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STEAM IN THE GARDEN

Vol. 16, № 6
Issue № 90

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

Articles

Departments

FRONT COVER:

Carl Malone's 7/8 scale steamer chuffs through his Texas back yard. The coaches are filled with live steamers on their way to Diamondhead, Mississippi for the World's Largest Small Scale Live Steam Convention.
photo by Carl Malone

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Steam in the Garden (USPS 011-885, ISSN 1078-859x) is published bimonthly for $33.00 ($42.00 Canadian or overseas) per year (6 issues) by Steam in the Garden, PO Box 335, 6629 SR 38, Newark Valley NY 13811. New subscriptions please allow 6 - 8 weeks for delivery (overseas via surface mail may take longer). Direct correspondence to PO Box 335, Newark Valley NY 13811. Periodicals postage paid at Newark Valley, NY and additional mailing offices.

POSTMASTER: send form 3579 to Steam in the Garden, P0 Box 335, Newark Valley, NY 13811. Printed in USA.

USA, Canadian and overseas subscriptions may be sent to Steam in the Garden, PO Box 335, Newark Valley NY 13811. Phone, fax and e-mail subscriptions gladly accepted. We accept VISA, Discover and MasterCard. ***We also accept PayPal.***

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CALENDAR OF EVENTS

Southern California Steamers - contact Sonny Wizelman for dates, places and any other pertinent information. 310-558-4872 ● sonnyw04@comcast.net

January 12 to 14, 2007 - International Small Scale Steamup and Arts Festival - 2006/2007, Diamondhead Resort, Diamondhead, Mississippi. JERRY RESHEW 5411 Diamondhead Drive East, Diamondhead, MS 39525 - Phone / Fax (228) 255-1747 - email reshew_j@bellsouth.net DIAMONDHEAD RESORT - (888) 707-1300 or (228) 255-1300 or FAX (228) 255-9848 -- DIAMONDHEAD COMFORT INN - (800) 228-5150 or (228) 586-0210 or FAX (228) 586-0223. FOR MORE INFORMATION, VISIT THE WEB SITE AT: http://www.diamondhead.org/

February 17-19, 2007 - 10th Annual President's Day Weekend Meet, Electric City Trolley Station & Museum at Steamtown National Historic Site Grounds, Scranton, Pennsylvania. 9 a.m. to 4 p.m. Live Steam, electric G scale and other assorted large gauges. 20 ft. X 50 ft. dual gauge 2-track loop for live steam. Sponsored by Pennsylvania Garden Railway Society, Warrior Run Loco Works and Aickenback Live Steamers. For more info on this event and local accomodations, call Clem O'Jevich, Jr. (570) 735-5570 or e-mail wrunloco@aol.com

Because of publication lead time, please send info for Calendar of Events well in advance. Include name of host and location of event, with address and/or phone number to contact for complete information. Some basic info about the site is also useful (i.e., ground level or elevated, minimum curve radius, ruling grade, etc.)

WHAT'S NEW?

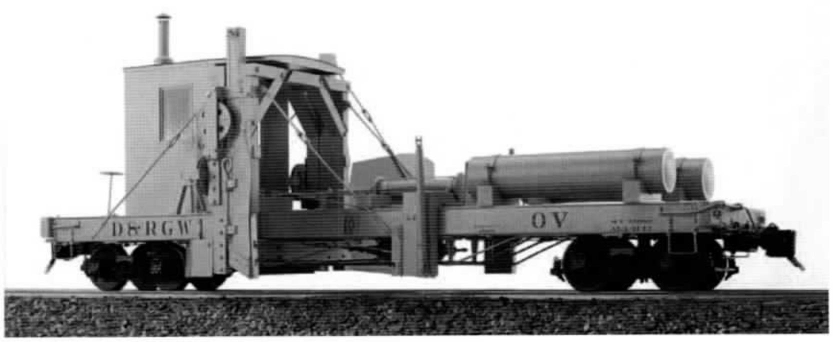
ANNOUNCING A NEW LIVE STEAM VIDEO - "VIC SHATTOCK STEAM TRAINS"

A historical look back at the first thirty years of Vic Shattock's involvement with the Live Steam locomotive building hobby in the San Francisco Bay Area. Covers the following general subjects: Vic's 1⁄2" scale basement railroad (the birthplace of the Golden Gate Live Steamers) - Loren Thacker's 1⁄2" scale live steam outdoor layout (1st outdoor GGLS operation) - Golden Spike Ceremony –Redwood Regional Park—Oakland—Sept.1950 - Brotherhood of Live Steamers Meet—Redwood Regional Park-Oakland-Sept.1951 - Plus plenty of great "high track" action in 1⁄2, 3⁄4 and 1 inch scales thru 1966 . See many long-deceased members having a great time with Live Steam. It's all there for you and your friends to enjoy for many years to come ! Don't miss out on this historic opportunity ! Get a copy today !

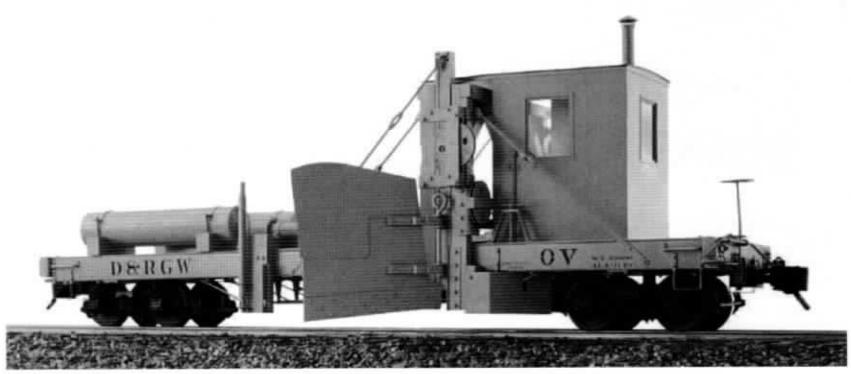
"VIC SHATTOCK STEAM TRAINS" - DVD format – B&W//Color—Running Time 2 hours - Music//Narration Cost $ 20.00 (includes shipping) - Order from: KEN SHATTOCK, 34312- 31st Avenue, SW, Federal Way, WA 98023—7634 - E-Mail: sp2422@earthlink.net or keyrouteken@msn.com

Accucraft announces the following new releases..... D&SP #191 2-8-0 Locomotive, both Live Steam and Electric and the D&RGW OV Spreader. The estimated delivery date for the D&SP #191 2-8-0 Locomotive and the D&RGW OV Spreader is currently set for Fall of 2007.

The D&SP 191 2-8-0 is built to 1:20.3 scale, 45mm gauge and is based on the popular D&RGW C-16 design. The chassis is constructed from brass and stainless steel. All valve gears, drive rods and wheels are machined from stainless steel.



The D&RGW OV Spreader is also built to 1:20.3 scale and 45mm gauge. The production run will be limited to 250 units.



Accucraft UK Ltd. EDRIG
by Mike Simpson

Beginning with Ruby, Accucraft has built a variety of worthy steam locomotives at very competitive prices. A downside is that language, distance, and culture put Accucraft a bit out of touch with the steaming public.

In 2004, the problem was alleviated for fans of British engines, when Ian and Sandy Pearse incorporated Accucraft UK Ltd. Mr. Pearse has built and sold railway models for a number of years, including the Nevada and Colorado live steam moguls.

Accucraft UK is the British importer for Accucraft and contracts with Accucraft in China for the manufacture of British live steam and electric model locomotives. Accucraft UK does initial design work and provides comprehensive requirements and specifications. Accucraft completes the design work and produces the locomotives. Accucraft UK products are available through Accucraft dealers in the United States. I bought Edrig from Royce at Quisenberry, who gave his usual good service and price.

"The name Edrig comes from a late Anglo Saxon/ Norman Chieftain who lived in our local area of the

Welsh Marches. He was also known as 'Wild Edrig', a little man with a big heart, rather like the engine. Although unlike the engine, Wild Edrig was also partial to a bit of cross border raiding and pillaging!"

Edrig is a freelance model of an open side-tank locomotive "with design inspirations from Hunslet." The chassis and running gear are the same as on Caradoc and Mortimer, but they have cabs, fancier bodywork, and prices about a third higher. Edrig is the base model in the Accucraft UK line.

This said, Edrig is a lot more engine than Ruby, with nearly twice the weight, three times the boiler capacity, and half-inch diameter cylinders. Lubricator drain, water level tap, superheater line, pressure gauge, and regaugeable wheels are standard. Color choices are dark green and maroon.

My Edrig is maroon, with black chassis, tank tops, smoke box, and cylinders. The cab is open, with a front wall and brass spectacle rings. A decorative (fake) whistle is mounted on the front of the cab wall. Nicely detailed hatches set off the side tanks. Boiler adornments include a cylindrical safety valve set for 60 psi, a brass dome, brass boiler bands, and a copper cap on the chimney (stack). With outside frames, lots of parts and motion are visible below the floor plates.

From left to right, the cab features gas regulator, water level take off, steam regulator, boiler filler cap, pressure gauge, lubricator, and reversing lever. The cab is well-laid out, with good access. The rectangular gas tank is mostly inside the left side tank. The right side tank could hold an R/C receiver. The pressure gauge needs repositioning, as it faces out one of the spectacles. The regulator knobs and boiler filler cap are plastic for insulation, but might be replaced for appearance. An open cab like this one really needs a driver.

The details:

General: Open cab, free-lance 0-4-0 with side tanks and outside frames. Generic quarry engine. Insulated wheels. Sold manually controlled but R/C adaptable.

Boiler: Internally gas-fired with single flue. 290 ml total capacity, approx. 250 ml useful capacity. Pressure tested to 150 psi. Rated to work up to 60 psi, the safety valve setting. Opening smokebox door. Stainless steel superheater tube.

Cylinders: Two fixed 1/2" bore cylinders with 3/4" stroke. Fitted with piston valves.

Valve gear: Simulated Stephenson link, piston reverse valve.

Scale and gauge: 1:19. Adjustable from Gauge 1 to Gauge 0, using Allen wrench (included), with settings marked by dimples on axles.

Minimum radius: Two feet.

Dimensions: 10 1/4" long x 4 1/2" high x 6 1/4" tall at chimney. Weight 6 lbs. 5 oz.

Cylinders are the heart of an engine. A larger bore produces more power and a wider power band, so that the engine is controllable over a wider range of speeds and loads. Edrig's half inch diameter cylinders have a bore area of 0.1963 inches, 80% more than Ruby's 3/8 inch cylinders and only 20% less than Roundhouse's 9/16 inch cylinders.

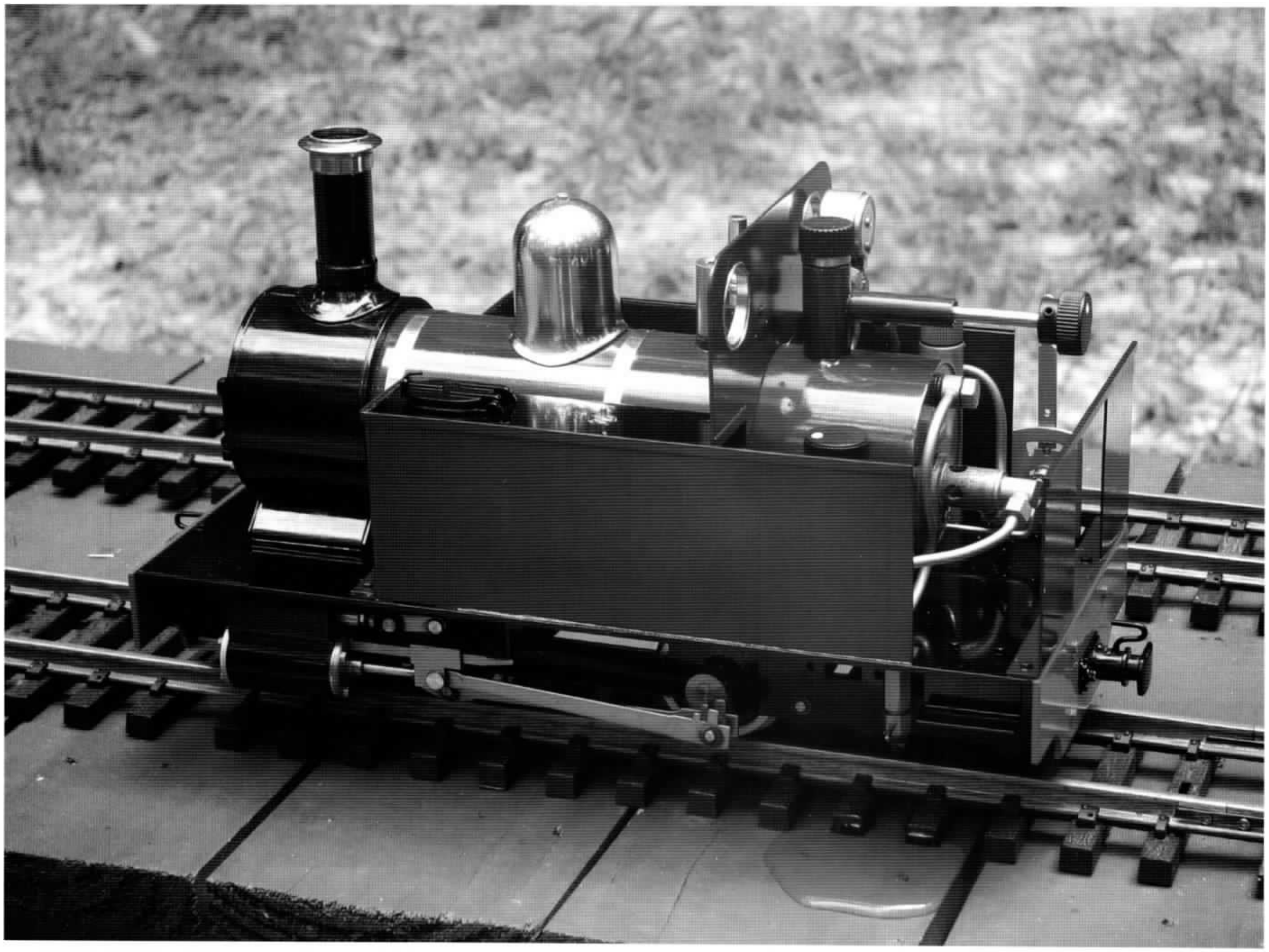
You may ignore the calculations and look to the running. Edrig happily pulls twelve four-wheel AMS ore cars and a bobber caboose, a prototypical load. With this load and low regulator settings, you easily find the high spots in a track, where the engine slows and begins to chant "I think I can . . ."

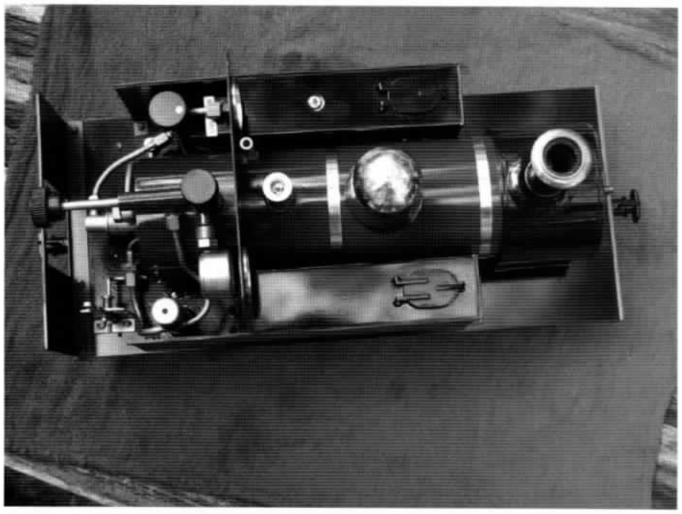
Preparations are slightly different from other engines. The gas filler valve comes through the top of the left-side tank. Since the force is on the edge of the engine, be sure not to tip it or to let the gas nozzle slip off and scratch the top of the tank.

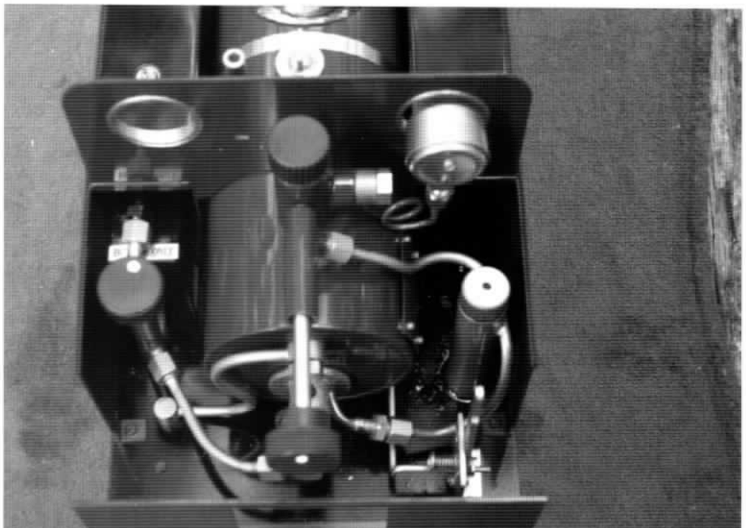
Mr. Pearse advises against over-oiling, to avoid wear from dirt in the parts. A soft rag or old towel cushions the stack and the top of the cab wall. Support with one hand and oil with the other. Lots of moving parts are visible on the underside.

