No. 178, March/April 2022 US $5.95
Canada $7.95

STEAM IN THE GARDEN

THE W.T. PRESTON

*** Accucraft P-8 Locomotive Review * Whimsical Climax - Part 4 Build**
*** Coal Boiler Design ... and lots more!**

Editor .... Scott E. McDonald
sitgeditor@gmail.com
(703) 490-9867

Associate Editor............................Gary Woolard
garishw2@earthlink.net
(310) 880-1369

Advertising Manager .... Sonny Wizelman
sonnyw04@gmail.com
(310) 558-4872

Circulation Manager .... Marie Brown
circ@steamup.com
(607) 642-8119

POSTMASTER: **Send Form 3579 to Steam in the Garden, P.O. Box 335, Newark Valley, N.Y. 13811-0335.**

Subscriptions **for the United States, Canada or overseas should be mailed to Steam in the Garden, P.O. Box 335, Newark Valley, N.Y. 13811-0335. Phone, fax and e-mail subscriptions are gladly accepted and we take VISA, Discover and MasterCard. PayPal payments are also available. Phone: (607) 642-8119; fax: (253) 323-2125.**

Hobby retailers: **Contact Kalmbach Publishing Co. at (800) 588-1544, ext. 818, if you wish to stock Steam in the Garden in your store.**

Steam in the Garden LLC
A Utah corporation

Editorial: **P.O. Box 1539, Lorton, VA 22199 USA**

Advertising: **10321 Northvale Road Los Angeles, Calif. 90064-4330 USA**

Circulation: **P.O. Box 335 Newark Valley, N.Y. 13811-0335.**

Steam in the Garden **(USPS 011-885, ISSN 1078-859X) is published bimonthly for $35 (Canada: $US42; Overseas: $US72) per year (six issues) by Steam in the Garden LLC, P.O. Box 335, Newark Valley, N.Y. 13811-0335. New subscriptions, please allow six-eight weeks for delivery. Periodical postage paid at Newark Valley, N.Y., and additional mailing offices.**

http://www.steamup.com/

Vol. 31 No. 6 Issue No. 178; March/April 2022

STEAM IN THE GARDEN

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

In This Issue

Cover: The magnificent stern paddlewheeler W.T.Preston out for a spin on the local pond - **Photo by Mike Jones**

Also inside:

LATEST WAYBILL

In Memoriam
Steve Shyvers -


Rob Lenicheck Photo

We lost a true friend and small-scale live steam devotee when Steve Shyvers passed on November 7, 2021. Steve was always on the quest for more knowledge, and constantly amazed those around him with his depth of subject matter and willingness to experiment to find answers to complex questions. If you had a question he was the go-to guy. As with most of us in this hobby, Steve was a tinkerer, fine-tuning his engines to improve their running characteristics. He scratchbuilt much of his rolling stock and converted one each of two Roundhouse Billys to alcohol and coal.

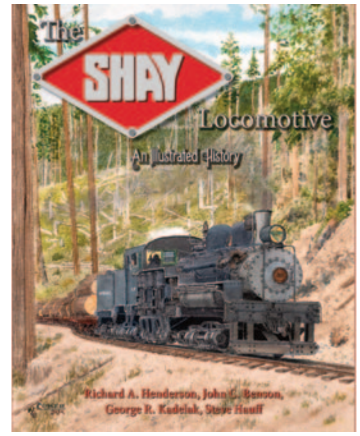
Unbeknownst to many, Steve was also a 10Ghz microwave radio aficionado and built his own units. He loved the outings the radio club provided, which most times were atop local mountains of the SF Bay Area. But most of all Steve was a cherished and devoted friend to many of us in the live steam community. He was kiddingly dubbed “The Gnome” by the Bay Area Live Steamers group because of his small physical stature and long beard. You could always count on him to provide humble, knowledgeable opinions or prophetic and wry humor whenever he was brought into a conversation. He will be sorely missed by all who knew him.

Submitted by Rob Lenicheck

RAILWAY LIBRARIAN

The Shay Locomotive: An Illustrated History

There's something about Shays. Whether it's the byzantine drive train so different from rod-driven locomotives, the distinctively fast three-beat of the chuff, or the romanticism of a piece of heavy machinery climbing a nine percent grade into the tree-covered mountains, we are fascinated by them. And judging by the several commercial offerings, their endless modifications, and the several classic scratchbuilds and kitbashes that the pages of this very magazine have helped bring to life, it's a fascination that we in the Gauge One live steam community share. So White River's new *The Shay Locomotive, an Illustrated History*, by Messrs Henderson, Benson, Kadelak & Hauff will be of interest. The 640-page, heavily illustrated volume offers a comprehensive view into the history and design of the locomotive and its copies.



It's a deep dive, broken down into three parts. The first part covers the history of the design, production and operation of the locomotive, from Ephraim Shay's beginning to the days of Lima's great expansion, and to the Shays which survive today. Part Two is simple but powerful -- Lists! Organized by Lima shop number, owners & operators, and even by geography. This is where to go to track down any Shay, anywhere.

Part Three constitutes the very meaty appendices; the patents, including profiles of the various inventors. The engineering and erection drawings, including the evolution of the Shay's power truck design. And lastly, miscellaneous statistical and technical info, including records of unusual variations, and designs that were never built. That the authors went directly to the 'source material' is illustrated by the bibliography, which includes Lima's own publications and U.S. patents.

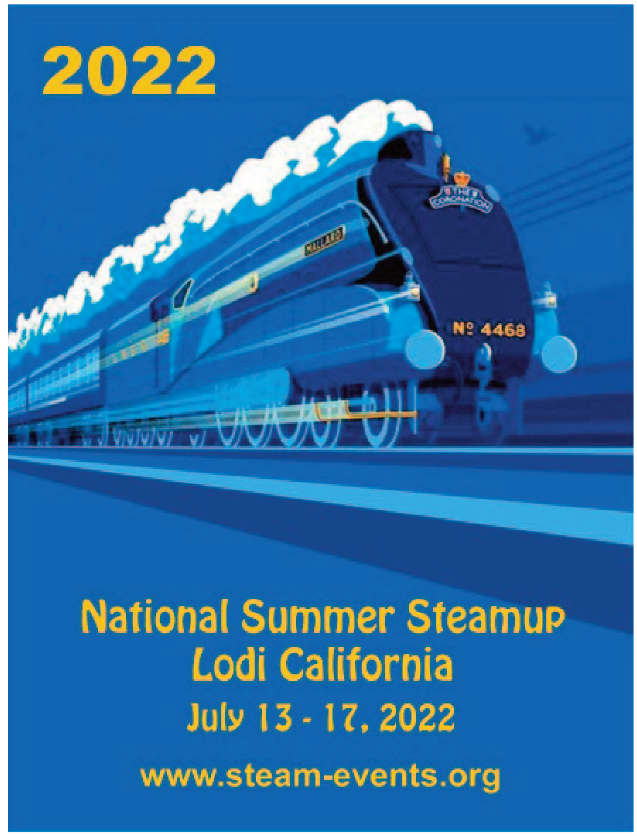
While this volume is detailed and extensive, it's also very readable, and full of interesting tidbits and anecdotes. This reader was surprised to learn how soon Ephraim Shay left the locomotive enterprise, selling off his stake to pursue other interests. And Lima's Shay business was a 'boom-and bust' story -- there was great expansion in the early 1900's, but Shay production had practically ceased by the early 1920's.

There are more than 1000 photos and drawings. There is some color, but the photos are mostly historical and black and white -- by themselves they show much about how the engine was used in the real world; in combination with the text they have quite a tale to tell.

