and the engine should continue to move in the desired direction, though maybe a bit jerky for the first few full turns of the wheels.

Because the Slide Valve is outside admission, it is held to its seat by the pressure of the incoming steam. If the pressure in the cylinder becomes greater than the steam, as would happen if the piston were squeezing a slug of water in the cylinder, the Slide can lift off its seat, allowing the water to pass to the exhaust pipes and up the stack... a condition known as "Slobber Stack". My Mikes can shoot water 3 or 4 feet above the engine and I have lots of shirts with little oily spots on them to prove it.

You may not be able to design valve gear at this point, but you should have a bit better idea of how and why valve gear does what it does. Now, tune up your locomotive's valve gear and put some vapor to work... no, strike that... put it to that indescribable joy of running a live steam locomotive!

Semper Vaporo!

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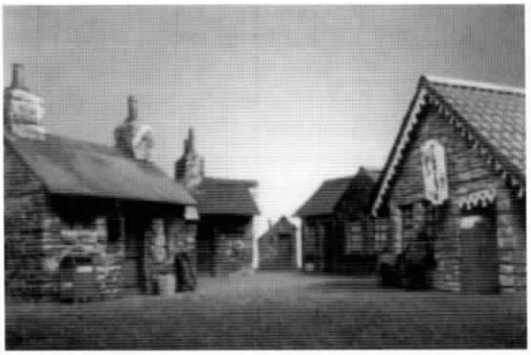

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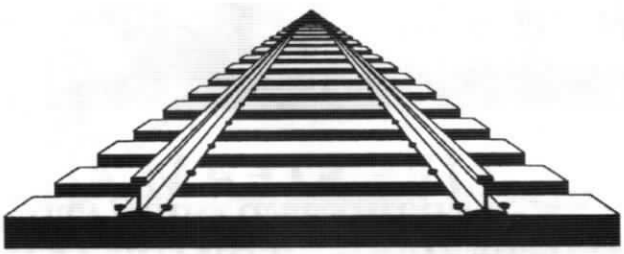

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**Outside rear cover photo:** Mt. Greta Railway Live Steam Locomotive #1, fresh from a major overhaul. Originally built in 1996 by Gordon Watson and recently overhauled and rebuilt by Ric Collins. Photo shows engine #1 with a local freight, stopped at the Skippers Cove Depot. Locomotive #1 is a 2 foot gauge, gas fired, 16mm scale, 2-6-0 operating on 32mm gauge track.

***photo by Ric Collins***

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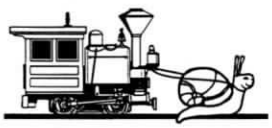

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