If you blew out the lubricator after the last run, remove the cap and fill with steam oil to slightly above the weep hole. If not, use the supplied T-handle wrench to open the drain, located below the floor plate on the right side. Close the drain and fill the lubricator. (At the end of a run, put a rag or paper towel under the drain and open it. Residual steam will empty the lubricator when you open the throttle.)

Caution. The wrench is a mini-cheater bar, offering great leverage. You can damage the drain and cause drips by over-tightening. Use a light touch, only as much as needed to close it. I have seen web posts from steamers with damaged lubricator drains and water level taps, who now must leave them permanently closed.







Open the water level tap under the left-side floor plate. Same wrench, same caution. Remove the cap from the tube on top of the boiler, inside the cab. Add distilled water until it runs out the tap. Replace the cap, but leave the tap open.

Open the smokebox door. Apply flame as you open the gas valve. Sometimes gas enters the burner while still liquid, causing irregular burning. This can be addressed by letting the gas run for 20 or 30 seconds before lighting. Keep your eyebrows out of the fire.

As water heats, it expands and flows out the water level tap. Once steam pours out, close the tap. You will now see that the wrench is not for leverage, but to avoid burnt fingers.

Let pressure rise to 20 lbs. or so. (Mr. Pearse says 40 psi, but I haven't had that much patience. I mostly run Edrig between 15 and 20 psi.) Shift into gear, then reverse it a time or two. Because the water level is precisely set and because you start with a full boil, there is relatively little sputtering and cylinder clearing. (I drop a closed tube with an insulator over the top of the chuff pipe to divert the spatter.)

Hook up your cars and let the good times roll! I have run Edrig, comfortably under control, on two foot radius track, but he is happier with a larger radius. Without a load, on ten foot radius, Edrig ran for 17 minutes with 135 ml. of water left in the boiler. And then I started extending the run.

Caution. Mr. Pearse tells you not to add gas without adding lubricator oil and water. This engine runs out of gas well before water. If you don't follow his instructions, you could run out of water first and de-solder your boiler. No one – neither the manufacturer, the editor of this magazine, nor yours truly – will fix or replace your engine if you break it.

First, I tried more gas. I turned off the gas when I closed the water level tap, topped off the gas, and relit. This gave me a 24 and 2/3 minute run. You heat a shrinking amount of near boiling water at the end, so a little gas goes a long way.

Next, I ran in reverse, after topping off the gas. Like other Accucraft piston valve engines, Edrig is set up for outside admission in forward, so that he runs better and more efficiently in reverse. On two foot radius, Edrig ran 27 minutes, 10% better than in forward. It will be worth both reversing the admissions and checking to be sure that the reversing lever is properly adjusted (so that the "neutral" position is actually neutral).

Ruby suffers from a combination of burner and boiler design that in some examples produces a shrieking howl. Edrig's burner made a loud rushing noise, but not the dreaded shriek. I pulled Edrig's burner and found that it was the same as Ruby's, but without the screen sleeve. My friend, Sal Martocci, wrapped the burner with stainless steel mesh and replaced it. Edrig now ran noticeably quieter. He also ran for 29 minutes in forward, nearly 20% better than before, with about 30 ml of water left at the end.

These results are affected by factors such as ambient temperature and whether the engine is already hot. Last night, on a cool evening and starting with a cold engine, I got a 26 minute run with more than 100 ml of water and some lubricator oil left. I will continue to disobey the instructions, but only with caution and a Goodall valve. (Sorry, Mr. Pearse.)

My Edrig has some minor flaws. One spectacle ring is slightly cocked. I see it but a casual observer would not. There is a slight over-spray, of the maroon paint onto the black tank tops. Again, it is noticeable only on close inspection. One of the E clips, at the end of one of the under-side bars, came off. I spotted the loose clip while oiling, so it was easily replaced and squeezed tight.

Edrig is a bit fast for an industrial locomotive, but not bad for a preservation engine pulling tourist trains. With low gas and steam settings, he runs at a scale 25 to 30 mph. Speeds should drop as parts work in.

I am likely to make some additions to Edrig. Milton Locomotive Works offers a nice safety valve cover and a coal basket to mount on the side tank. A set of permanently open doors would set off the back wall of the cab. A handrail, mounted on the tanks and curving in front of the smokebox, would let a helper ride the front plate in relative safety. Wooden dumb buffers would mimic those in old Hunslet photos and let me pick up a hot Edrig without pain. Maybe I'll just let the driver decide how to fit out the engine.

Edrig is a very satisfying engine, with a chunky, plausible appearance. While he is relatively plain, there is sufficient detail to keep your eyes occupied, particularly with the engine in motion. Controls are accessible and intuitive. He pulls a good sized train at reasonable speeds for a fair amount of time. Definitely good value and good fun.

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Live Steam, Coal Smoke and Sushi

by Hans Huwyler
photos by Michio Shinbori and Hans Huwyler

During my annual visits to the Aster Factory in Yokohama, Japan I have had the good fortune to be invited to visit different live steam clubs and experience first hand how this hobby is being played on the other side of the planet. Being illiterate in the Japanese language warrants an interpreter and tour guide at all times to find your way through the densely populated Metropolitan area of Tokyo and Yokohama, no matter if traveling by train, car or on foot. My escorts to all of these club activities where either by Toyoki Inoue, Satoshi Tamada and Yasuko Yamamoto, all of them great hosts and employees of Aster Hobby Co. Inc.

Many of us live steamers here in the U.S.A. have our private backyard, sizeable enough to build an elevated track or on the ground garden railroad. In the surrounding area of Tokyo this situation can be very rare indeed and only a few live steamers can boast having their own railroad. Some live steamers residing in high rise apartments or condominiums may even resort to laying a circle of track on their balcony or rooftop to fire a small locomotive when the urge strikes. Nevertheless, running trains in such confinement is not necessarily much fun and deprives one of the social aspects.

Mr. Kanda (rear left), Mr. Iwaoka (baseball cap), Mr. Tamada (center left), Mr. Hosono (front left), and Mr. Shinbori (front right)

Luckily, owners of larger layouts form private clubs where one can become a member by invitation and run steam locomotives with other like minded friends. Some live steamers join more than one club to increase their chances of steaming activities. A membership fee is charged by the track owner to help cover operating expenses. Most clubs have a gathering once every month. One of my most memorable experiences has been my 3rd visit to the Kichijoji Kitaura Railroad Club. Here, the social aspect is as important as running trains. Everything is well orchestrated and as a member you arrive at a precisely arranged time. All members assist with setting up tables, tents, chairs and getting the track ready. Wooden planking is temporarily laid on the infield to protect the lawn from being trampled. Nobody runs anything until the setup is completed. The operating hours are rather limited (from 10 AM until 3 PM) and strictly adhered to, respecting the owner's private family life.

The owner, Mr. Takahashi, has constructed his elevated layout consisting of 4 mainline tracks with a walk over bridge to the inside where most of the activities take place. Servicing and steaming up of smaller locomotives is performed on folding tables. The engines are then carried to the mainline for running. One would expect mostly JNR prototype locomotives in operation. However, the Japanese live steamer seems to like diversification and to my amazement many nations were represented, including an array of locomotives from small Rubys to big Alleghenies. Mr. Suzuki, a real talent and innovator many of us have read about, is a regular at these meetings. Popular creations by Mr. Wada such as a Union Pacific GP9 diesel and "Burlington Zephyr" are covering the surroundings with a haze of blue smoke. Another great model engineering talent, Mr. Kazuo Yano, is a member of this club, operating several of his fantastic scratch built engines.

To increase the pulling load of your Allegheny, Big Boy or Berk-

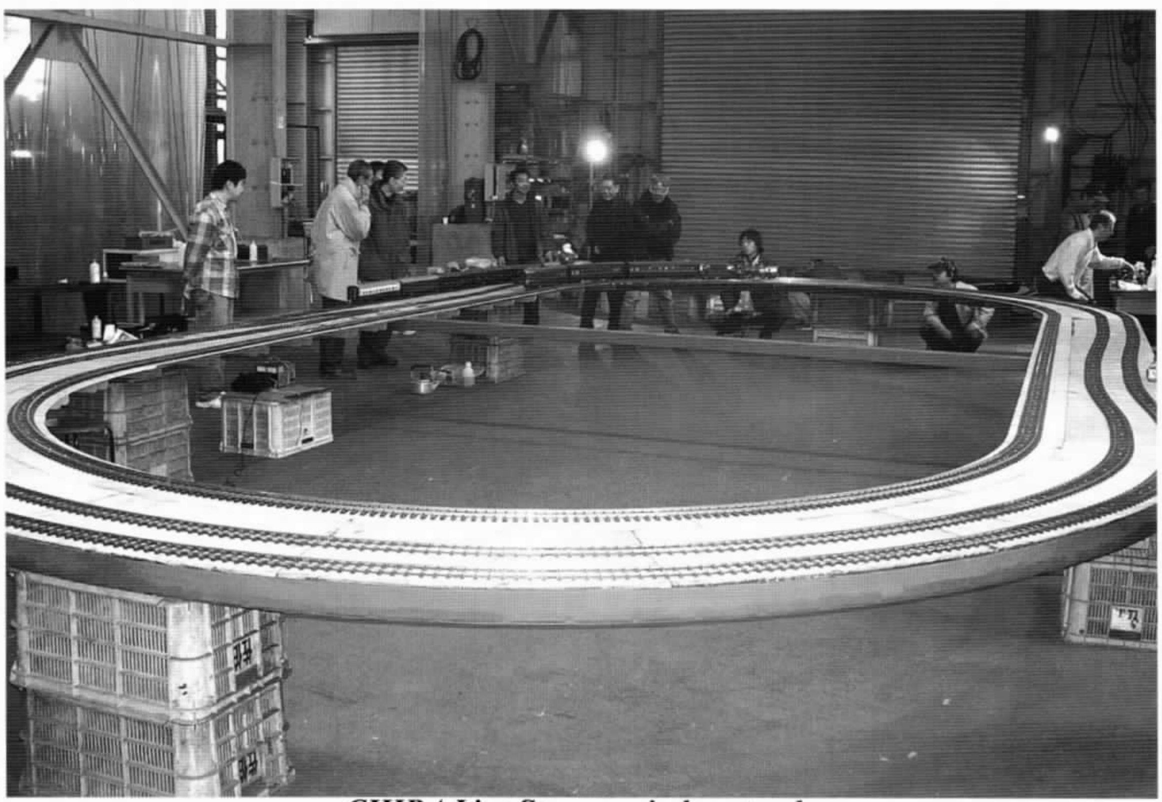
Hans Huwyler looks on as Mr. H. Harada and Mr. K. Itabashi doublehead their Aster H8 Alleghenies. The separate track on the inside of the layout is for electrically powered locomotives.

Master builder Mr. Kazuo Yano with his beautiful scratch built, alcohol fired Chinese Railroad class QJ 2-10-2, modeled in 1:30 scale.

Lunch at the Kichijoji Kitaura RR club is no small feat, as is evident by the fine food layout on the table. From left to right: Mr. Z. Struzik, Hans Huwyler, Mr. K. Takahashi (host), Miss Yamamoto (Aster).

shire, it seems customary to couple up and deadhead "your other locomotive" (or that of your friend). Long freight trains with 40 plus cars are not very common in these suburb settings and "inertia cars" may not be a popular substitute.

When visiting Japanese railroad clubs one should be sufficiently equipped with business cards since the traditional "Meshi" or exchange of cards is an important part of your introduction and also must be conducted in a proper and respectable way. Of course it helps identifying names of the many club members, who are very friendly and eager to find out more about your visit and involvement in live steam.



CHIBA Live Steamers indoor track.

Many Japanese speak sufficient English to carry on a "hands involved" conversation. Of course the accompanying interpreter should always be present to help out in these situations. When visiting Japan, "cultural mistakes" are almost inevitable. However, the people I have met are very gracious hosts and appreciative to foreigners making an effort to sample the Japanese way of life and traditions.

Members and visitors of the CHIBA live steam club pose for a group photo.

Test running the Aster BR 52. Left to right: Mr. S. Tamada, Aster Hobby Co. Inc.; Mr. M. Itoh, owner of the YLSC; Hans Huwyler, Aster Hobby USA LLC.

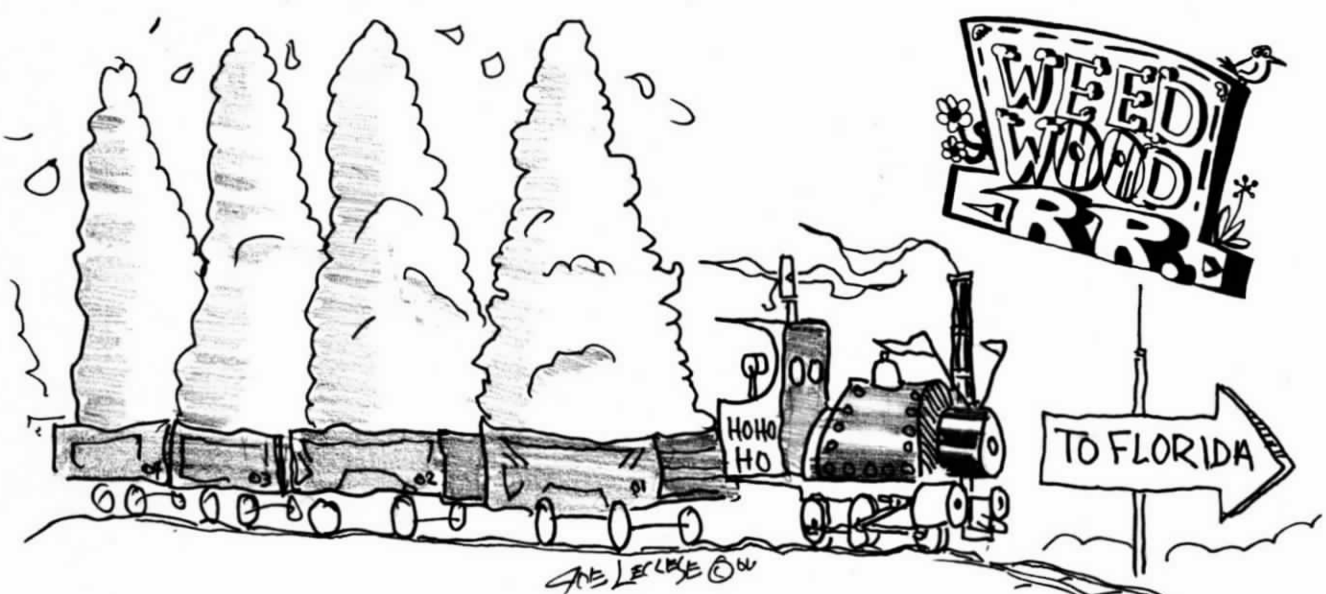
In commemoration of my third visit, which took place in September 2005, the host Mr. Takahashi and the club members arranged a surprise party, which was a most memorable experience for me. The food presentation was outstanding, covering everything from traditional Ramen dishes to Sushi delicacies and fine desserts. Thanks to everyone of the Kichijoji RR Club and also to Mrs. Takahashi for the fantastic hospitality.

In the case of the CHIBA live steamers, the members meet inside the factory building of the owner Mr. Saeki. The large track oval is mounted on plywood installed on a steel substructure, which when not in use is stored vertically against the factory wall. On operating days, this structure is simply lifted from its resting-place with the overhead gantry crane and lowered onto plastic containers to form an elevated railway. The Chiba live steamers operate one Saturday every month. My visit to Chiba took place on a cold and rainy December day. Kerosene heaters were in use to cut the chill and yes, they served hot coffee and donuts. The weather is definitely not an issue for this indoor operation.

As can be seen from all 3 Railroad clubs visited, the elevated tracks are much lower to the ground than most of us are accustomed to. This makes bending over, crouching or kneeling necessary to do whatever needs to be done to get your locomotive going. The reason for this low to the ground operation has remained unexplained to me. But then why do you sit on the floor on very low tables in many Japanese Restaurants? The great physical shape most of these "elderly" live steamers are in may not necessitate a comfortable waist high layout.

The oldest and most talked about Gauge One Railroad in that area of Japan must be the Yokohama Live Steam Club. Situated fairly close to the Aster factory it is located in a residential section of the outskirts of Yokohama and owned and operated by Mr. & Mrs. Masahito Itoh. I had the opportunity to see this layout on a private visit and test run the BR52 together with Tama-San from Aster. The track is partially elevated and partially on ground level. The elevated main section, situated in the front yard of the house, features multiple tracks and sidings for steaming up. A single track circles around the entire house on ground level and emerges into the front yard section, through a patio covered with Persimmon trees. A very unusual situation that deserves mention is the visibility of this track to public traffic. Bordering the sidewalk of a public street without a significant fence or protection for privacy, no theft or vandalism has ever been experienced by the owner. During my visit, pedestrians on the sidewalk respected the privacy of the owner and reluctantly glimpsed at the live steam activities. Minding your own business seems to be a strong virtue among the Japanese population.