If you're at all interested in Ephraim's Shay, buy this book. It will make you even more interested. Available from White River Productions for $99.95

Submitted by Gary Woolard

Cass, WV, three Shay race. S.E.McDonald Photo



Steam in the Garden Magazine Transition to All Digital

Our September/October 2022 Issue #181 will be our last subscription printed issue. All subscriptions following #181 will be digital only and available for download to Digital Subscribers at our website:

www.steamup.com.

The following is our pro-rated schedule for those whose print subscriptions expire before issue #181. Please order online. The issue number that your subscription expires on is located on the mailing label of your most recent magazine.

(3 Issues) Issues #179 - 181: $15.00
Renewals must be received prior to 18 February 2022.

(2 Issues) Issues #180 - 181: $10.00
Renewals must be received prior to 25 April 2022.

Final Print Issue #181 - Order online

For those who want to continue to receive a printed version of the magazine after #181, you can order from our Print-on-Demand provider at *https://www.blurb.com/user/sitgeditor.*

www.blurb.com/user/sitgeditor

Please note, this is a contracted service. *Steam in the Garden, LLC* is not reponsible for any issues between Blurb and their customers.

A Whimsical Climax Part Four

Text and Photos
by Bill Allen

Cab, Bunker & Carrying Case

CAB

The Climax is built with a wood cab and brass bunker. I believe the early Climaxes had the wood cab and steel bunker so I wanted to match that look as closely as possible. I wanted a rough and slightly weathered look so I decided to use oak for the siding and mahogany for the trim. I used a black antiquing glaze for the finish which brought out the grain of the wood. The oak I used is fairly close grain. Although you can never get the grain to scale, I am happy with the look.

Long strips were ripped to 1/8-inch thickness on the table saw and then to width to make the boards for the center panel. They were then cut slightly over-length and glued side to side with TiteBond III. The resulting panel was squared up and cut to size on the table cross-cut sled. More of the 1/8-inch slats were used for the border of the panel and to frame in the window openings. The longer upper frame with the roof support was shaped on the band saw. The mahogany window frames and arm rest were again ripped to size on the table saw from scrap pieces I had laying around (**Photo 4-1**).

The front of the wood cab Climaxes had a metal heat shield which I replicated from brass (**Photo 4-2**). The cab front was made from birch plywood as I felt it would be stronger where the material is thin around the doors and boiler cutout. The notch at the right bottom in the photo is for the steam pipe and the slot on the left is for the reverse reach rod.

Photo 4-3 shows the construction from the inside. Glue blocks are used in furniture construction to fortify corner joints. After the pieces are all glued together, the blocks are glued in place and slid up and down to expel any air and get a full glue joint on both sides. You can see the blocks I used here. Also shown is the brass strip used to attach the cab to the floor. E6000 is

Whimsical Climax Series

Part 1 - Frame & Cylinders
Part 2 - Boiler
Part 3 - Chassis
➡ Part 4 - Cab & Bunker


Photo 4-1


Photo 4-2


Photo 4-3


Photo 4-4

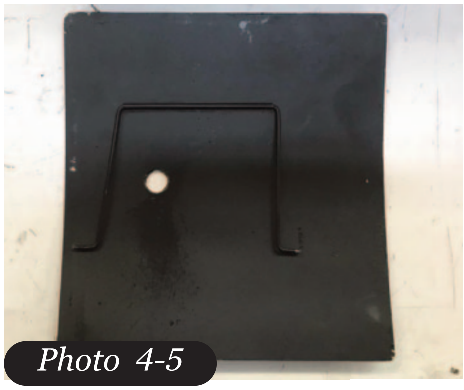


Photo 4-5


Photo 4-6

used here as the wood glue doesn't stick to the brass very well.

The rear section of the cab is very thin at the top, allowing for access to the boiler fittings. The wood strip is supported by a brass strip which also serves as the female pivot for the roof bracket (**Photo 4-4**).

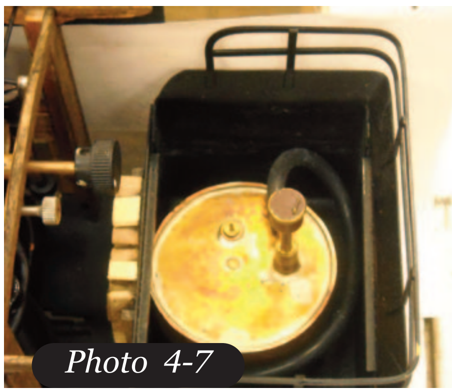


Photo 4-7

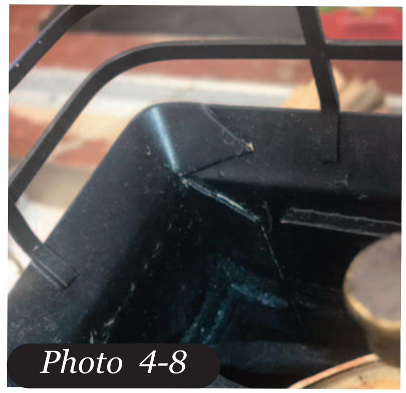


Photo 4-8

Photo 4-5 shows the bottom of the roof. The pivoting bracket is formed from music wire inside a length of copper tubing which is soldered to the roof. The hole is where the safety protrudes through.

Photo 4-6 shows the cab in place around the huge Tee box boiler which allows for maintaining a steady pressure while pulling a couple of dozen heavy log cars.

To finish off the rustic look, the roof is coated with a sheet of canvas and painted flat black

BUNKER

The bunker houses the fuel tank and is made waterproof, allowing water to be used to maintain a consistent temperature in the tank (**Photo 4-7**). Because the boiler has a large water capacity, a hand or axle pump is not necessary. A Goodall valve is all that is needed for water level maintenance.

The bunker is just a brass box with four sides. The only tricky thing is the way it flares out at the top. The two sides were made a little longer to allow for the bend up at the two rear corners, where some nipping and grinding was necessary to get a smooth transition (**Photo 4-8**).

The removable top has wood logs made by cutting some twigs to length and then splitting them to quarters with a wood chisel. They were glued in place with E6000 (**Photo 4-9**). The little hatch protruding through the wood load is the gas valve knob (**Photo 4-10**).

Short pieces of logs were glued to the front of the bunker to simulate the access to the cab (**Photos 4-11 & 4-12).**


Photo 4-9


Photo 4-10


Photo 4-11


Photo 4-12


Photo 4-13


Photo 4-14


Photo 4-15


Photo 4-16

CARRYING CASE

The carrying case is a plywood box with a couple of twists. First, the lower half is missing the front and back and has two grooves which the wheels ride in. This allows for easy lifting of the engine out of the box by holding the front and rear buffers

On the back is a substantial brass fixture which holds the engine from moving vertically and horizontally by attaching to the lower coupler pocket by the pivot pin. (**Photos 4-13 & 4-14**).

The front and rear of the upper section of the box are longer and cover the missing sections of the lower half. There is also a square piece of foam glued to the inside which keeps the front of the engine from coming up and out of the track grooves (**Photo 4-15**). Four snap latches make it ready to transport (**Photo 4-16**)

CONCLUSION

This has been a rewarding project. Thinking back to the swap meet where I bought a truck only because the price was right; to swapping some labor for another truck; to making a unique model that still retained several prototypical features, and finally coming up with what I consider may be the best running Climax model ever. I urge you all to consider doing some kitbashing or scratch building. To me, the pleasure derived from building live steam engines far exceeds the joy of running them.