Small scale live steam in Japan seems to be a fairly popular hobby. Maybe the exposure to real trains on a daily basis by a huge percentage of the population coupled with lots of nostalgia, tradition and a strong economy is driving the hobby? Whatever it may be, the Japanese live steamers I have met are a most friendly and enthusiastic group to associate with. Language barrier aside, the locomotives and steam action speak for themselves and I hope I will be able to savor more of it very soon.



Snow Train 100 Car Special

Loco Cradle

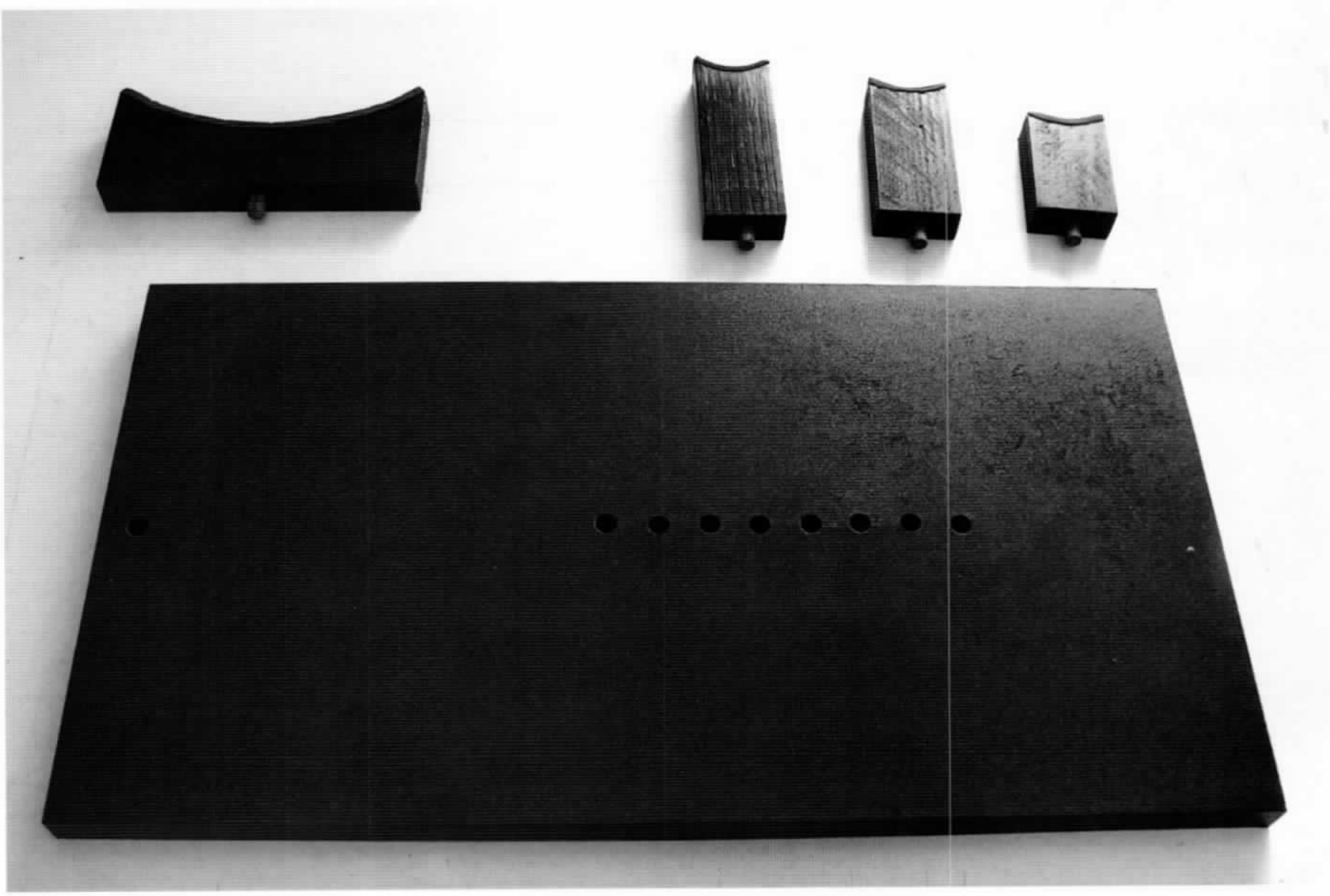
by Bert Horner

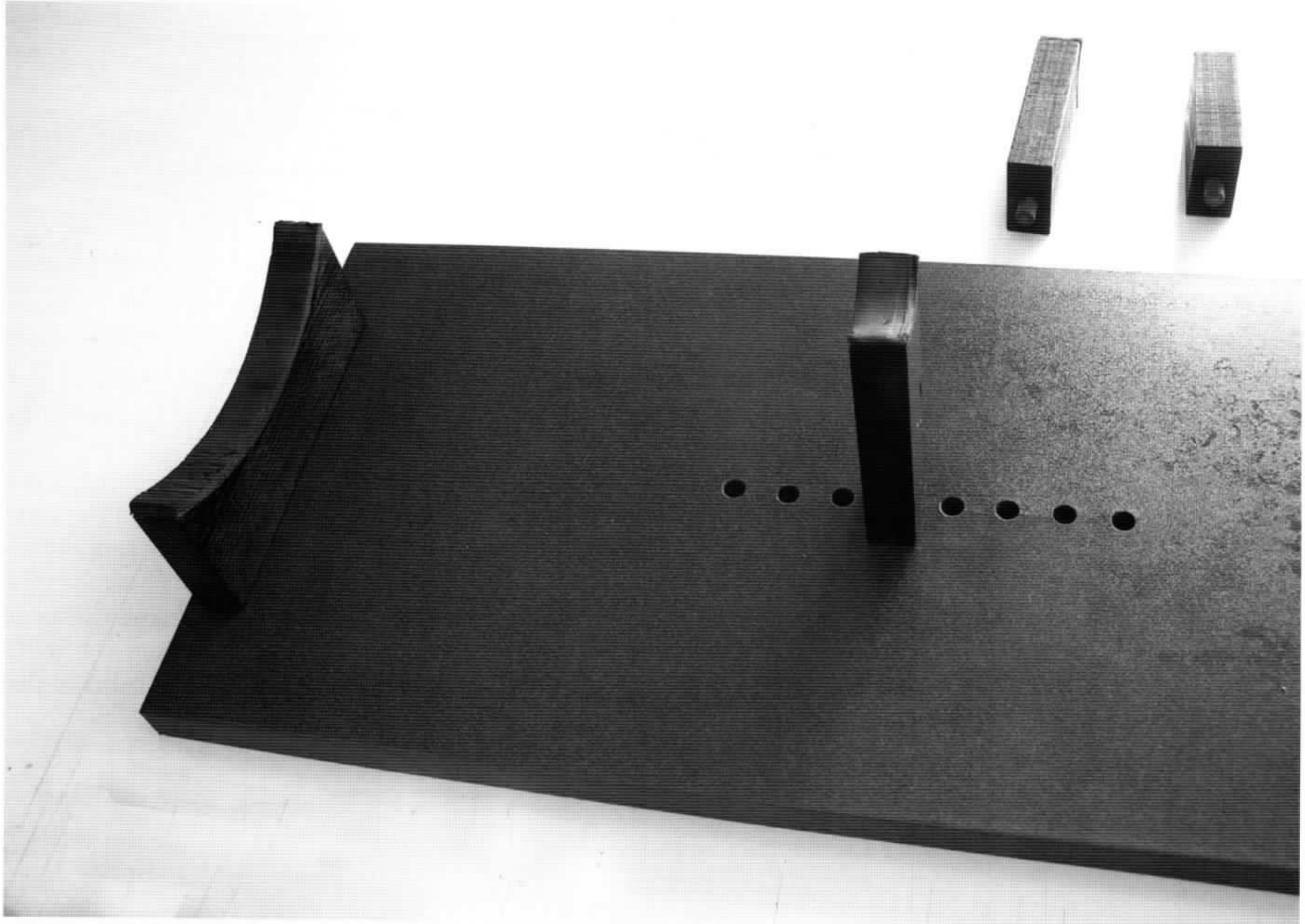
An easy to make, useful tool for maintaining and servicing our steamers

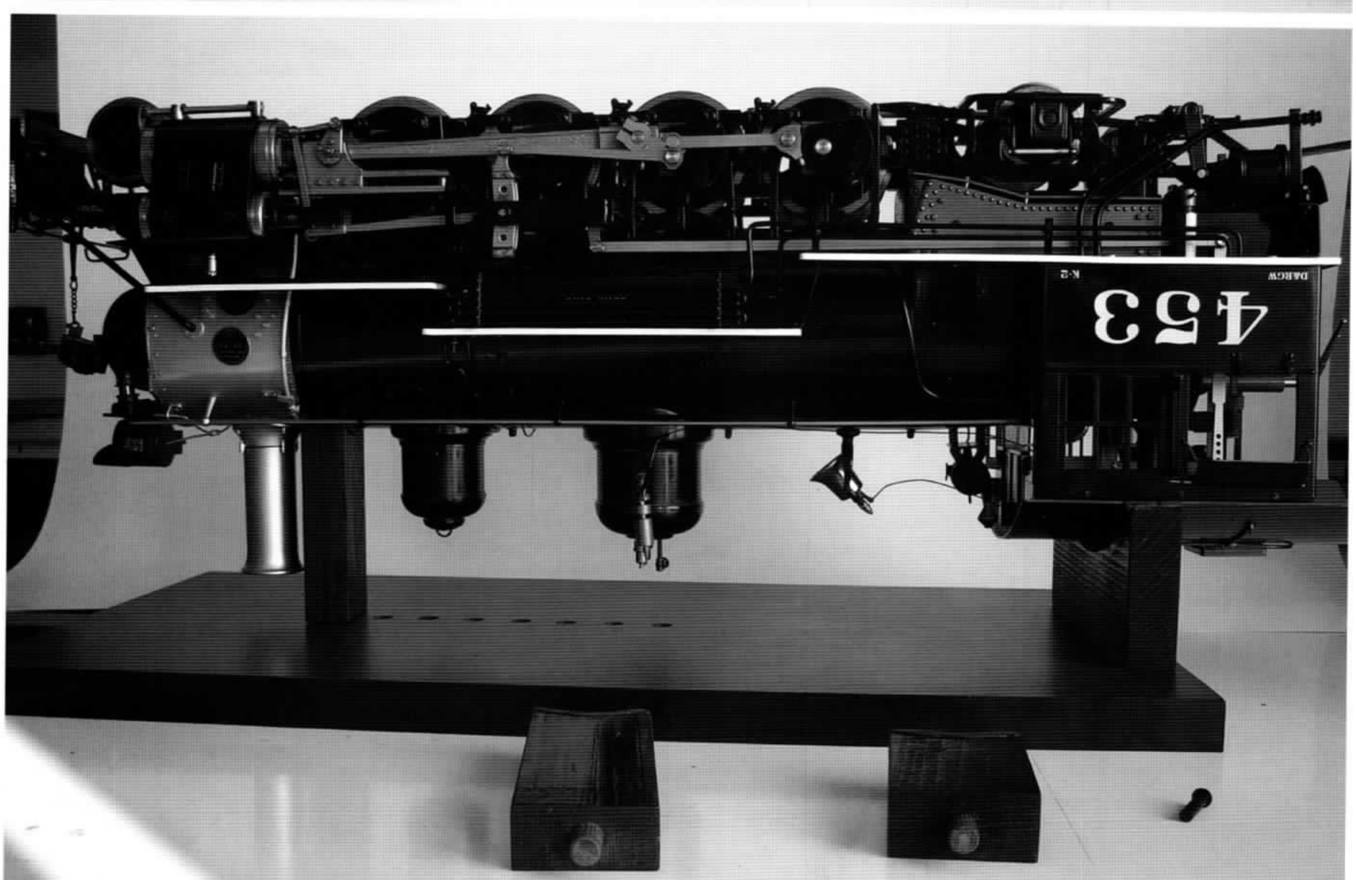
This loco cradle is easy to make and holds all of our engines from Accucraft K-27 down to the little ones. Our loco cradle will hold a loco safely upside down for oiling those inside running parts.

The vertical ribs are pegged into the holes. A good fit. The large radius rib is to support the cab roof. The smaller ones at different lengths support the boiler at any given distance from the cab. They are about three quarters of an inch thick by approximately two inches, and the rounded tops are covered in soft rubber (non absorbent). These can find a space between domes, bells, etc. to support the boiler. It is not rocket technology but it works and you can leave a loco upside down for hours without danger of it rolling over and onto the floor.

The cradle is made of plastic coated chipboard which can be cleaned with a cloth after use. The closer together you drill the holes the finer the adjustment, but you can usually move the cab roof a little forward or backwards on the support. The different heights of the ribs accept differing heights between cab roofs and boilers. Make sure that the boiler support fits between any handrails!!



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A Class A Climax Locomotive

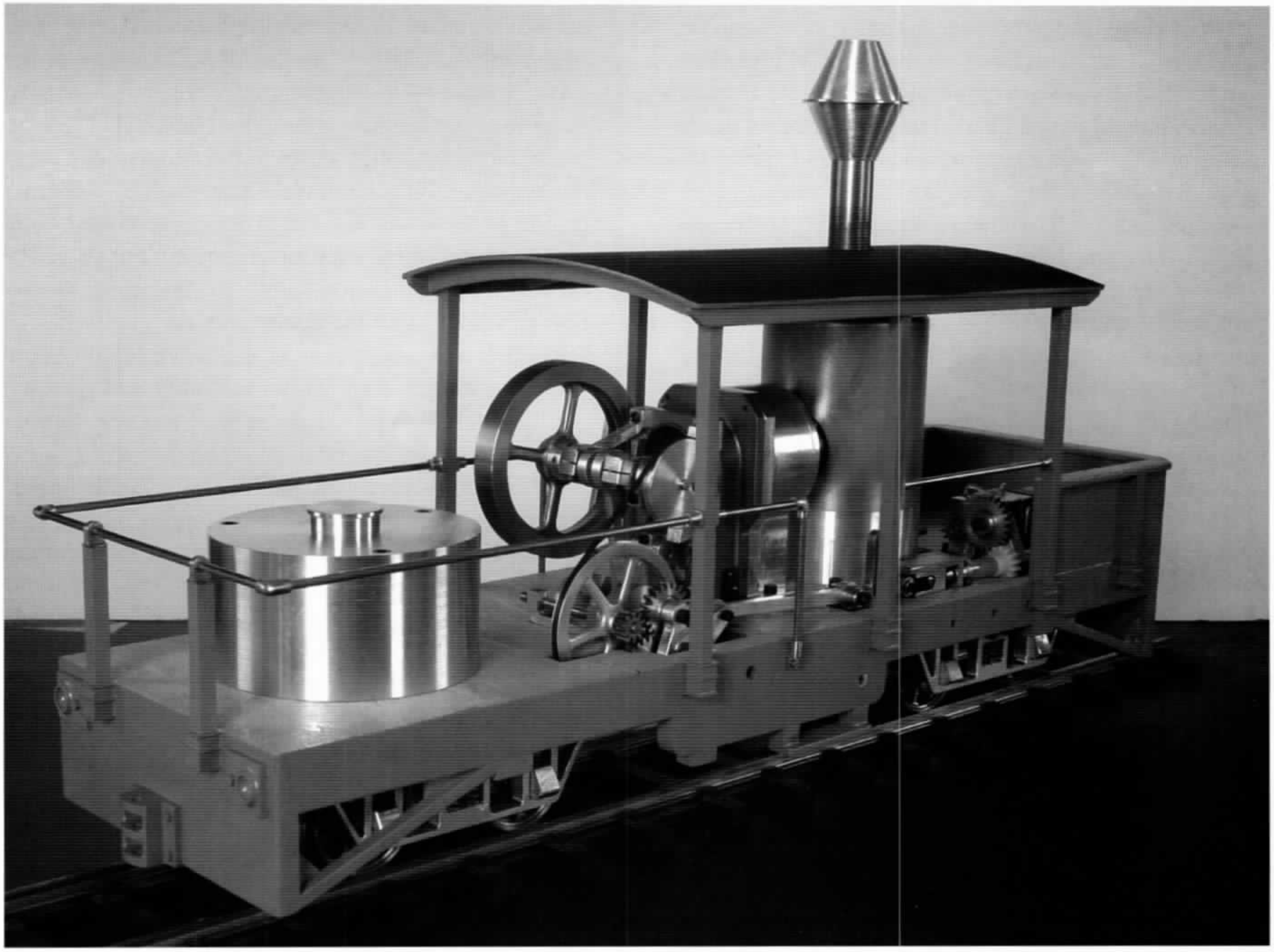
by Andy Ross

Outstanding craftsmanship and a different approach to power

I've been interested in the class A Climax logging locomotives for a long time, but could never find enough information to adequately model one until I discovered ***The Climax Locomotive*** six months ago. This magnificent 497 page volume, published by Oso in Hamilton, Montana, is a treasure of rare and wonderful photos, authoritative history, first-hand accounts, technical details, drawings, and much more.

It wasn't long before I decided to make a gauge 1 model of the 13-ton open-cabin class A built for the "Judge Lewis Railroad" in Clay County, West Virginia, as shown in an intriguing photo on page 72 of the book.

Although I have made various live steam engines over the years, I have a special affection for the Stirling engine, and decided that my class A would be Stirling-powered. Four years ago I completed a gauge 1 model of a four wheel Swiss rail car that was



Too wide, too low and too unrealistic: the first version of my Class A Climax.

powered by an alcohol-fired Stirling engine for long runs, and by compressed air supplied to its steam engines for short demonstration runs (Modeltec magazine, March-April 2002). Now I wanted to revisit the Stirling-powered locomotive idea, this time incorporating a gearbox to provide forward, idle, and reverse, with remote control through the track. The aim was to create an unusual, attractive, and practical fire-driven locomotive for a garden railway.

It seemed reasonable to begin with the trucks, since all the other parts rest upon them. I started with some wheels and axles from Hartford Products, then re-machined the wheels' contours and milled out sixty-four little spokes. How to drive those wheels became the next challenge. Climax used driveshafts located along the locomotive's center-line to transmit power from the marine-style steam engine to the trucks. These driveshafts passed over the axles, driving them with skew gears, which are similar to bevel gears except their shafts are not in the same plane. As I could find no source for such gears, I used stock bevel gears in combination with a pair of helical gears to raise the input shafts above the axles. By locating these gears on the outboard ends of the trucks, the driveshaft connection for each truck could be located immediately below the swivel joint for that truck, minimizing both lateral and fore and aft driveshaft motion. The "universal" joints here are simply lengths of silicone rubber model airplane fuel line fitted over the shafts. The two remaining axles are driven by small plastic sprockets and chain from the gear-driven axles. All axles are sprung independently.

A simpler approach to all-wheel drive would omit powering the trucks' second axles, but rather let those axles float with very light springs, so essentially all the machine's weight would be borne by the two driven axles. The resulting cantilevered forces on the truck bolsters would need to be addressed, of course, but the trucks would be significantly easier to make.

The transmission of power from the Stirling engine to the trucks is as follows: A standard rubber O-ring transmits power from a pulley on the engine to a larger pulley on a countershaft. This is a high speed, low torque connection, and there has been no sign of any slippage. The countershaft has a small brass pinion gear, which is the heart of the gear shift mechanism. Below this pinion is a pivoting yoke, containing a train of three brass idler gears. The top two of these gears are located so that one, or the other, or neither, will engage with the countershaft pinion as the yoke is pivoted to and fro on an axle concentric with its bottom (third) gear. This is the same arrangement used on many lathes to provide forward, reverse and neutral to the lead screw. In my model, one more gear provides further speed reduction, and drives a set of miter gears which turn the power 90 degrees to align with the driveshafts. It is here that the true universal joints are used. They are of the simplest type, merely a cup with a slot engaging a ball with a pin. These allow for any fore and aft, and angular, movement of the drive-shafts.

The gears are shifted from forward to neutral to reverse and back by means of a small motor and reduction drive unit (a hobby shop item) connected to a screwjack by yet more silicone rubber fuel line, which provides a necessary high-torque slip clutch for the drive. The pivoting yoke needs firm stops to prevent its gears from being driven too far into the countershaft pinion. These are provided by routing the yoke's drive linkage through a steel lever with adjustable steel stops. But the overall rigidity of the drive system would occasionally force the shifting gears together on their outer diameters, rather than in mesh, thereby greatly increasing friction and stalling the engine. Filing the mating gear teeth to a sharper profile, so there would be less likelihood of their outer diameters colliding, minimized but did not solve the problem. Putting a stiff spring (in this case, an oxbow machined into the connecting rod) between the screwjack and the stop lever *did* solve the problem. The transmission now works smoothly and reliably; but as with the trucks, I do believe a much simpler and more elegant approach could be devised.

The controller for this shifter is a handheld battery box with a reversing switch and a button, and two leads that are attached to the track. The button controls when the current can flow to the servo motor in the locomotive, and the reversing switch controls which way the motor (and therefore the shift linkage) moves. Idle is between the stops of forward and reverse, and it requires a fairly deft finger on the button to stop the shift linkage during the brief time when neither gear is engaged with the pinion. Forward and reverse are easy to engage by merely driving the mechanism to its stops, whereupon the slip clutch lets the motor continue to turn until the operator removes his finger from the button.

The Stirling engine is quite similar to the one I made for the Swiss railcar. It is a two piston (or alpha) type Stirling, in which the pistons are linked together so the motion of one leads that of the other by 90 crankshaft degrees. They move in separate parallel cylinders that are connected together by a long annular passage that is divided into three sections of heat exchangers. The section next to the expansion (or "hot") cylinder of the leading piston is the externally-fired heater. The section next to the compression (or "cold") cylinder of the trailing piston is the heat-dissipating cooler. The section of the annular passage between the heater and cooler is heated or cooled only by the gas flowing through it, not by external means. This section serves as a regenerator, which is a heat-conserving device invented by Robert Stirling in 1816. It is interesting to note that the engine bearing Stirling's name was merely one of several ingenious ideas he suggested to illustrate how his regenerator might prove useful.

This arrangement of parts cooperates to accomplish the following four things during each crankshaft revolution:, 1) compress the working gas when most of it is in the cold cylinder and its temperature and pressure are low; 2) transfer most of the working gas through the heat exchangers to the hot cylinder, thereby raising its temperature and pressure; 3) expand the working gas when most of it is in the hot cylinder and its temperature and pressure are high; and 4) transfer most of the working gas through the heat exchangers to cool cylinder, thereby lowering its temperature and pressure. Expanding the high pressure gas produces more power than is consumed by compressing the same gas at a lower pressure, and this excess power is the engine's output. Of course there are many subtleties, but this is the essence of the Stirling cycle engine.

The crank drive mechanism is my own design, which I call the Rocker V mechanism because it uses one rocking piston and is balanced like a V-twin. A nice schematic of this simple, strong, and readily-balanced mechanism may be found on Izzy Urieli's web site:
www.ent.ohiou.edu/~urieli/stirling/engines/engines.html.

But making a robust model Stirling engine depends not so much on choosing the right cylinder arrangement or drive mechanism as it does on; 1) keeping friction very low, 2) keeping internal dead volume low and compression ratio high, 3) making pistons that seal really well, and 4) providing enough surface area for the heat exchangers to transfer heat to and from the working gas rapidly.

Rather than having cooling fins, the engine simply has its cooler section screwed down to the massive aluminum alloy frame, which serves as a heat sink to dissipate waste heat. The original burner for the new engine had only 37% of the wick area of the railcar engine, and therefore burned about 37% of the fuel, or about one cubic centimeter of alcohol for each nine minutes of operation. The burner holds ten cubic centimeters when filled. Warm up takes about one minute after light-up.

Less wick area of course means less power; in part this difference is made up by a lower overall gear ratio used in the Climax as compared to the railcar. On its original test trials, when the wick was perhaps three-sixteenths of an inch above the top of the wick tube, the Climax spun its wheels (but slowly) when restrained, and while doing so produced 450 grams of tractive pull. But the wick was not fully filling the tube, and it subsequently dropped to only about an eighth of an inch above top of the wick tube. Tested under these condition the engine stalled at only 420 grams of pull. The railcar, even with its considerably higher gear ratio, would not stall, but would consistently produce 300 grams of pull. Only two of its four wheels are powered, and none are sprung. Overall weights are close, with the Climax weighing 2.3 Kg (5.07 pounds) and the railcar 2.39 Kg (5.25 pounds).

These first trials were disappointing; I wanted more performance to show for the extra effort that went into those all-wheel drive trucks! So I drilled out the wick tube a bit to provide 44% of the wick area of the railcar. New trials showed the Climax would now easily produce 550 grams of pull, and adding some additional weight brought that up to 600 grams. Knowing that so much improvement was so easily obtained made me a whole lot happier.

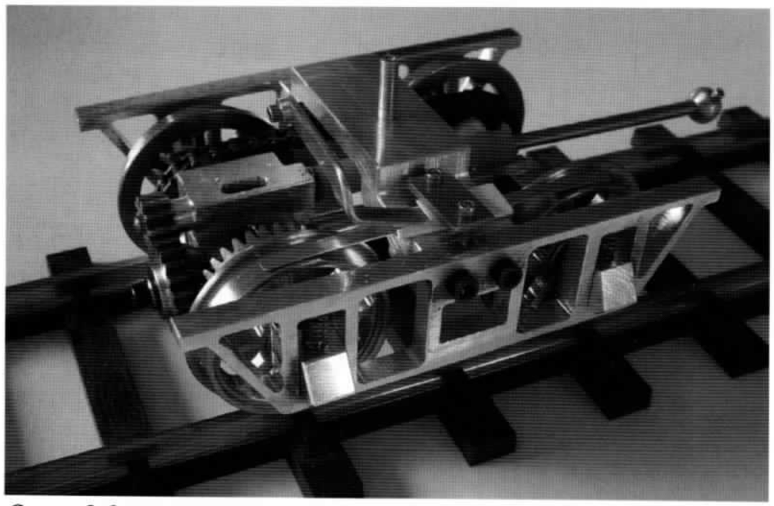
As mentioned above, the original locomotive I sought to model was one with a roof but no sides. With an appropriately small steam engine this design would be quite charming, but the Stirling engine was obviously too big to look at all realistic in its place. I had also made other mistakes on the wooden structure of this first Climax: It was too wide for the prototype I'd chosen, it sat too low on the trucks, and it could not be removed to tinker with the mechanical parts without extensive disassembly of the transmission components. This project had already taken substantially longer than expected, and I was impatient to declare it completed, but I could not let it be. The mechanical components were too beautiful, and the aesthetic aspects too displeasing, for me to consider the model completed. An extensive rebuild was therefore reluctantly undertaken.

One great virtue of modeling the class A Climax is that these locomotives were made and modified in so many appealing variations. I now chose from among various prototypes with sides to hide the Stirling engine; and this time I designed the wooden structure so it could be easily removed without disturbing any of the mechanical components with just four screws.

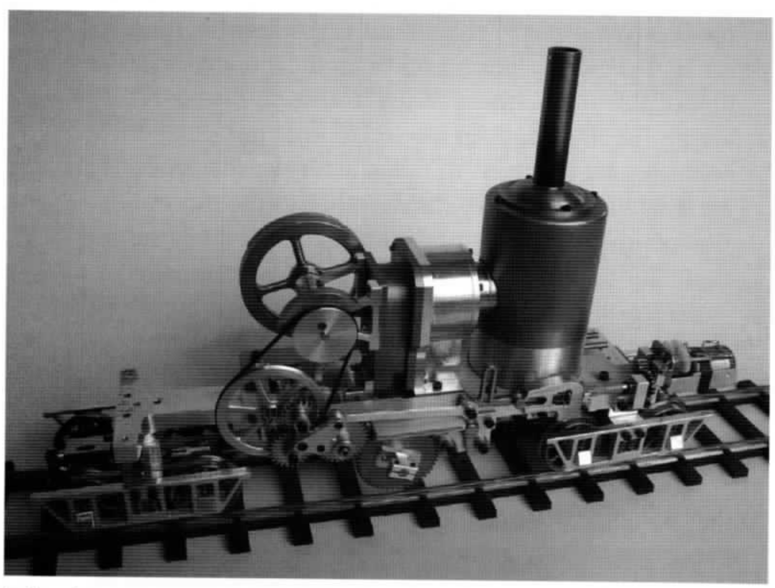
As it happened, designing and building the new wooden flatcar and cabin was great fun. One of the interesting challenges was machining the underside of the little piece that slips over the stack and rests on the curved roof, holding the safety valve and whistle. The radius of this curve is just over 9 inches, and I had no easy way to cut it directly; but the job was readily done with just 8 trigonometrically-calculated step cuts per side with an eighth inch end mill. The tiny steps didn't even need to be filed smooth; the part just fit and clung to the roof perfectly when aligned correctly.

Other interesting parts included the window frames, since their mullions were so long and skinny. They were machined (very carefully!) out of aluminum alloy, and the round corners were filed square. I also had to consider how to flip the crankshaft over to start the engine, now that it was behind wooden walls. This task became easy, once I remembered that the flywheel was attached to the crankshaft by being screwed to a clamp mounted behind it. Although these screws were recessed into the flywheel's hub, the hub was easily milled down to expose enough of the screwheads and crankshaft to permit engaging them with a starting key placed through the open window.

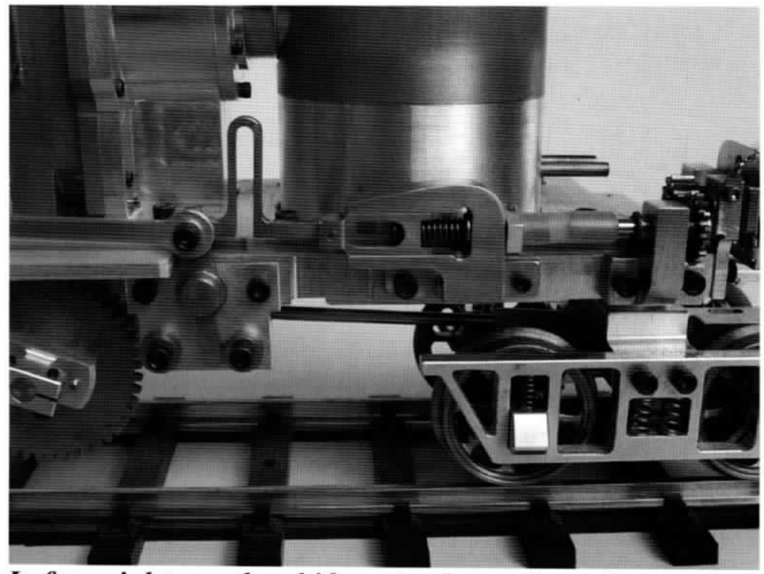
At last the modifications were complete, and I am now quite satisfied with the model, both mechanically and aesthetically. Of course that doesn't mean it won't get modified again, sometime in the future. I consider most of my projects to be experimental works-in-progress; and that attitude seems particularly appropriate for a model of a Class A Climax.



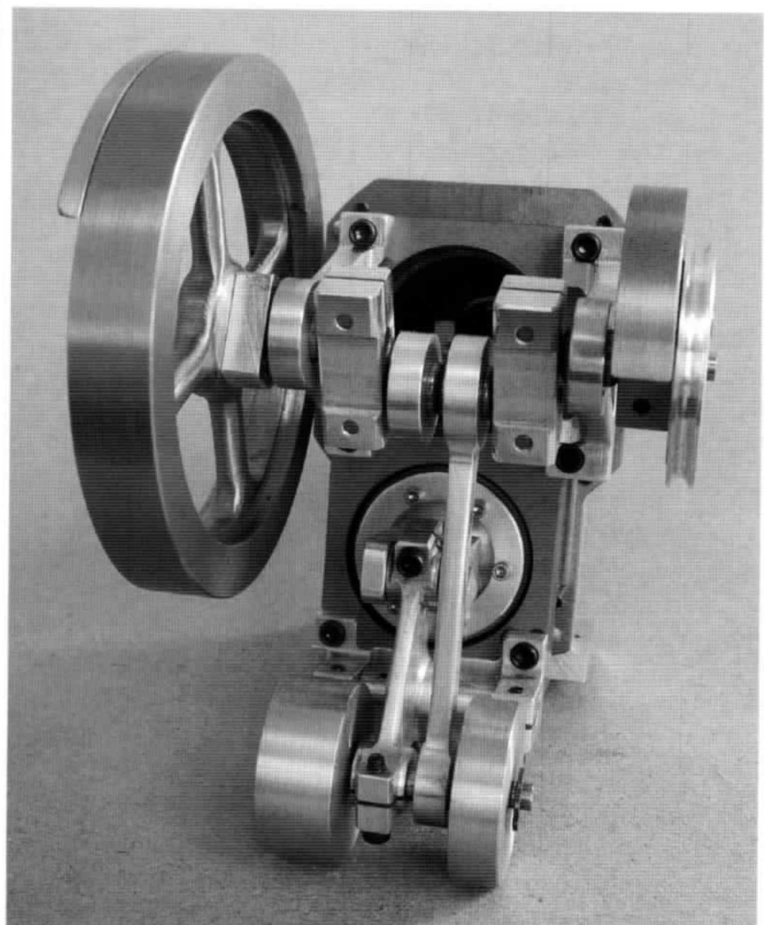
One of the completed trucks, with its portion of the driveshaft attached.



The locomotive with the wooden structure removed, revealing the entire gear shifting mechanism, and the power train components above and beside the frame.

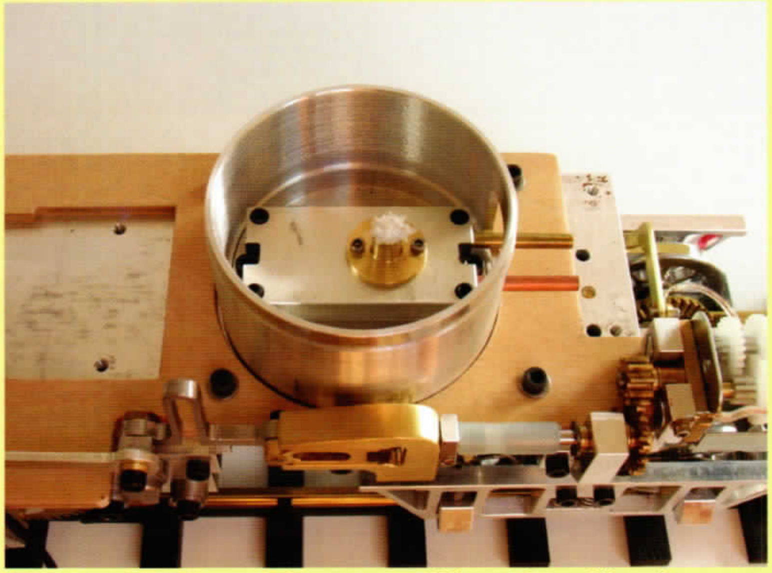


Left to right are the shifter stop lever, the oxbow spring, and the screwjack.