The Army's Greatest Boat

THE W.T. PRESTON

Text by Mike Jones

Photos by Mike Jones & Dave Sohlstrom

Background

The building of this model has its roots going back over seven decades to a little logging town at the foot of the Olympic Mountains in Washington State. I was born into a logging community that ran on steam power. My world consisted of monster drag saws, huge Kenworth logging trucks so big I needed help just to get up on the running boards, massive fir and hemlock trees, and to me the most fascinating of all, Simpson logging company's big 80 ton Shay geared locomotives! Their distinctive machine-gun-like engine noise and steam whistle was an exciting 'heads-up' that one was coming, belching dark grey smoke and steam. Why, you'd think it was doing 80 miles an hour. But I could run fast enough to keep up with one.Their engineers bragged that 'you could scratch a pair of lines in the dirt and a Shay would follow them...' Not quite true, but damn close. Spiking down new rail wasn't done with much finesse in the forests where these amazing engines worked. Operating on tight radius turns and steep grades were the reason Shays existed.

My earliest memories are of laying in bed on cold wintery mornings in Camp Grisdale and listening to the shrill echoing whistle of a Shay laboring with a consignment of 50 log cars, charging up the grade out of the Wynoochee River valley on its way to the sawmills in Shelton, 50 miles distant. Geysers of gray smoke shot hundreds of feet in the air. The whistle would blow telling all who could hear that not gravity or grade was going to stop its run up the mountain. Camp Grisdale was the very last resident logging camp in the country, and home to 57 families and hundreds of bachelor lumberjacks.

My grandfather **(Photo 1)** finished his career with Simpson operating the steam donkey at a transfer site near Camp Govey just north of Shelton. Govey Transfer was where logging trucks brought their loads to a railhead. They were then loaded on log cars for the trip to Shelton's sawmills. He often took me to work with him which meant getting to the transfer very early in order to get steam up in the boiler. My great joy was seeing enough pressure to blow the whistle! The sound echoed and lingered in the deep Vance Creek

Photograph Courtesy of the Anacortes Museum

Photo 1

canyon nearby.

Simpson's logging Railroad operated for 120 years over 80 miles of track. It was the last privately owned logging railroad in the continental United States. The Vance Creek Bridge and High Steel Bridge were among the highest railroad bridges in the world. Interesting that they were both built the same year as W.T. Preston.

Years later, as a teenager living in the seaside town of Edmonds, 70 miles from Shelton, I spent many days kayaking on Puget Sound. Sometimes I could intercept a glorious old paddlewheel steamboat, the W.T. Preston, as she made her way past Edmonds. Her job was to remove deadheads, stumps and logs from Puget Sound. With a draft of just three feet she was perfectly suited to do this work on the 11 navigable rivers feeding into the Sound.

W. T. Preston was a Snagboat operated by the US Army Corps of Engineers. She was built in 1929 and served until 1981. Being an Army vessel, she made no pretense nor need to hold to nautical traditions. She was built on a flat bottom barge. Her superstructure was built more like a World War ll barracks. However, one nautical concession was made. She sports just two round porthole windows. All her working gear came from the logging industry, including her Washington Ironworks three drum steam donkey engine that operated the 80-ton crane on the bow.

Three sternwheeler snag boats served; the Skagit, Swinomish and W.T. Preston. Many parts of the very first boat ended up on the Preston including her engines, boiler, steam donkey and ship's bell and whistle. Bits and pieces were handed down much like kids getting older siblings' clothes.

Her crews of 10 to 14 people lived aboard. Their job was vital to keeping commerce and trade on the rivers moving. There were few roads as mining, farming and logging pushed deeper into the old growth forests – rivers were the superhighways of the time. And the perfect boat to keep them open was a shallow draft sternwheeler. Such a design could tolerate grinding over a gravel bar, a maneuver that would lay up a propeller driven vessel. Preston was routinely run up on them so that the ship's cook could go ashore to barter for fresh eggs, bacon, milk. He used dynamite,which was carried for breaking up log jams, for barter. Farmers used it for cleaning pastures of stumps. There was no ATF or Homeland Security to deal with.

Many crew members were recruited off the riverbank and most went on to spend their entire careers aboard Preston, with a few becoming Chief Engineers or Captains. Just seven men served as Captain on the Preston.

In 2010 I moved from Honolulu back to Edmonds, where I grew up after Shelton. Here at last I had access to a shop where I could fulfill my long-time dream of building a model of the Preston. No plans existed. However, W.T. Preston being a two - hour drive away was a stroke of good luck. Many trips were made to photograph, sketch and measure the boat.

Preston had been donated to the city of Anacortes, 60 miles north of Seattle, to be part of a museum display celebrating a 98-year history of service provided by the Army Corps of Engineers. Anacortes Museum inherited old War Department drawings from the Corps, and among these were side, top and front drawings of Preston. I had these printed at 150 percent of the original. This served as my main reference for building the model.

Almost immediately I began thinking about how to power the model and how big to build it. Early on, a 1/24th scale build was considered, yielding an 84-inch long model. This scale was desirable to keep the paddlewheel rpm low, avoiding the unnatural look created by throwing water everywhere while turning at high rpm.

The second major consideration was whether to go live steam or electric. That decision wasn't made until well into construction. And at one point I built an electric drive for the boat. Many on RC Groups where I had started a build log were more than happy to offer advice on the subject. Most argued electric would be the way to go – lower cost, less maintenance, ease of operation and no fire hazard. All these were true, but did not take into account my strong bias growing up around steam power. I chose to take the path less traveled, so steam it would be. 1/24th scale was changed to 1/32nd scale making the model easier to transport.

Having built a previous sternwheeler model of my own design I thought I had a good idea of what I was in for. This assumption proved to be off by several orders of magnitude. I wanted to do plank-on-frame construction as before. I also began searching for Alaska white cedar for the hull and superstructure framing. Nothing could be found to do the planking. The solution came by way of a pile of very old discarded Alaska Cedar one-by-six fencing boards rescued from a burn pile. First I rough-cut the boards into six-foot by one-inch by one-inch planks. These were milled into finished lumber on a precision Byrnes table saw and run through a thickness sander. My little sawmill setup worked great.

Once the decision was made to go with steam, calculations were made to give me the scale speed I wanted to achieve. The first order of business was to determine boiler size. Mike Abbot from Macc-models in the UK delivered a work of art.

Design Assumptions/Calculations:

- Scale cruising speed - around 1.39 Knots
- Paddle speed required to achieve 1.39 Kt- 110 rpm (assuming 20% slippage)
- Cylinder bore= .625"
- Stroke = 2.25" (Double acting)
- Sweep volume (X4) = 2.75 cu in per revolution
- 2.75 cu in X rpm (110) = 302.5 cu in of steam per minute at 40psi making 1.39 Knots
- Boiler must be able to evaporate 0.755 cu in of water per minute
- Boiler capacity = 45.77 cu in of water
- Capacity (45.77 cu in) divided by evap. rate (.755 cu in/min) = 61 minute run time. Because not all boiler water is usable, run time estimate turned out to be much lower.

A boiler feed water pump and tank were added, extending run time to about 50 minutes.

The goal was to have a realistic-looking model that also functioned as realistically as possible.

By June of 2011 the decision to go with steam was made and announced on my build log. This elicited a response from a follower on the log and technical discussions ensued with him. Dave Sohlstrom turned out to be a retired Coast Guard master machinist with a very complete machine shop. He is an expert in steam engine design and fabrication as well as CAD/CAM design. We planned a trip to Anacortes to examine Preston's engines. No drawings or plans were available. It took several trips to make careful measurements and take photographs of the engines before doing CAD drawings.