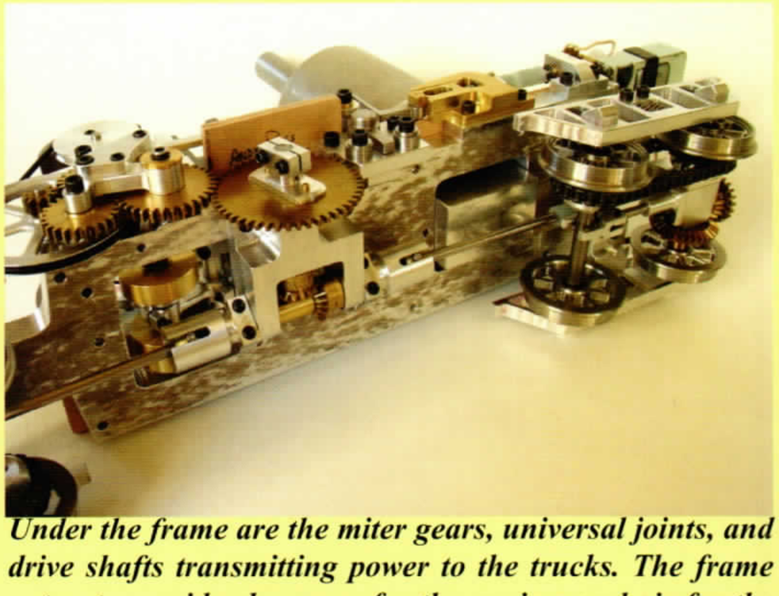


The Stirling engine from the crankshaft side of the cylinder block.

The Stirling engine from the heat exchanger side of the block, with the cylinder head removed. All static seals are O-rings.



The engine burner has open filler tubes, like those on model aircraft fuel tanks.



Under the frame are the miter gears, universal joints, and drive shafts transmitting power to the trucks. The frame cut-outs provide clearance for the engine, and air for the burner, respectively.

The starting key, standing in the doorway; in use it would poke through the open window and engage the flywheel mounting screws.

The author's completed Class A Climax.

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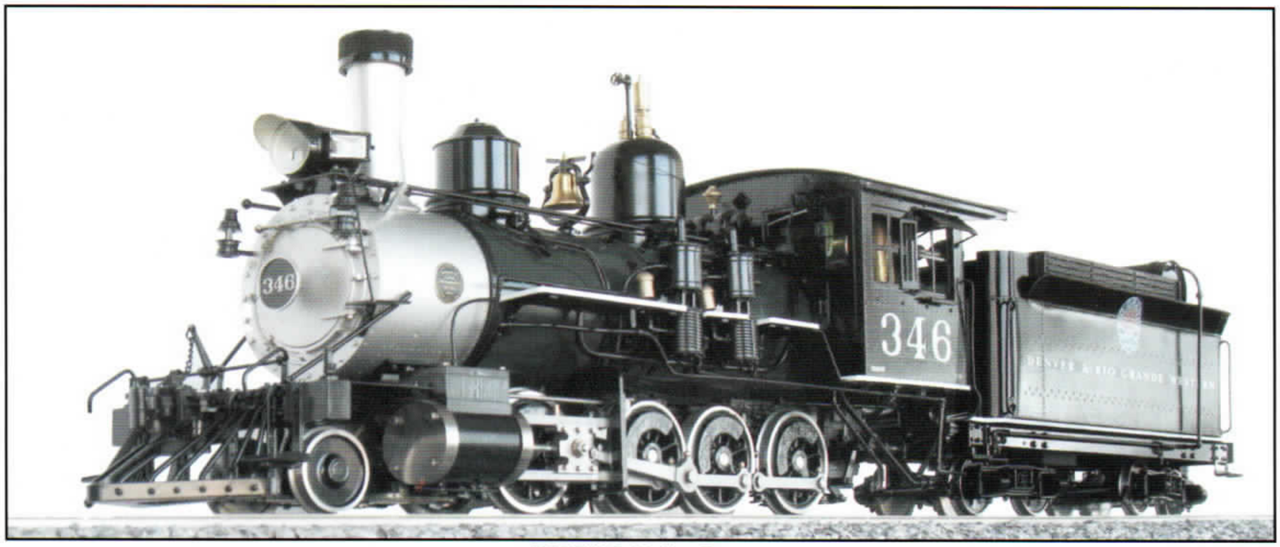

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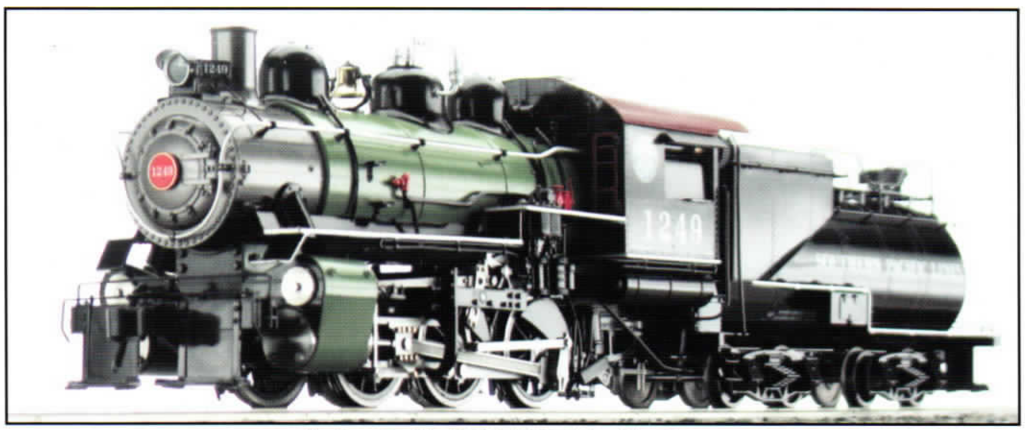

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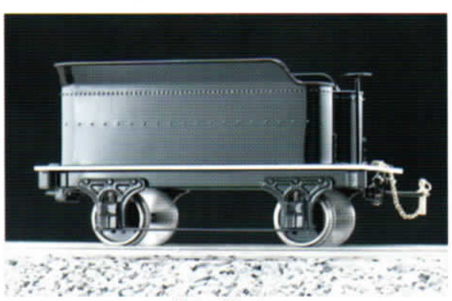

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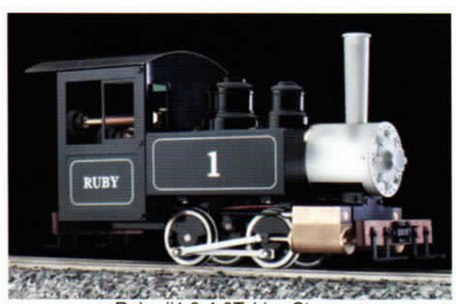

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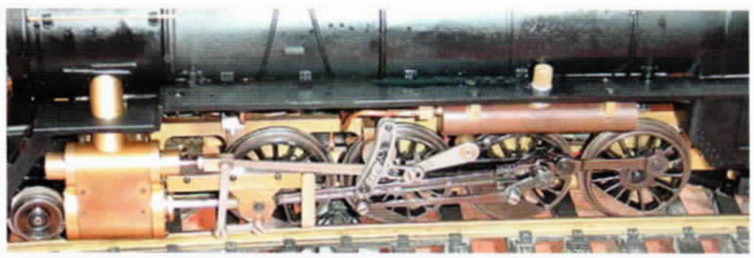

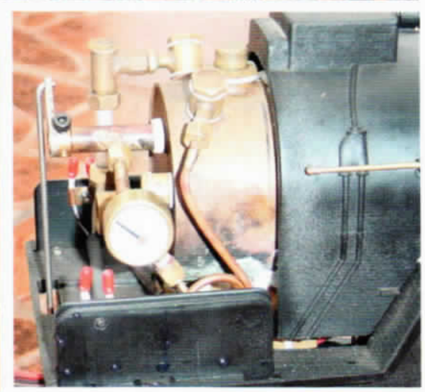

Photos are of Engineering Sample. Appearance of production model may differ. Cylinders, under frame & many other metal components will be blackened.

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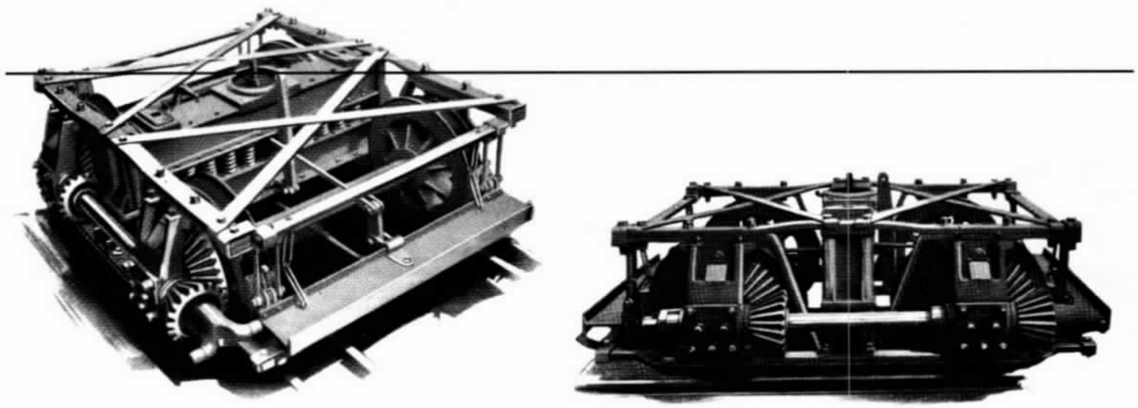
The Nuts and Bolts of Shays

Standard Arch Bar Trucks

By Dan Rowe

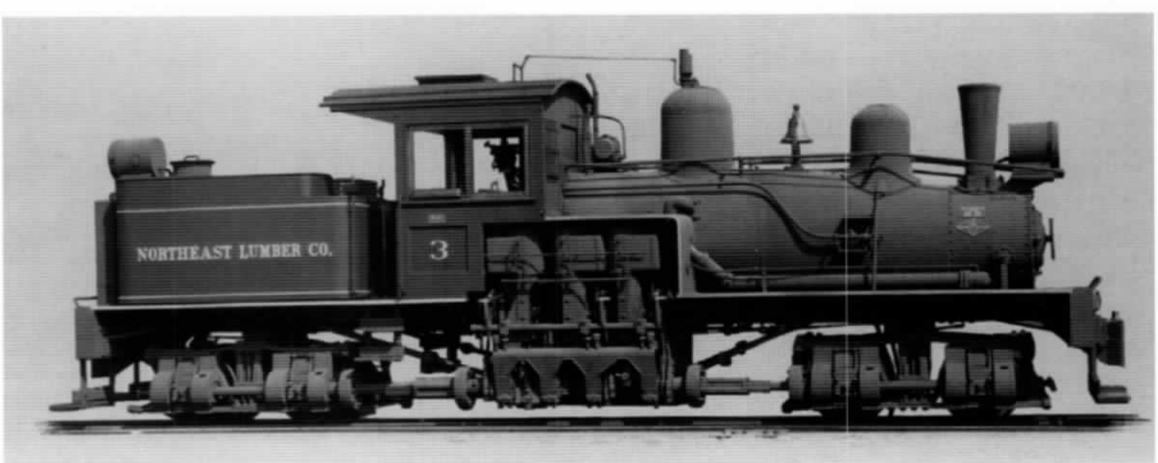
The majority of Shays rode on arch bar trucks. The early arch bar trucks with wood parts evolved to a standard mostly steel truck. On some models even the cast iron bearing boxes were replaced with cast steel. The standard bottom bolster is a box beam with channel sections for the sides and plate steel for the top and bottom. Spring centers are simply steel disks bolted to the plates of the bolsters. This eliminated the need for a cast spring plate. The top bolster is a similar box beam with end castings. There were design variations for special conditions such as wood rail that needed wide tires or low profile trucks.

The catalog photo dates to around 1911. Notice the two-link safety chain rigged to support the brake beam and prevent derailing the locomotive if the normal support fails. Some of the early designs had two sections of flat bar bolted to the top and bottom cross bars and bent to form a cage for the same purpose. The design is nearly the same as both the 3-foot gauge trucks shown in the builder's photo of S/N 3267, and the 2-foot gauge truck in Figure 1. S/N 3267 left the Lima works on 7/11/1924.



SHAY LOCOMOTIVE TRUCKS

Photo 1 from Catalog #16 of the Lima Locomotive and Machine Co. Authors collection.



Shop Number 3267 Photo courtesy Allen County (Ohio) Historical Society

The early wood top bolsters had end castings to prevent the wood from chafing. The edges of the center column extend to form a channel that guides the bolster chafe plate. The standard steel box beam top bolster has an end casting with a vertical grove in the center that fits on a vertical tongue on the center column.

Early trucks did not have either oil covers or gear covers. The first style of gear cover had hinges attached to the arch bar. This was a full-length cover that protected both gears. S/N 450 is shown in issue # 86 with one cover up and the other one down. These covers were not produced for very long and they are rarely seen on Shays after hard service in the woods. The standard gear cover is a sheet metal cover supported by a section of flat iron that is bolted to the top of the ribs of the right truck bearing box. A second brace is secured to the line shaft bearing adjustment bolts and keeps the cover from interfering with the pinion. The last version of this cover had gear covers on both sides of the right bearing box as seen on S/N 3267.

There was one experimental fully enclosed gear cover used on the front truck of S/N 3152. The only other full gear cover that I know of was used on S/N 2800. A close look at the builders' photo will show that what looks like the gear is actually a formed cover bolted to the side of the right bearing box ribs. The drawing of this part has a notation that the side-tapped holes are special order only. I checked and could not find another Shay that was ordered with this special gear cover. These bearing boxes still exist and some of them are being used for the rebuild of S/N 906 at the Illawarra Light Railway Museum in Albion Park NSW Australia. When complete this will be the only operational Class A Shay in the world.

The diagonal braces look like flat bar simply forged 90 degrees at the far ends and bolted to the arch bars. The method to manufacture this part is specified in the LLW Standard Engineering Practice No. 93–SP–32. The diagonal brace bar has forged ends that are about twice the thickness of the rest of the bar. The bar is laid out on the truck and a groove to fit the top arch bar is machined. This mechanically locks the diagonal bar to the arch bar and relieves the strain on the bolted joint.