Several changes were made to our design to aid low-speed engine performance. The first was increasing the bore from 7/16-inch, which was scale

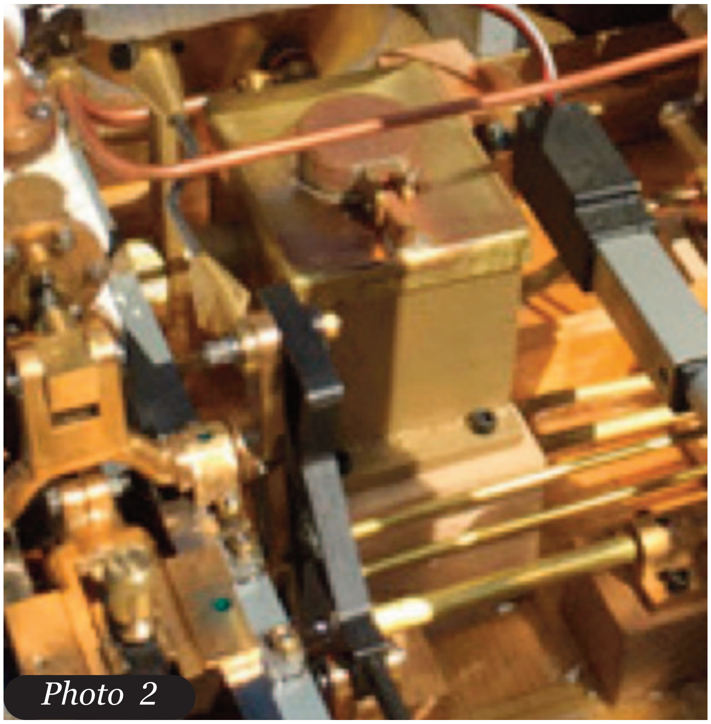


Photo 2

at 1/32, to a bore of 5/8-inch. The second change was to not incorporate Preston's variable steam cutoff on the valving. This would have turned an already complicated design and machining project into a watchmaking exercise, and while it would have retained the scale operation of the engines, I elected to go with a fixed cutoff. The cylinder dead space was slightly increased to reduce the risk of hydrolock. Three-position radio controlled cylinder drains were built with 'closed', 'half-open' and 'fully open' positions selectable on the transmitter. All live steam lines, cylinder and valve chest castings were insulated. Steam oil is metered and injected into the cylinders by way of a two-piston pump and oil reservoir shown in **Photo 2**. The pumps are driven off a drive link connected to the port engine rocker shaft. Engine reversing is done using a Stephenson reversing gear design, which is actuated by way of a linear servo.

Dave lived on the south side of Mount St. Helens 120 miles from me. We spent many hours on Skype collaborating on the engine build. His Bridgeport mill was used in making the aluminum master cylinders and cylinder valves for the investment casting of the engines. A total of three sets of bronze castings were made (**Photos 3 through 6**). Several fixtures were also made to hold the cylinder castings during machining.

There were other departures from scale, such as making the lubricating grease cups larger to hold adequate lubricant. Nuts and bolts made to scale

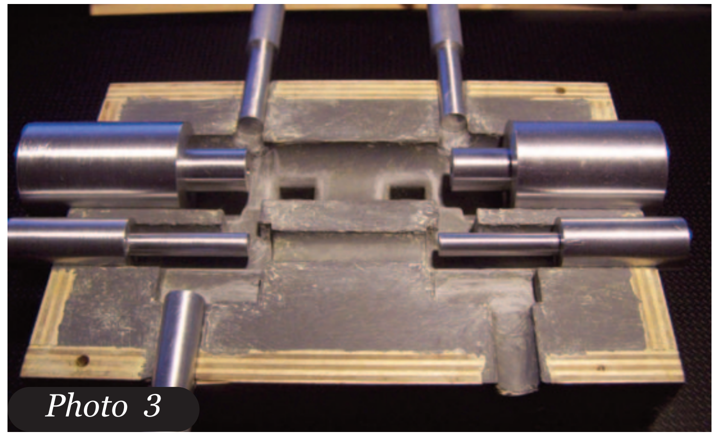


Photo 3

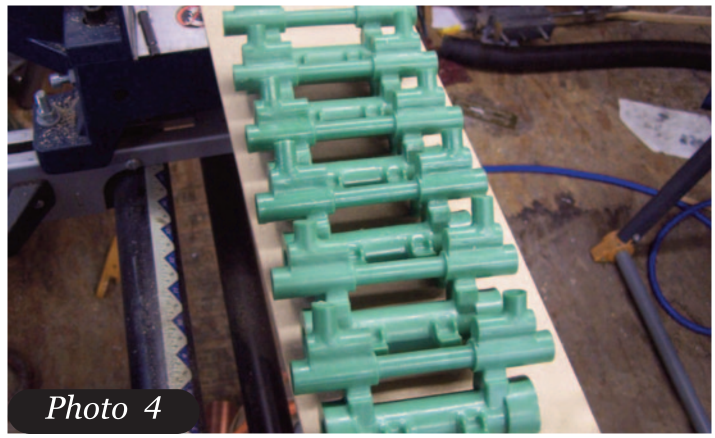


Photo 4

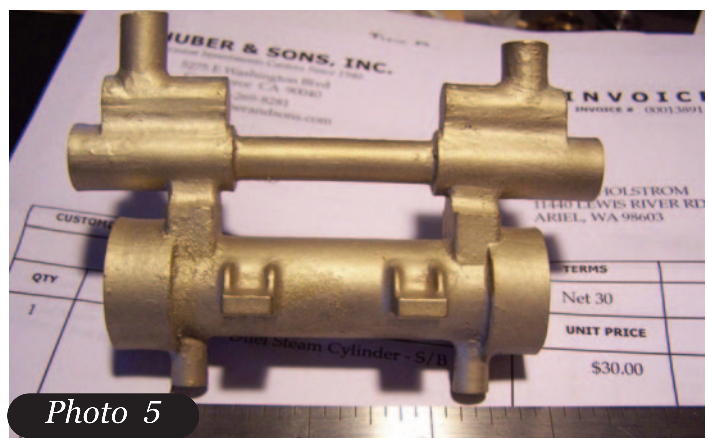


Photo 5

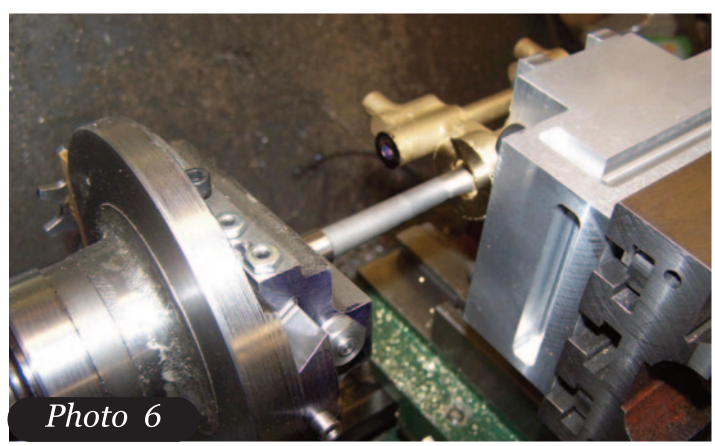


Photo 6

Photo 7

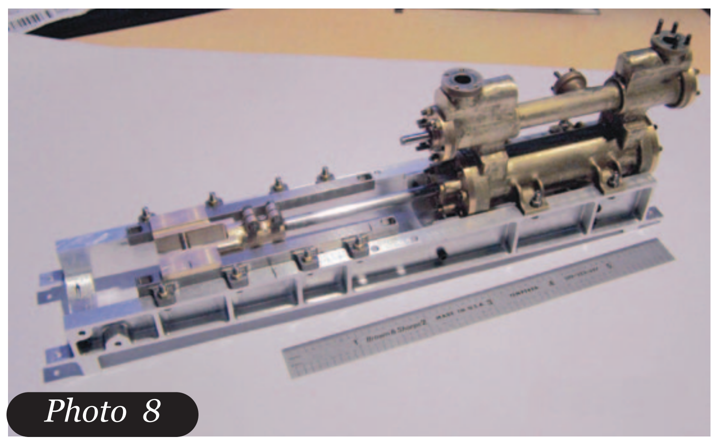


Photo 8

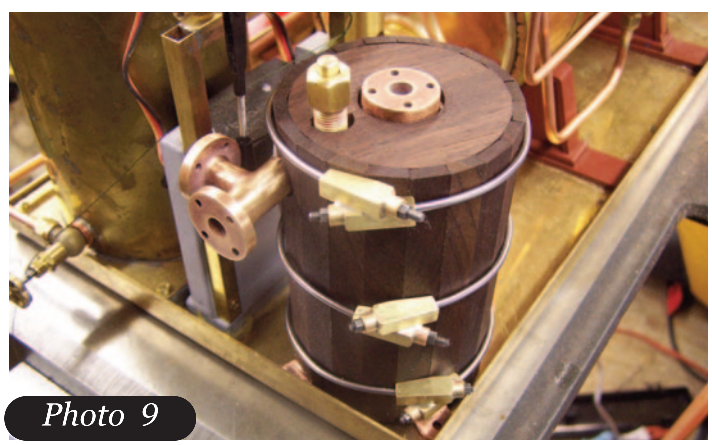


Photo 9

would be too weak. The biggest departure from scale was made to increase draft and buoyancy, by adding one-half inch of freeboard. I also added a half-inch keel to improve seakeeping. W.T. Preston was notoriously bad at handling wind and waves.

Mike Abbot's boiler and fuel tank arrived just before Christmas, 2012. They were jewels, beautiful works of art! (See **Photo 7.**) The certified horizontal marine fire tube boiler is three and one-half inches in diameter and seven inches long with eight cross tubes, two longitudinal stays, burner unit, water gauge, feed water check valve, safety valve, pressure gauge and various bushes. It is made from 16 gauge copper and silver soldered. The propane/butane fuel tank is two and one-half inches in diameter and six inches long, and is also made from 16 gauge copper. It is pressure tested to 300psi.

Covering up Mike's exquisite work with mahogany cladding was hard to do. Cladding the boiler was more about protecting my fingers from burns. It would have taken a half-inch of insulation to make a difference. An inner copper smokestack attached to the boiler slides inside the superstructure stack. This allows the superstructure to be lifted off. Besides venting the firebox, two smaller tubes inside the stack vent engine exhaust and steam from the safety relief valve.

Two engine girders were milled from block aluminum to hold the engines and cross-head guides **(Photo 8)**. Each 10-inch Pitman arm was also milled from aluminum bar.

For me the crown of a sternwheeler is the paddlewheel. The model faithfully recreates Preston's 18-foot wide and 17- foot in diameter wheel. There are 814 individual parts in the model's wheel. It is made out of brass and wood paddle buckets. Her center hubs were cut on a waterjet table, as were the outer two "iron circles."

About the same time, work was finished in machining the master cylinders and valve cylinders. From the masters, wax castings were made. Six wax plugs were prepared for bronze casting. The plugs were sent off to the foundry. Christmas came early - Dave was able to sell one of the extra casting sets.

Several systems on the model had to be either thrown out or modified. The reversing gear was remade to accurately duplicate Prestons' Stephenson system,and the oil/water separator was done over to lighten the boat **(Photo 9)**. Valve cages turned out to be a challenge to make due to their small size and the precision required to control admittance and exit of steam in the cylinders. An extra set was made in case of damage. These were made on a

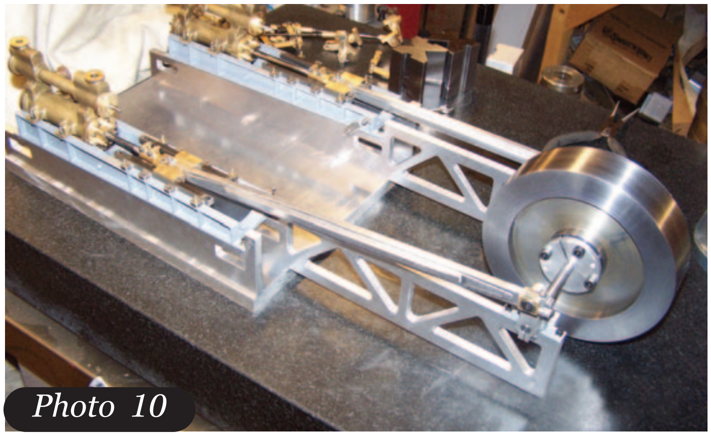


Photo 10

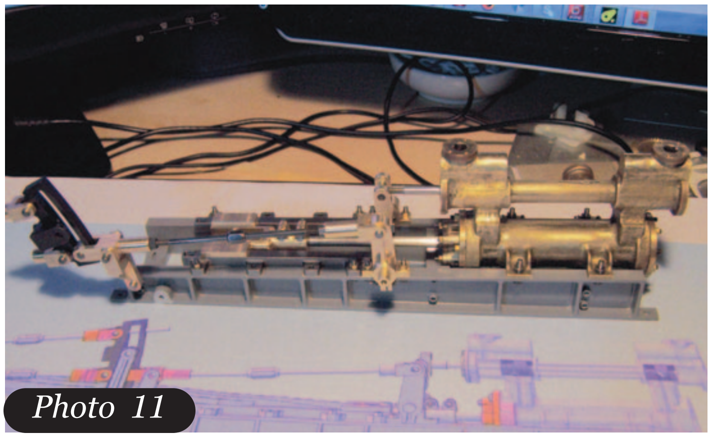


Photo 11

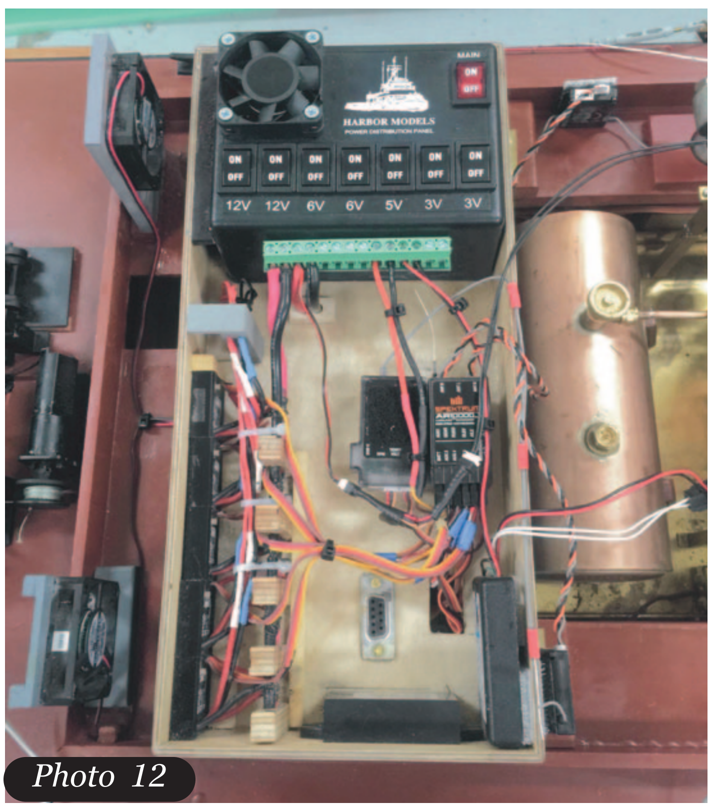


Photo 12

smaller mill. We used a commercially sourced steam oil injector pump with integral reservoir to lubricate the engines.