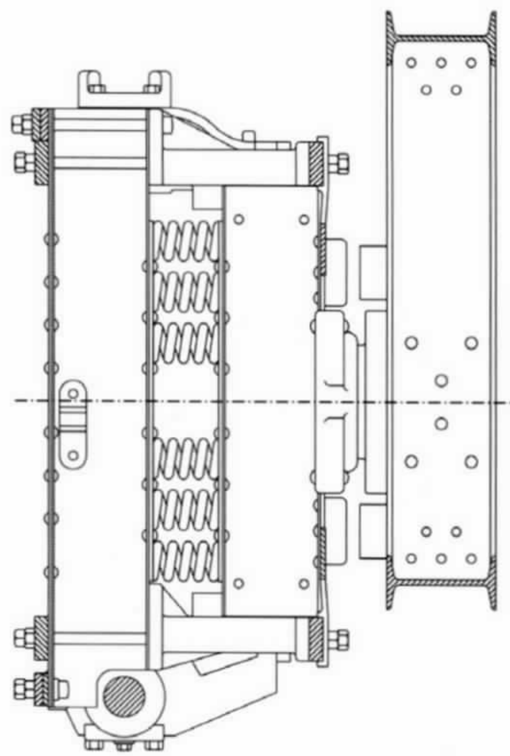
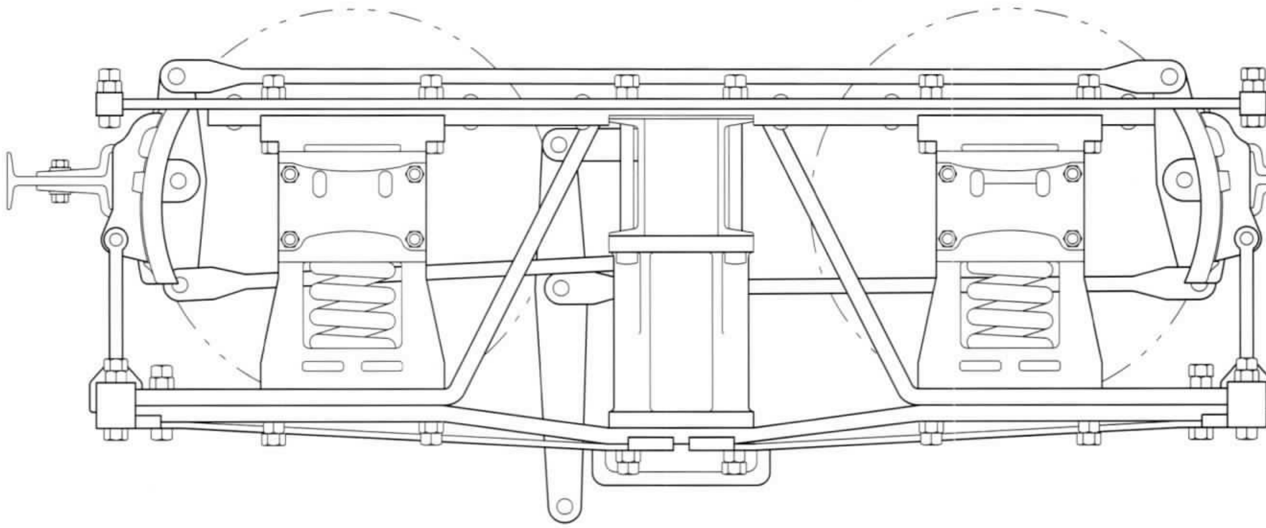
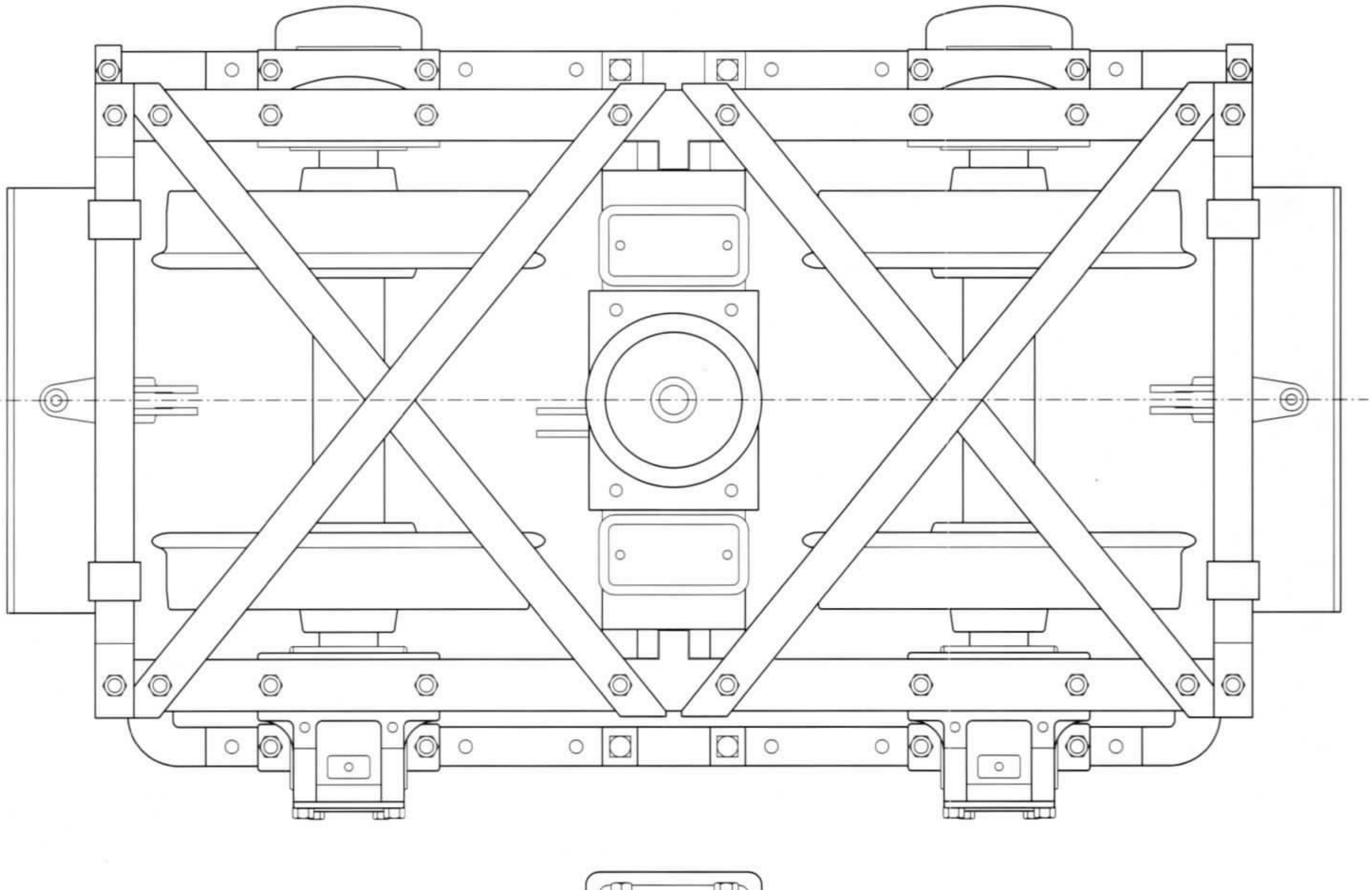
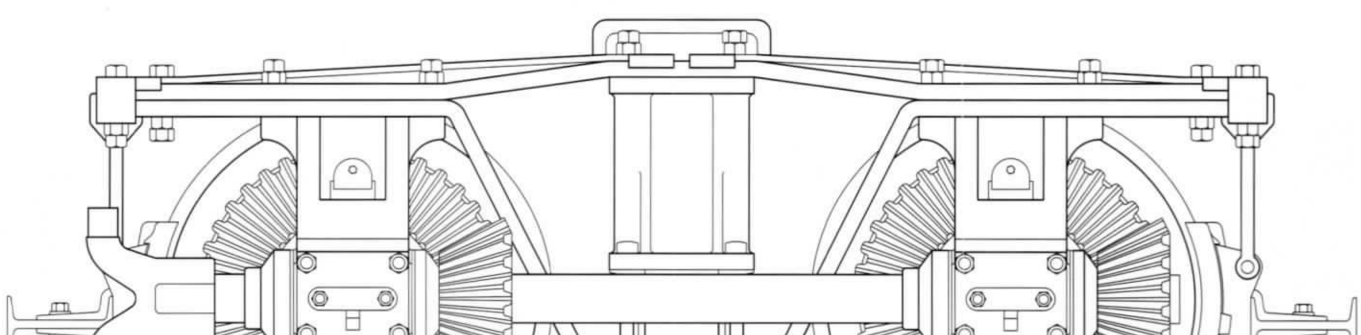


Figure 1 The truck built for S/N 1928 was the largest 2' gauge truck built.

Figure 1 is a 7/8 scale for G1 drawing of the trucks built for S/N 1928. The next issue will cover cast steel trucks.







The LED vs. The Sight Glass

by Bill Ford

Having trouble seeing the water level in your sight glass? Here's a solution that really works!

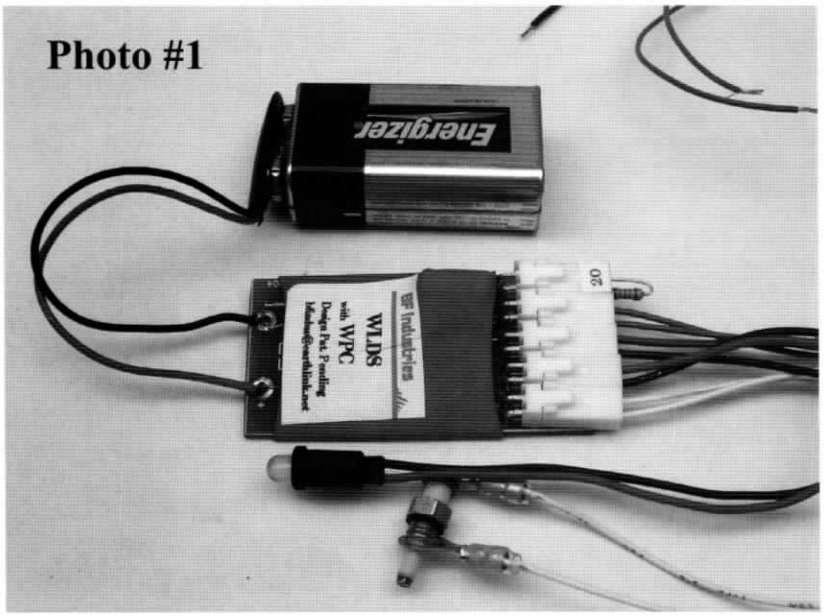


Photo #1

When an LED is used to determine the water level in a boiler, it has many advantages over the typical sight glass. One of the biggest advantages is that the train or boat doesn't have to be stopped, and we don't have to contort ourselves to try and see whether and how much water is visible in the sight glass.

In our models, the sight glass is normally very small and even if we see water, we're not always sure it is reading the water level accurately due to a number of factors. The LED is extremely accurate as indicated by the LED changing from ***solid Green*** when the boiler is full to ***flashing Green/Red*** and finally to ***solid Red*** as the water level reaches the probe in the boiler, indicating a need to add water. Since the LED is always one color or the other, the system is "positive acting", indicative of an operating system.

As the current desire for longer runs increases, the use of larger fuel sources and the Goodall valve dictate a need for closer, accurate monitoring of the water level to prevent boiler damage. For coal fired locomotives, more attention can be focused on maintaining an adequate fire when the water is easily monitored. When an axle pump is used, the LED is useful in adjusting and monitoring the action of the pump.

The WLDS System (See Photo 1)

The Water Level Detection System operates as an "electronic sight glass" using a bi-color LED to signal when the level of water in a boiler approaches a low level and is in danger of damaging the boiler. The electronic circuit uses a unique approach offering many advantages such as: 1) Simple, accurate and easy to install 2) Works with distilled water, no need to add tap water, 3) Uses RF coupling which avoids corrosion or plating of the probe, 4) Miniaturized for easy installation and operation.

How It Works

In operation, a probe is inserted in the boiler **(Photo 2 - Probe in a C-21 boiler),** usually in line with the top of the flue, which acts as an antenna and couples the signal to a circuit when water is present and turns on the Green LED. If no liquid is present to couple the signal, the Red LED is turned on.

Installation of the probe is not as scary as one might think. A hole is drilled and tapped 10-32 thread into the boiler back head in line with the top of the flue. This is to assure that when the "low level" is indicated, there still is sufficient

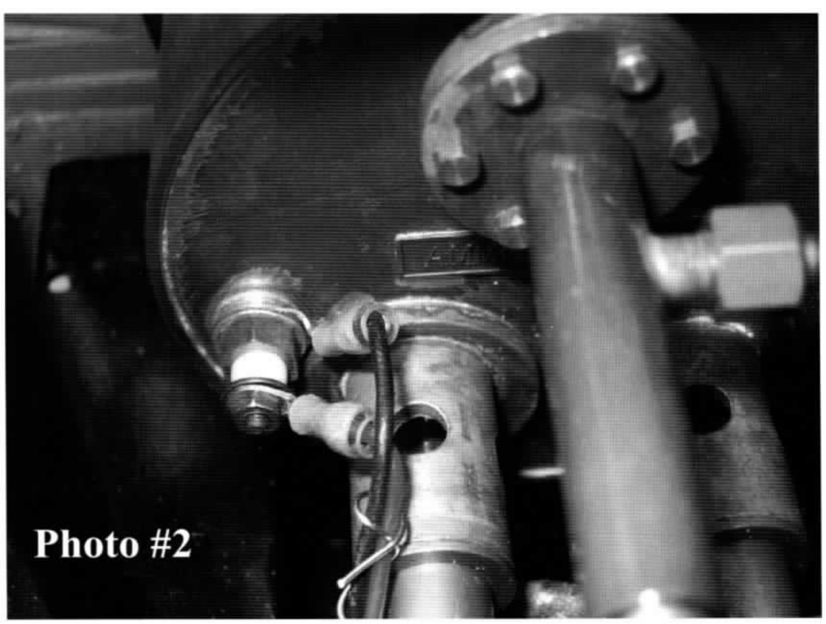


Photo #2

Photo #3

water surrounding the flue, but water should be added shortly. Since the area of the probe inside the boiler is very small (0.01 sq. in.) the force on the probe is less than 1 lb., even at boiler pressures of 60 psi and higher. Therefore, even though the boiler wall is thin and only a few threads hold the probe, it is sufficient due to the small force on the probe. Recommended installation instructions and techniques are provided. (**Photo 3 - Complete System in an Accucraft C-21)**

For those having an Accucraft locomotive with a mounted sight glass, a special probe and plug are available in lieu of the standard probe which replaces the sight glass, uses the existing bushes and therefore no holes have to be drilled into the boiler.

The new WLDS with Water Pump Control has the ability to control an Electric Water Pump or a Solenoid Valve for use with an axle pump and thus maintain sufficient water in the boiler automatically. When the WLDS senses a need for water, the electric pump is activated and water is added to the boiler. A delayed turn off, adjustable by the owner, is provided to prevent excessive cycling of the pump. With a locomotive using an axle pump, the WLDS controls a Solenoid Valve which is mounted in the bypass line, to automatically maintain adequate water in the boiler.

BF Industries has developed an Electric Water Pump **(Photo 4 - Electric Water Pump)** which uses a high torque servo, operates on a separate 6 - 9 volt battery and delivers 20 to 35 ml of water per minute. The total amount of water injected is adjustable by the time delay selected by the customer.

For those using an axle pump, a Solenoid Valve **(Photo 5 - Solenoid Valve)** is also available from BF Industries. The normally open, on/off valve is placed in the bypass line, usually in the tender, and is controlled by the WLDS so that the axle pump injects water into the boiler as needed. It operates on a separate 6 v battery drawing approximately 100 ma when activated.

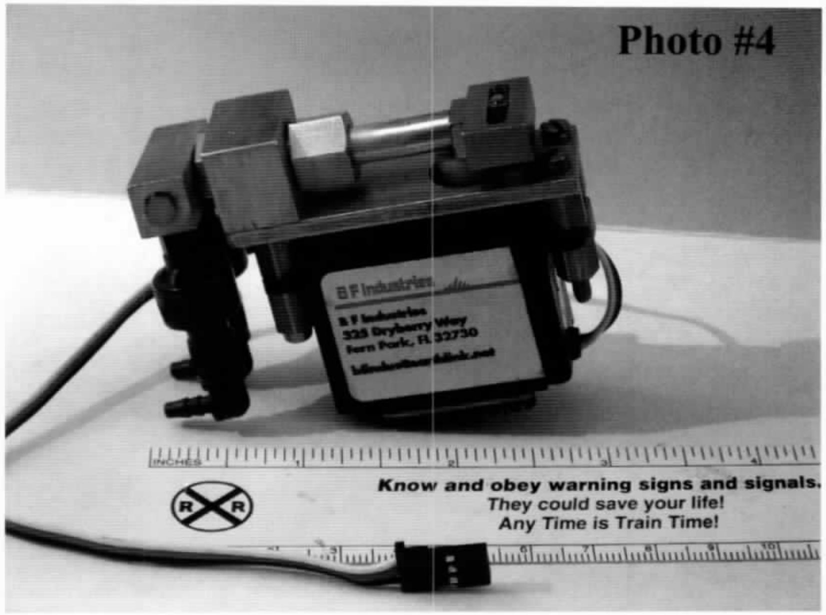


Photo #4

Since the on-time of both of the above water delivery systems is short, large capacity batteries are not required.

The price of the WLDS with WPC is $125.00, the Electric Pump is $110.00 and the Solenoid Valve is $45.00. For further info, contact:

BF Industries
325 Dryberry Way
Fern Park, FL 32730
USA
Email bfindus@earthlink.net

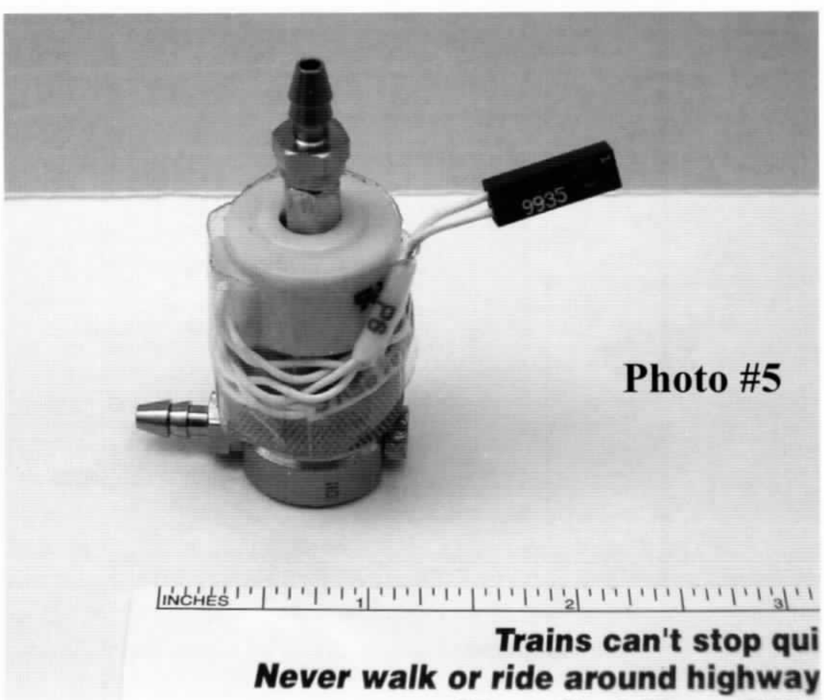


Photo #5

Rivets

by Charlie Mynhier

Rivets were used to hold plates of iron together when building a Locomotive, much like nails are used to hold planks of wood when building a house. They usually had a half round head on one end and nothing on the other. When two plates were fastened together, a close fitting hole would be drilled through both plates, and the rivet with its plain end heated "red" hot would be inserted through both holes and the red end (which was soft) would be forged into another head, capturing both plates together in a permanent fashion. Many rivets would be used side by side or staggered depending on how strong the joint needed to be. Joints which were riveted together displayed a multitude of these rounded heads and this is one of the reasons the American Locomotive had such a rugged and masculine appearance.