A test fixture was built allowing the engines to operate out of the hull and turn a heavy aluminum disk in lieu of the paddlewheel **(Photo 10)**. Engines were operated on compressed air and live steam in the test fixture. The aluminum disk provided a dummy water resistance load on the engines. It gave us a very good idea of how smooth the engines could operate at low 20 to 30 rpm speeds. Testing showed that at just 10 psi the engines ran smoothly at around 30 rpm.

Running in the test fixture uncovered no design issues and gave us a good idea of what to expect when the engines were installed in the boat. Final installation proceeded in Dave's machine shop. It was a crucial test of how well the engines and drive components would mate with the hull, and especially the paddlewheel. The paddlewheel cranks were set 90 degrees apart. It took quite a bit of adjusting to get everything properly aligned and free of binding. Mating precision machine work and woodwork is not easy.

Power from the cylinders is transferred to the paddlewheel through crossheads running on lubricated guide rails machined out of iron plate, then through Pitman arms milled from aluminum plate and connected to the main crank pin on the paddlewheel **(Photo 11)**.

The main deckhouse and engine room are ventilated by two 12v fans pulling in air through windows in the forward work deck area and exhausting through two side doors near the stern **(Photo 12)**. Insulating sheets were installed on the outboard side of each engine to protect the styrene main cabin walls. This was done to prevent overheating the styrene walls of the cabin and to keep the temperature below 135ºF. My fire suppressing system uses a fusible link to discharge a CO2 bottle if the temperature goes above 135ºF. in the engine room. An automatic bilge pump dewaters all spaces in the last two compartments. There are four openings for the Pitman and eccentric arms in the splash bulkhead through which water enters when backing the boat.

The biggest challenge, other than building the engines, was installing the 51 lights and R/C controller. Wiring had to be torn out and redone several times. 32 gauge winding wire proved to be very delicate and did not tolerate bending. The first steam donkey was thrown out and replaced.

The final control configuration used a Spectrum DX-10t tray radio, telemetry unit, and a separate 12-channel radio control unit for the 51 lights.

Each nav light is individually controlled. This allows Preston's lights to be set according to US Coast Guard Rules of the Road — see **Photo 13**

Control Functions (DX-10t):

- Rudder
- Steam throttle
- Cylinder Drains
- Spuds[1]- Up and Down
- Emergency Fuel Shutoff valve
- Steam Donkey/Crane functions
- Topping Lift drum
- Pennant drum
- 80-ton main lift drum
- Crane turntable

Through the transmitter, boat operation functions can be switched over to crane functions. The model must first be stopped and spuds lowered in order to operate the crane.

Spektrum's Telemetry System allowed monitoring of boiler temperature and receiver battery voltage to be displayed on the transmitter as well as to an iPhone set to vibrate warnings. Preston's electrical panel is powered by two LiPo 3500mah batteries.

I built a 1/32nd scale wharf that is eight feet long to go along with the Preston **(Photo 14)**. It features radio controlled lighting and a three-channel dock crane. The dock is anchored to cement blocks.

Many times I questioned my decision to go with steam. One downside not thought about was how Preston would be displayed and operated. As good as she looks all buttoned up, I found more people were interested in seeing the inner workings work **(Photos 15 & 16)**. The crowning glory of W.T. Preston are her steam engines and paddlewheel.

Photo 13

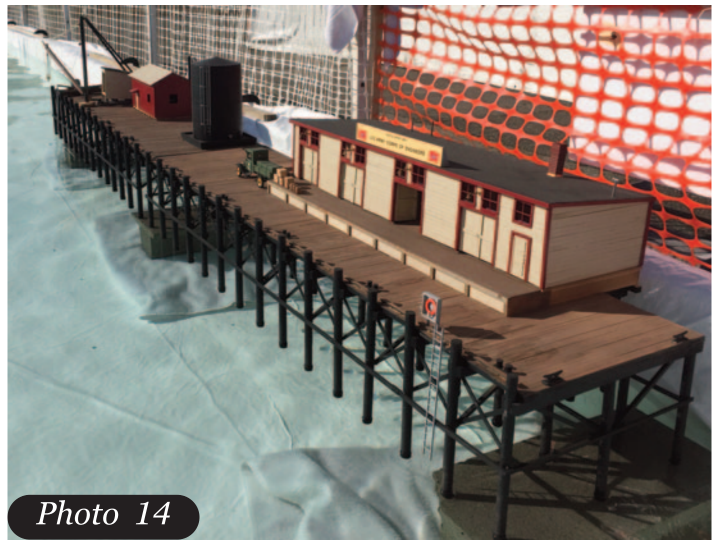


Photo 14

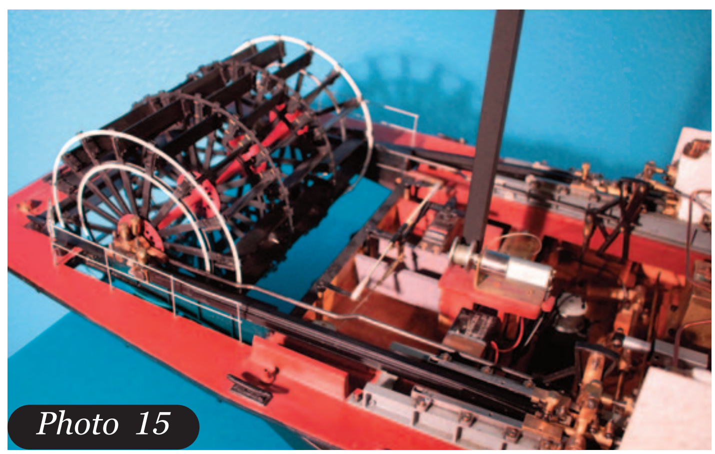


Photo 15

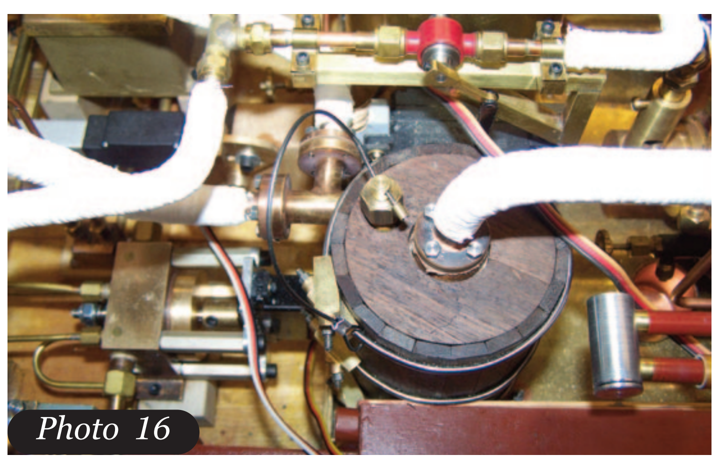
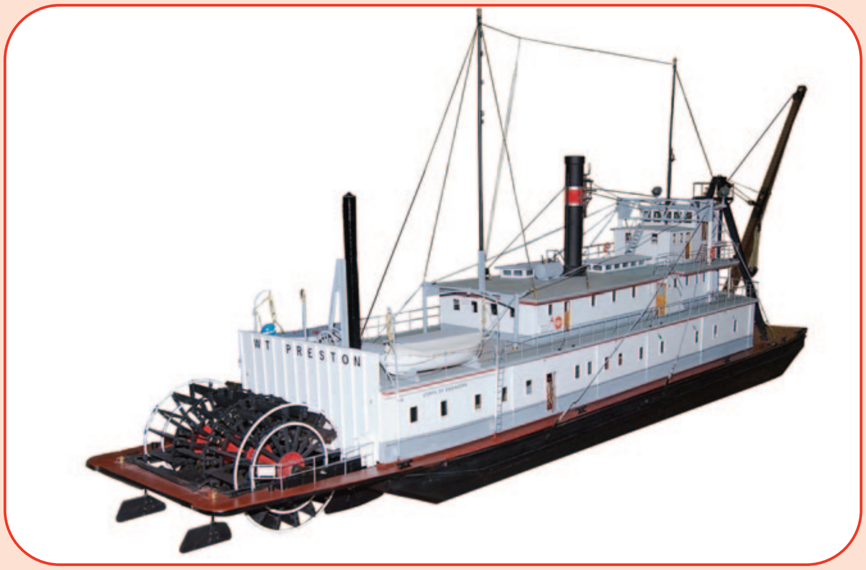


Photo 16

Summary

The model has captured what I had envisioned from the beginning. Build standards where set high to capture Preston's charm and character. Even so, compromises in the design and building had to be made but still resulted in a very unique model who's value goes far beyond what she's appraised at.

Specifications of the W.T. Preston



Scale: of 1/32
Length: 63-inches
Width: 13-inches
Height: 29-inches
Weight: 49lbs.

From the beginning the model was intended to be powered by steam engines modeled after the Gillette and Eaton engines in the actual boat. All major functions of the Preston were to be accurately recreated and fully functional. These included:

Power Plant: Scale operating non-condensing long throw steam engines with Pitman arm drive to the paddlewheel.

Fixtures:

- Five rudders
- Two operational spuds for anchoring the vessel in shallow rivers
- Crane on foredeck, including operational three-drum Washington Ironworks steam donkey and Bull Wheel
- Bilge Pump
- Steam throttle and steam engine reversing gear
- Automatic boiler pressure regulator
- Automatic high pressure boiler feed water pump and tank
- Automatic CO_2 Fire Suppression System
- Emergency Fuel Shutoff valve
- 12 Channel lighting control system including interior and exterior work lights
- Independently controlled search lights and all navigation lights.
- Nav lights can be set according to all USCG Rules. There are a total of 51 lights on the model.

W.T. Preston has been displayed at the following venues:

- 2014 Northwest Hobby Expo
- Oysterfest 2015, 2016
- Allyn Days 2016
- Elma County Fair 2015
- Edmonds Saturday Market 2014

The model continues to be a source of great interest, not only in the model, but her long and colorful history in the Puget Sound region. Many people who have seen the model comment on their experiences watching the W.T. Preston working around the Sound. She worked from Blane, north of Bellingham to Olympia and on all the navigable rivers in Western Washington.

1. Spud – A shaft that is usually made of steel used to anchor or moor a barge to a particular area. This protects the barge from movement due to currents, wind, and use of machinery on the vessel. The spud is driven into the soil or sand below the barge. Spuds usually can be raised using either a specialized machine on deck or by using a winch, either mechanical or hydraulic.

Locomotive Review

Accucraft P-8

Text and Photos by Jeff Williams

I'm just old enough to remember the last years of steam locomotives operating on the Southern Pacific Railroad. I was born in Berkeley, CA where one of my parents' favorite restaurants was "Spenger's Fish Grotto," located less than a block from the Berkeley Southern Pacific depot. This is where I began a life-long fascination with trains and became enamored of the steam locomotives that pulled the passenger trains through Berkeley. I have a black and white photo of me with my older sister gazing up at one of those enormous (compared to a four-year-old) locomotives.

Pacific-type and Mountain-type (4-8-2) locomotives typically pulled those trains that I loved to watch as a small child, so when Accucraft announced its intention to produce a live-steam P-8 class Pacific-type in 1:32 scale, I ordered one immediately. Many years have gone by since that announcement, but eventually my very own live-steam model of the locomotive was delivered in October, 2021. The model is sold under the "Accucraft" brand, not the "Aster Hobby" brand (now partners with Accucraft) but many design features are similar to Aster models and are different from and improved over the older Accucraft-branded locomotives I own.

Accucraft offers this model in both live steam and electric versions; the live steam is available either gas or alcohol fired, and in ready-to-run and kit versions, a novelty for Accucraft. I chose the RTR butane #2467 version. Accucraft decided to use a ceramic burner for the butane versions rather than the poker-type burners that most of their previous butane models have used. This makes sense for design and cost reasons, as the boilers for butane and alcohol versions can be almost identical. This is my first ceramic burner locomotive model.

One accessory that the owner must have for either version is a draft fan, as the ceramic burner requires an external means of supplying draft air during start-up (to draw the burner's heat through the boiler tubes and out the stack), just as with the alcohol version. The single-speed battery-powered fan I bought many years ago works just fine for this function.

I had some problems installing the detail parts that are packed separately from the loco. The beautifully detailed whistle was easy to install, but the other two detail parts were not. The instruction manual directs you to install the pipe with the red valve handle "in the front of the safety valves."

History of the Southern Pacific P-8 class 4-6-2 locomotives.

SP P-8 at Niles Canyon Railway. Photo by: Espeeac12, CC BY-SA 3.0 , via Wikimedia Commons

The Southern Pacific Railroad purchased 149 Pacific-type (4-6-2) locomotives from 1904 to 1937 in classes P-1 through P-14. Pacific-type locomotives ran all over the SP system and on their Texas subsidiaries, pulling named passenger trains such as the Daylight between San Francisco and Los Angeles, the Overland Limited between SF and Ogden, Utah, the Sunset Limited between LA and New Orleans and the Sunbeam between Houston and Dallas on the Texas and New Orleans Railroad (T&NO) as well as on less well-known passenger routes, pulling up to a dozen heavyweight passenger cars.

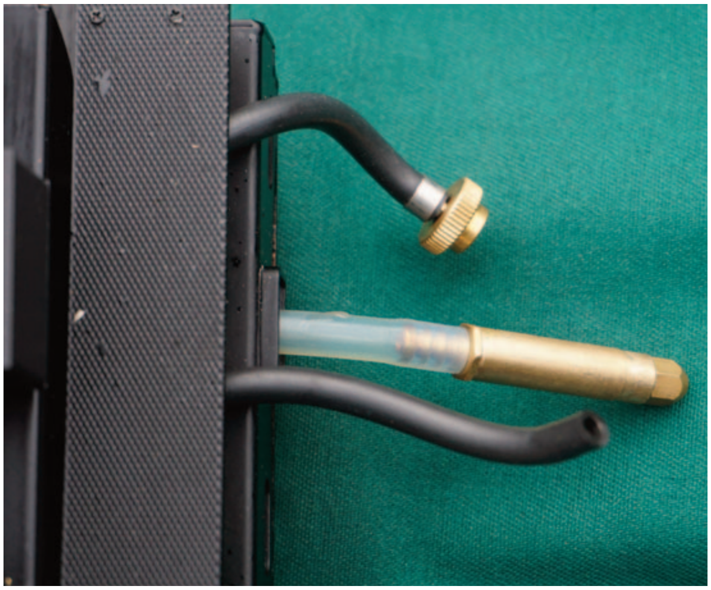
The P-8 class locomotives that Accucraft has chosen to model were part of a 1921 purchase of fifteen locomotives (#2461 through #2475) from Baldwin weighing 300,000 lbs with a tractive effort of 43,660 lbs. This class had 73 inch diameter driving wheels, 25 inch bore and 30 inch stroke cylinders, and operated with a maximum boiler pressure of 210 psi.