Today rivets are seldom used, as "welding" is the method of choice used to hold steel plates together.

The engines that I build would never require rivets because I would use threaded fasteners or "Silver Brazing", but, their full size inspirations had rivets and looked so good that I will use rivets, or at least make it look like I use rivets, which brings me to this article.

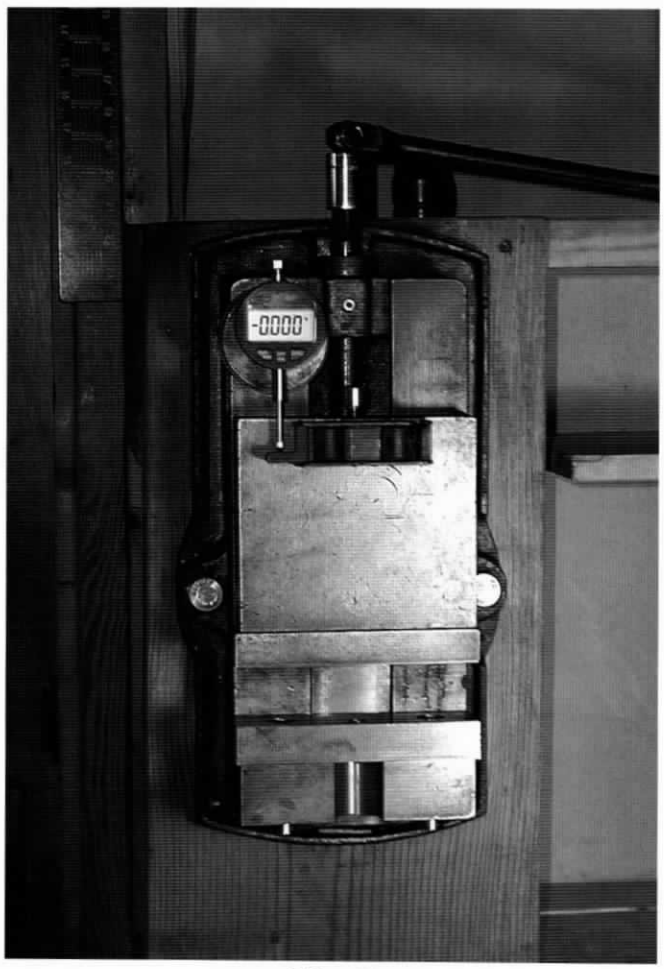


Fig. 1

When I go to steam meets, the engines that I enjoy seeing most are the ones that my friends build in their home shops. I am sincerely proud of you who build your own engines. As I build all of my own engines, maybe you can find use for some of my tricks and techniques in building your engines.

Figure 1 shows my favorite tool for all my riveting techniques. It is a 6" "Angle-Lock" vise, mounted on the wall to be used as a precision press. Notice the Dial Indicator. This vise can exert over 6,000 lbs. of force, and that's plenty for any job we will do.

Notice the fixed jaw has a trough cut in it, and the removable fixed jaw has a .5" hole. This allows wheels and bearings to be pressed on and off. This jaw was made from a 1" X 1.5" X 6.25" flat bar.

Figure 2 shows 3 different embossing tools used to make rivet heads. Each tool will consist of 3 basic parts: anvil, guide, and punch. The anvil is made from O-1 Tool steel and hardened 60-62 RC. The guide is made from brass, and the punch is made from a Drill Blank with a brass head. The large embossing tool was used to make the Smoke-Box front. The idea is to have your rivet pattern drilled into the anvil before it's hardened. For my "O" gauge engine (1 to 48 scale) I drilled .047 dia. x .05 deep, then I drilled an identical pattern of .062 holes in the brass guide. The punch is made from a short length of .062 Drill Blank (the back part of a .062 drill will work), the nose of the punch is ground to approximately .035 dia. with approximately. 20° included angle.

The part that wants to have the rivet heads should be approximately .035 thick and sandwiched between the anvil and guide. The punch is dropped into one of the holes in the guide and the assembly is put in the press. The movable jaw of the press (vise) is brought down on the punch. There will be a noticeable looseness in the screw when it goes from hanging the Jaw to pushing it down on the punch. It is here that the dial indicator is "Zeroed" (refer back to Figure 1). Then crank the jaw down an additional .030 and retract it, remove the punch and place it in another hole and repeat the procedure until all rivets have been embossed. Figure 3 shows what your finished rivets should look like.

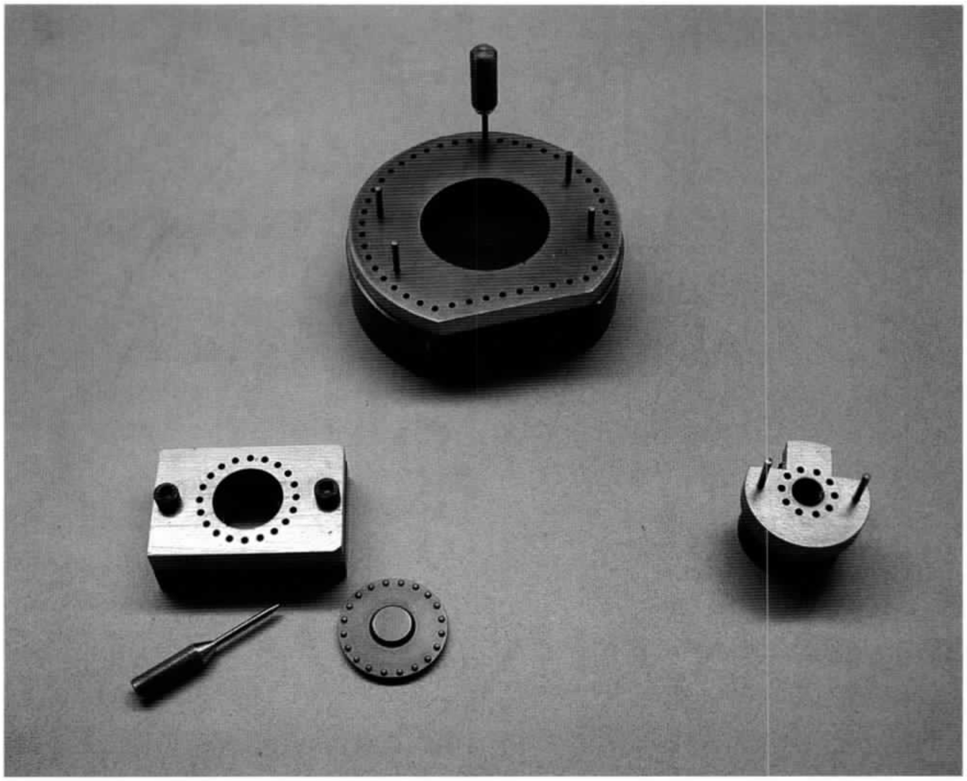


Fig. 2

Next time, I will describe a completely different technique for making Rivets, and how I make "Firebox Stays".

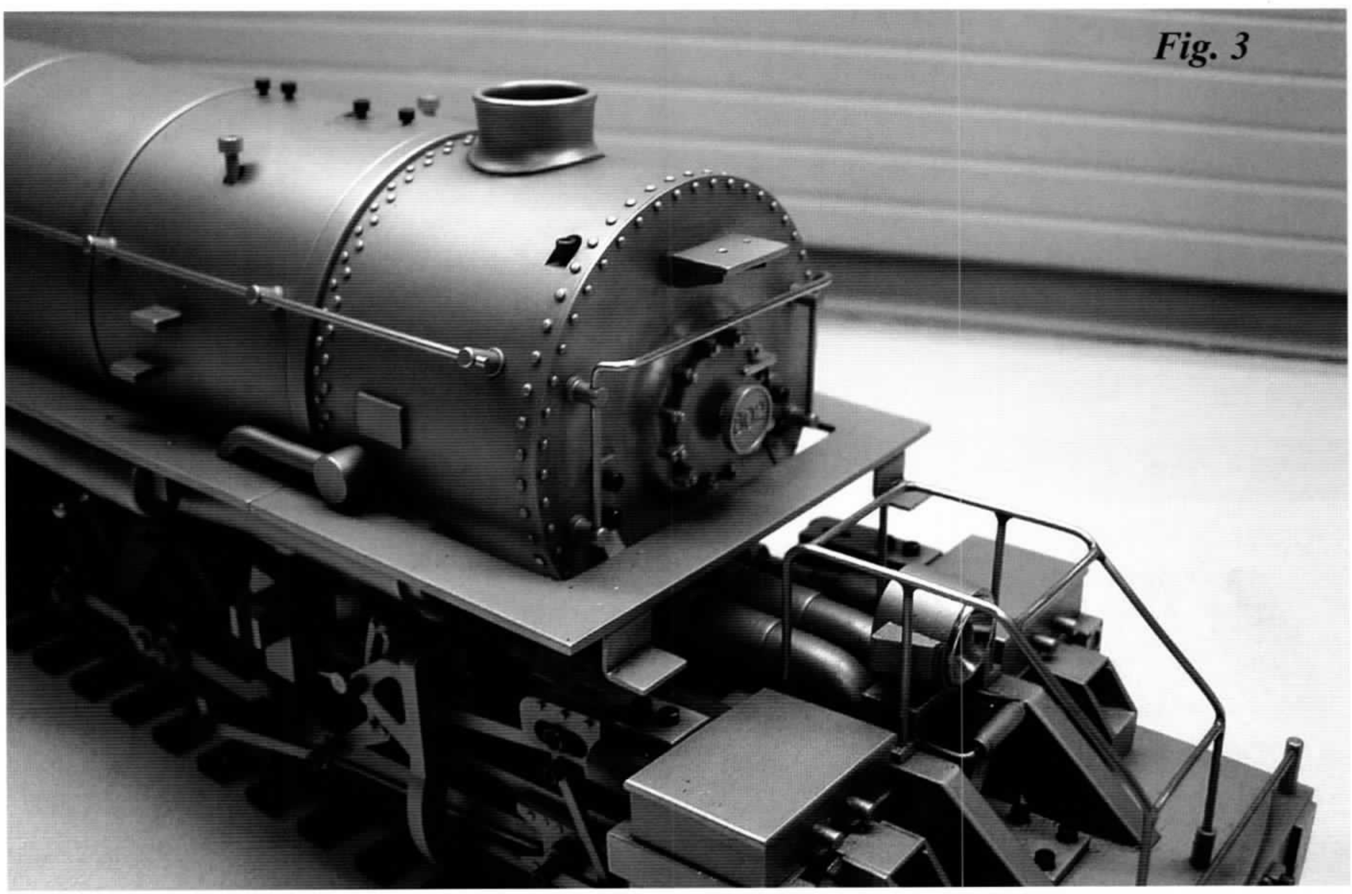


Fig. 3

Valve Gear, Part V

by Charles McCullough

Okay, I guess it's time to explain that little error in ***Figure 1*** of the first article of this series. It is not a great error, but it typifies one of the things that a properly designed valve gear should take into account. Yes, I said it wasn't my intent to turn the reader into a valve gear design engineer, but then I made that mistake in the original diagram, was too lazy to correct it and then had to point it out before some sharp-eyed reader did. And, yes, Dan Rowe got it right (See RPO Mailbag in issue #88).

The drawing shows the piston centered in the cylinder and the drive pin at the bottom of its rotational positions. If everything were designed correctly, this would not happen. When the piston is in the center of the cylinder, the drive pin would be slightly forward of the bottommost position. Conversely, when the drive pin is at the bottommost position, the piston would be closer to the rear of the cylinder, not centered. This is caused by the angular position that the main drive rod takes as one end traverses the circle inscribed by the main drive pin.

A minor odd thing that this causes is that the piston travels faster in the front half of the cylinder than in the back half ! Granted, the piston speed is constantly changing, going from stopped at the point where it is changing direction to maximum speed when traversing through the middle of the cylinder and then slowing again to a stop before reversing direction for the return stroke. However, note that in the quarter revolution of the wheel from the drive pin being at the most forward to the bottommost position; the piston has to travel from the most forward position to more than just halfway though the cylinder. In the next quarter revolution of the wheel, the piston has less distance to travel to reach the rearmost position.

This same thing happens to the valve when being driven by the valve gear and this slightly affects the timing. Each item in the drive train that inscribes an arc of some sort can add to this effect.

In full sized practice, the gear is set at the very last stage of construction. It has to be done then because the weight of the locomotive on the suspension has an effect. Springs compress and things bend and contort, this changes the relative positions of the wheels to each other, to the cylinder and to all the valve gear parts. Although a fully equalized suspension will mitigate this somewhat when the locomotive is sitting still on flat uniform rails, when the engine is moving, track irregularities will move the wheels vertically and cause slight, momentary errors. Clearance (looseness) must be designed-in to allow these misalignments or things will bind or break. That looseness must be accounted for when setting the positions of the parts of the valve gear.

Thus, when you set the gear timing on your locomotive, it should be setting square on its wheels. If the chassis is suspended in the air, the wheels will sag out of the "normal" position, distances and angles will be altered, and you will not get proper settings.

I have included a bibliography here with some of the books I have referred to as I have been working on this series. I love the older books where the author makes comments about obtaining or making parts or drilling holes "of suitable size" and not giving any specific dimensions... real "seat of the pants" engineering. The more modern texts give specific information to remove the trial and error fitting of parts and take the guesswork out of material strength (and eliminate the consequent damage and expense incurred when you guess wrong!).

Most of the books listed in the bibliography include a section about setting the valves of a steam engine. Most state to set them according to the information provided by the manufacturer or the Superintendent of Motive Power (or some other similarly titled individual). Some took many pages to say that, but that is the gist of what all the words said. The book(s) by Charles McShane describes an actual "method" to do it.

I followed the method given by McShane and found that although it would work, it was extremely difficult to perform. The instructions find the exact forward dead center of the piston using "trams" (long rods, "of appropriate length", bent in an "L" or "C" shape, with sharp pointy ends). You rotate the wheels until the piston is not quite at the end of travel (Figure 14). Then, with one end of the tram on "some conve-

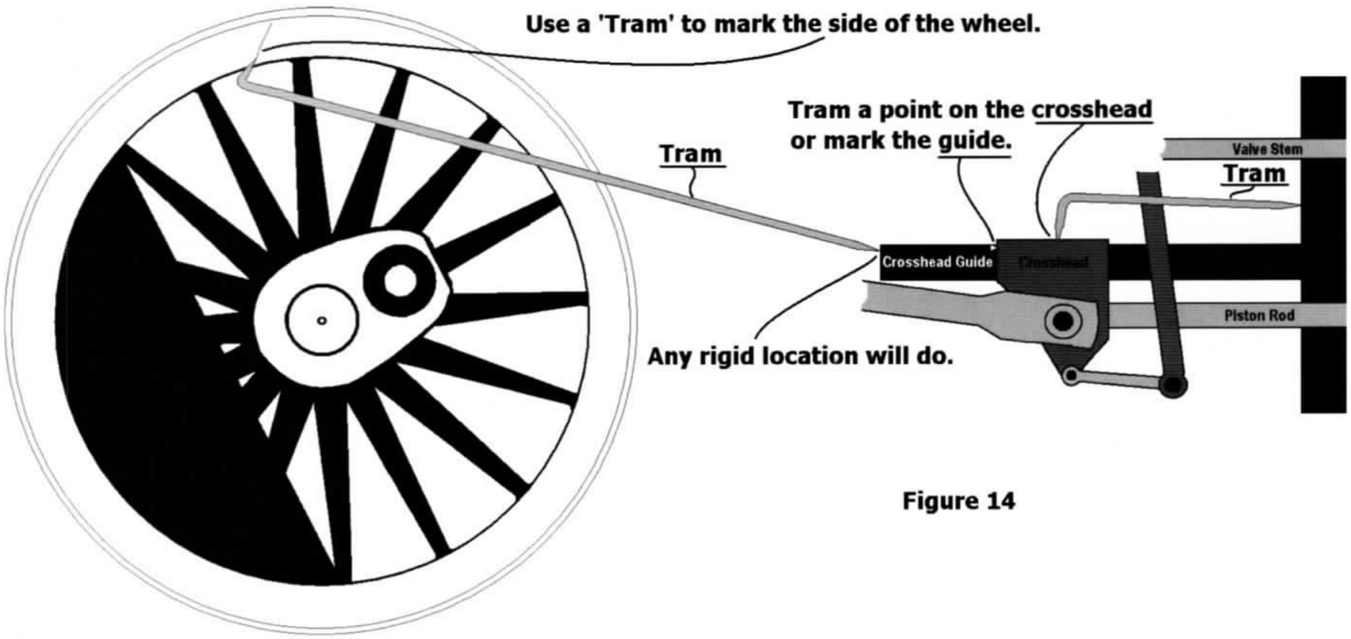


Figure 14

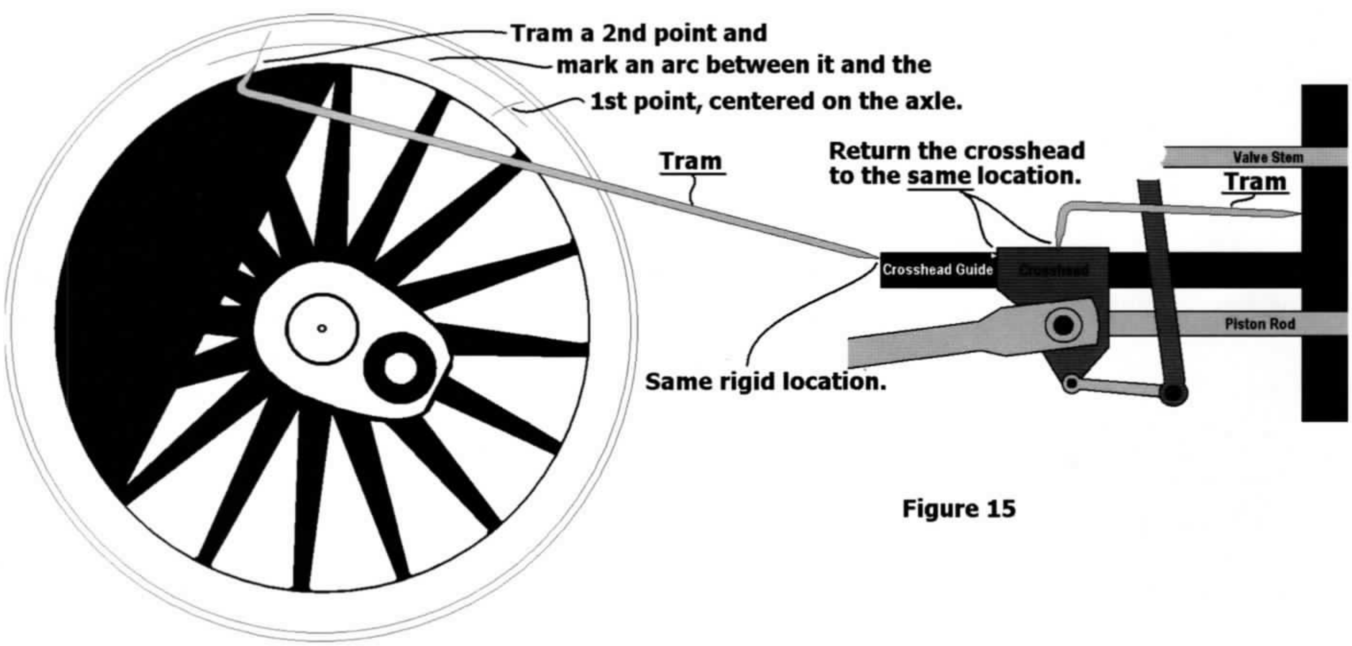


Figure 15

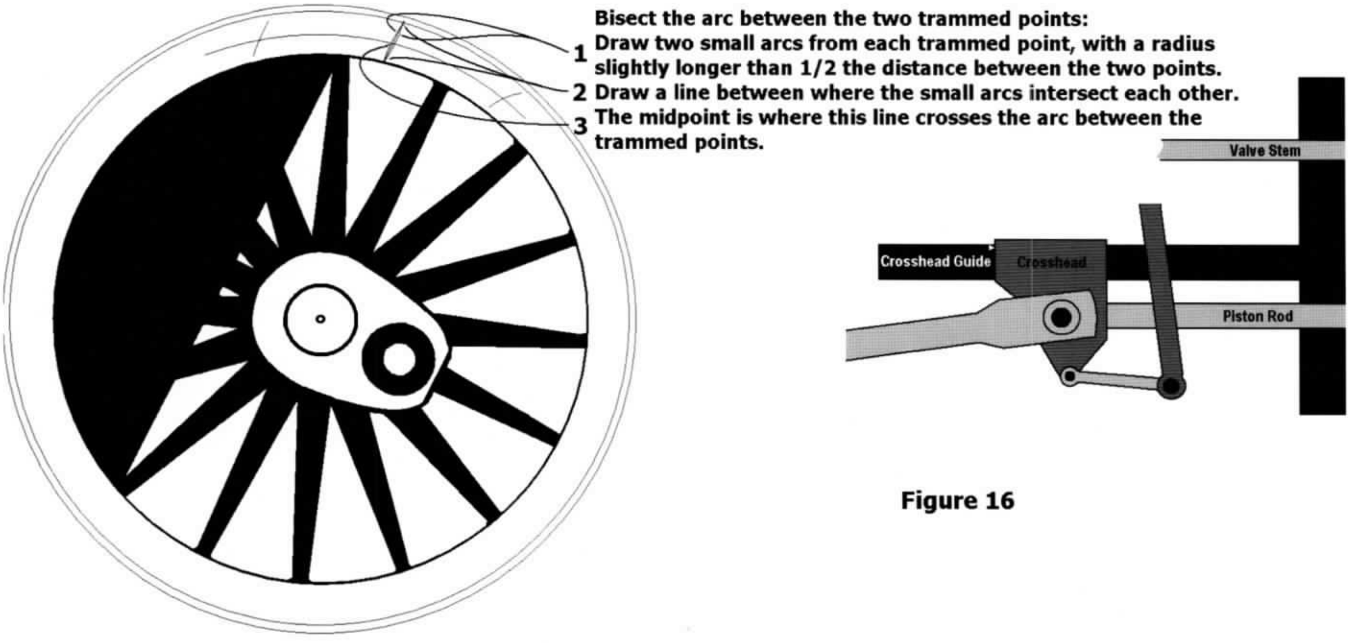


Figure 16

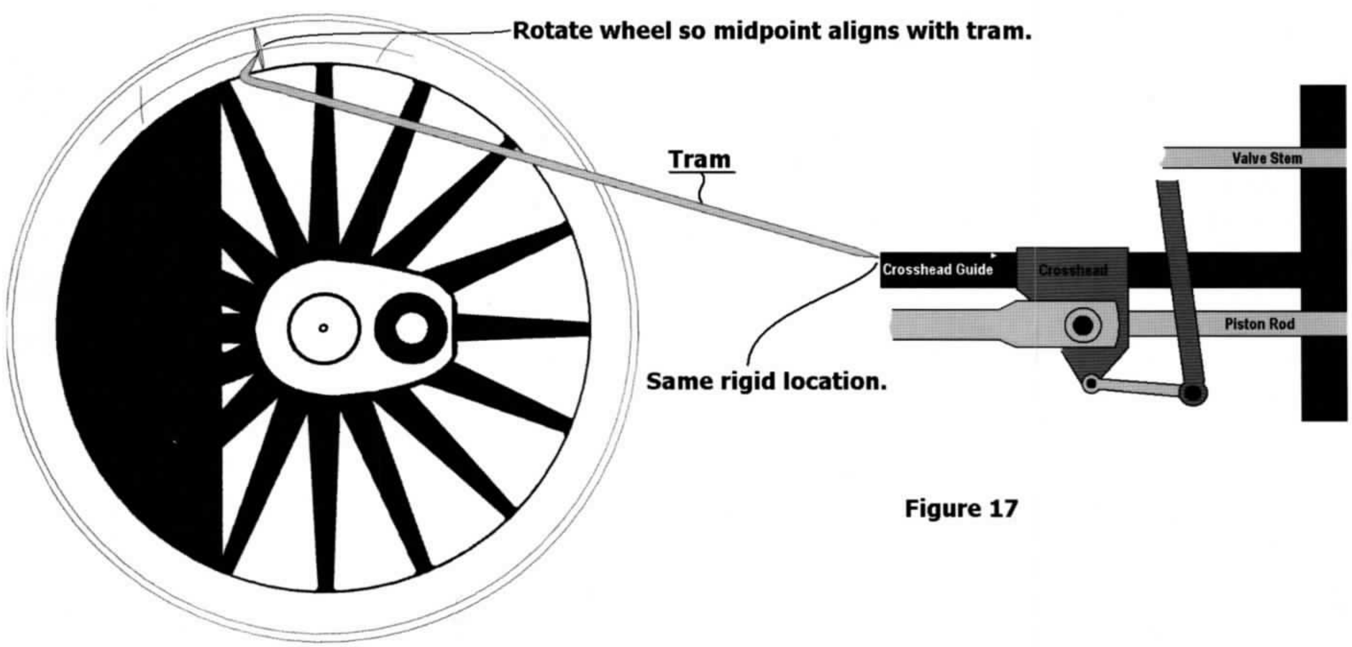


Figure 17

nient point" on a rigid part on the engine, you scribe an arc on the side of the tire with the other end of the tram. You also mark the position of the crosshead on the guides. Then you rotate the wheels to put the piston past the end of travel until the crosshead is back to the just marked position and you scribe another arc on the wheel (Figure 15). You then divide the distance between the arcs by two (Figure 16). Then reposition the wheel so the tram point rests on the bisect point (Figure 17). The reason for doing this is to eliminate or reduce the amount of lost motion error (due to designed-in "clearance" and wear). When the piston is at the end of its stroke, the wheel can move several degrees on either side of the extreme forward or rearward position of the main pin without the piston moving, but the pin driving the valve position is near the point of maximum movement with only slight rotational changes.

In the real 1:1 world, the trams are large enough to get both hands on to use the pointy end to scratch an arc on a 4 to 6-inch wide side of the wheel tire. In the model world, my hands are 32 times bigger than my miniature trams and it was VERY difficult to hold it rigid enough to scratch a visible arc on the 1/8-inch wide side of a wheel tire. I then tried drafting dividers to scratch bluing off the tire side. Although this produced two nice clear arcs, accurately finding the center between them was nearly impossible due to the extremely small area to work in (refer to Figure 16 again and you'll see what I mean!). I found it much easier just to tug on the crosshead to put the piston at the end of the cylinder.

Also note that in the 1:1 world, a tenth inch error in a measurement is a very small amount of error in a valve travel of 3 or 4 inches. However, in our miniature world that could be a 50% error if the valve has only a two tenths inch throw!

Next issue we'll cover the "Company Notch" and wrap this series up.

Bibliography:

Classic American Locomotives
The 1909 Classic on Steam Locomotive Technology
By Charles McShane
Originally published in 1899 by Griffin & Winters.
The special contents of this edition are copyright 2003 by The Lyons Press
The Lyons Press
Guilford, Connecticut
An Imprint of The Globe Pequot Press
ISBN 1-59228-054-4

The Locomotive Up To Date (1906)
By Charles McShane
Copyright 1906, Griffin & Winters
New York Life Building, Chicago, Ill.
Republished by: Little River Locomotive Company
Townsend, Tennessee
1999

The above two books are actually the same book. The only difference being that the second one includes 15 pages of period advertisements for other books by Charles McShane, other publications by Griffin & Winters, locomotives from various well and lesser-known locomotive builders, and artificial limbs from George R. Fuller. (The latter possibly being witness to the danger of working on the railroad in the late 1800s.)

The Locomotive Up To Date
By Chas. McShane
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Revised by Chas. L. McShane
Copyright 1920 by Chas. McShane
GRIFFIN & WINTERS
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1923

This is the best of the above three books for technical information and I know of no modern reprint of it. It must be noted that it is still a book from 1920, changes and improvements continued to occur in the industry, some of which may contradict the information presented. And an interesting note, in the earlier version of the book, Walschaerts' Valve gear is mentioned as being extensively used on the Belgian State Railways "but probably will not receive much attention from locomotive builders beyond that kingdom"... a scant half page. Whereas, the revised edition devotes nearly 60 pages to the design.

Basic Steam Locomotive Maintenance
Developed by D.C. Buell
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Model Locomotive Valve Gears
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La Locomotive A Vapour
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Camden Miniature Steam Service
Barrow Farm, Rode, Nr. Bath,
Somerset, BA3 6PS

Valve Gear Simulator
Charles J. Dockstader
P.O. Box 3111
California Valley, CA 93453-3111

This is not a "book" but is an excellent reference, none-the-less. It is a graphical computer program that will run on DOS or Windows based PCs. It can be used to design valve gear systems in any of over 3 dozen different types. It is also a great teaching tool for understanding the function and operation of the various types. If you enjoy watching the gear operate, it is just plain fun to watch!

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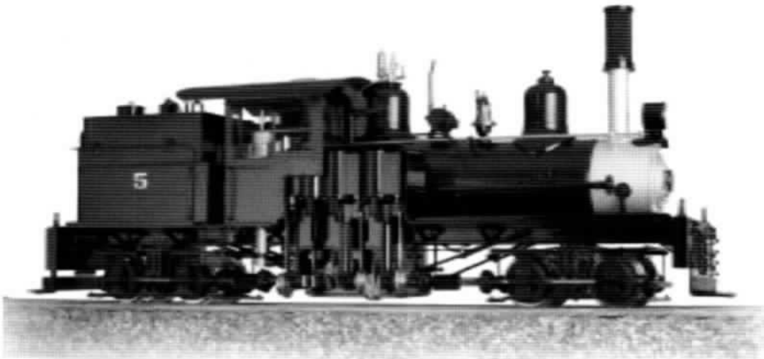


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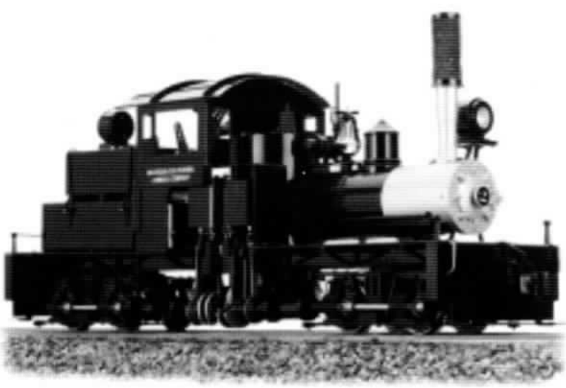

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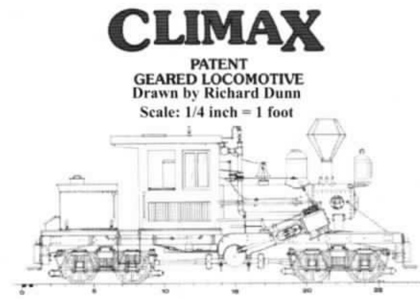

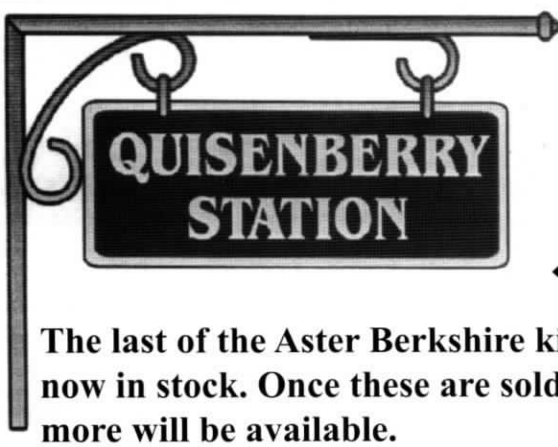

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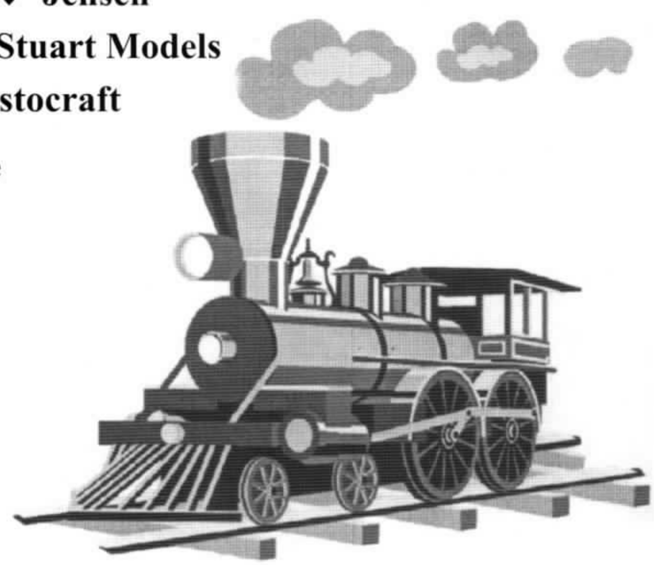

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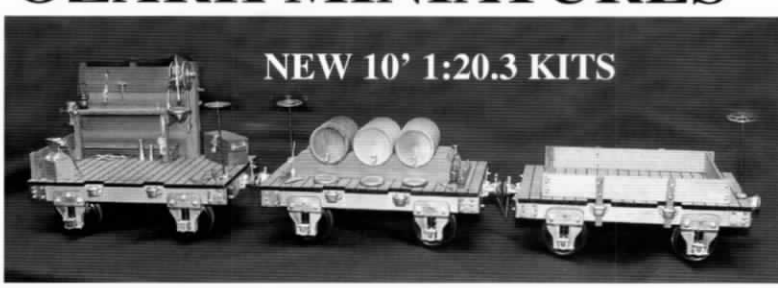

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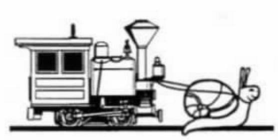

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