All of the SP Pacific-type locomotives were oil burners, most with Vanderbuilt-style tenders, but some with rectangular tenders.

By the 1950s, the Pacific-type locomotives were mostly relegated to commuter and other short routes. Pacific-type locomotives still pulled a few named trains, such as the Del Monte to Pacific Grove, CA, the Suntan Special to Santa Cruz, CA and the T&NO Sunbeam. At the end of steam power on the SP, all but three Pacific-type locomotives were scrapped. Two P-8 class and one P-10 class locomotives survived and went on display at public parks in the San Francisco Bay area. Accucraft has modeled the two surviving P-8 class locomotives, the #2467 and #2472.

Many decades after my childhood exposure to SP steam locomotives at the Berkeley, CA station, I participated, as a member of the Pacific Locomotive Association, in moving #2467 from display in a public park in Oakland, CA to a railroad siding near the Port of Oakland After years of restoration work, #2467 participated in the 1999 Railfair in Sacramento and also made several mainline railfan runs. This locomotive has been displayed at the California State Railroad Museum since 2005.

Golden Gate Railway Museum volunteers made #2472 operational in the early 1990s, pulling numerous mainline railfan trains. It also ran occasionally on the Niles Canyon Railway between 2008 and 2015. This locomotive now resides on the Northwestern Pacific Railroad at Schellville, CA.

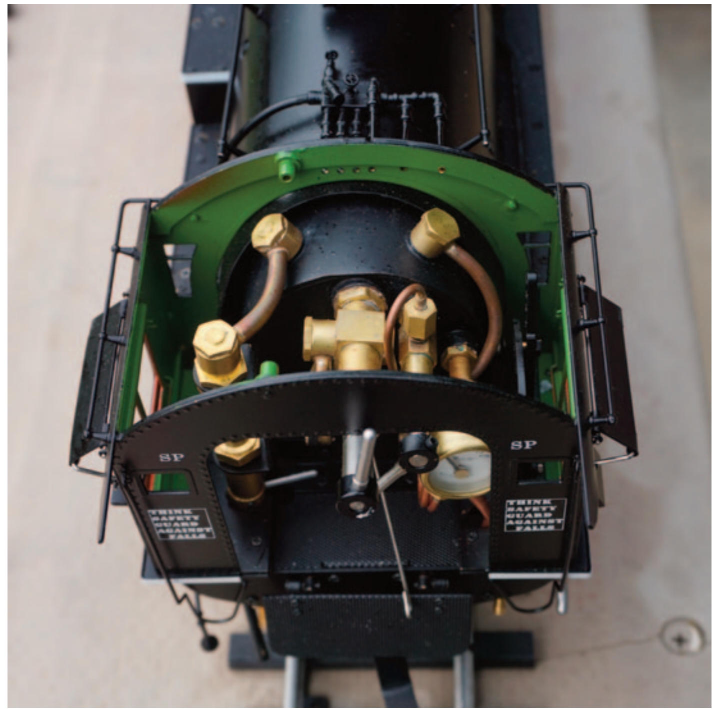


Tender connections from top to bottom: water supply to locomotive, gas line with jet and connecting pipe attached, water return from bypass valve.

There is a small Phillips-head screw in front of the safety valves that you must remove in order to install this pipe. I found that the pipe was poorly or incorrectly threaded so it wouldn't screw into the hole vacated by the screw until I ran a M1.6 die over the end of the pipe. Similarly, the turbo-generator exhaust pipe wouldn't screw into the generator until I both ran a die over the pipe and also cleared out the hole in the generator with a #55 drill and ran in a M1.6 tap. It's possible that there is some mix-up between the thread sizes Accucraft usually uses and the M1.7 thread that Aster often uses.

Since the P-8 is my first ceramic burner locomotive, I wanted to understand the design of the firebox and boiler. I used a small-diameter flexible-stalk inspection light to look into the firebox and at the rear boiler tube plate to see the relationship between the water level gauge and the firebox and the locations of the boiler tubes. This review includes a drawing of what I observed (**Figure 1**). I'll discuss the significance of this later in this review.

Before you connect the loco to the tender, pull gently on the center hose connection under the rear of the loco cab. The butane jet and its connecting pipe will come away from the locomotive. This is how you access the jet for cleaning. Push this assembly back into the locomotive firmly before connecting the locomotive and tender.

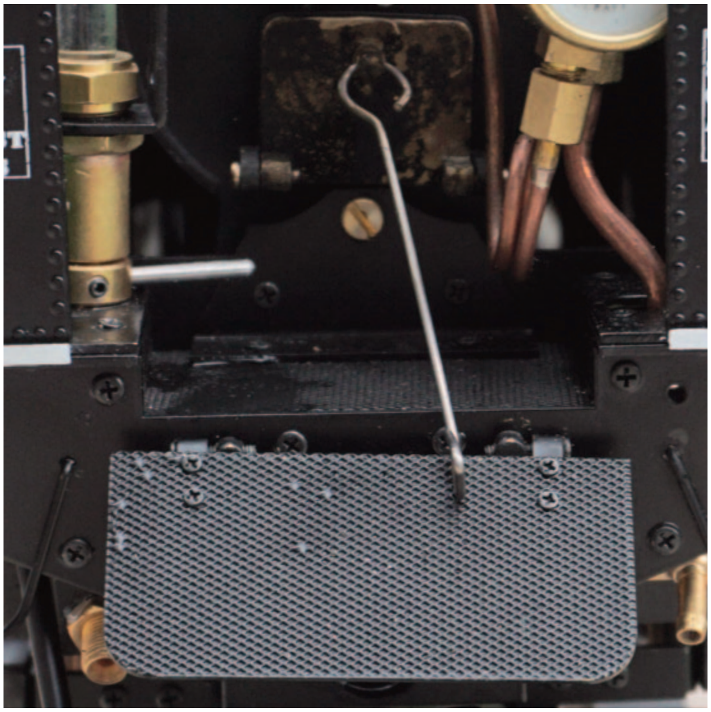


Cab arrangement - Note the position of the pressure gauge — viewed from the position of the engineer.

Gone are the difficult-to-install and remove brass sleeve connectors over stiff, fat hoses of older Accucraft models. The P-8 uses smaller diameter, more flexible hoses and an Aster-style connector on the high-pressure water supply hose between the hand water pump in the tender and axle pump and boiler check valve. The water return and butane supply hoses attach to simple barbed fittings which require only modest force and dexterity to connect. The hoses may be too long to couple the locomotive and tender any closer than the widest gap allowed by the coupling bar, so the footplate between the locomotive cab and the tender deck droops down between the locomotive and tender. This didn't interfere when the loco was operating on my track, but I will investigate shortening the hoses to allow a more prototypical coupling distance, which would allow the footplate to correctly span the gap between cab and tender.

Unlike the older Accucraft models, the butane flow control is on the top of the tender rather than in the front, so it is very easy to adjust while the locomotive is at rest or while running. The tank holds about three ounces by weight (90 grams) of butane.

There is no boiler-mounted water filling plug on this locomotive, so you must fill the boiler with the tender hand pump, as with many Aster models. This also means that there is no place to add a



Back head close up showing the firebox door with handle for lighting and checking the burners. On the left you can see the handle for the blow down valve at the bottom of the water sight glass.

Deadleg oil reservoir tucked up under the right side running board.

Goodall valve. The cavity inside the tender has two sections visible when the hatch plate along the spine of the round rear tender tank area is removed. The rear-most section stays mostly dry when the water reservoir section containing the hand pump is full of water. The instruction manual implies that the boiler water reservoir is separate from the area surrounding the butane tank, but the butane tank is in fact in contact with the water in

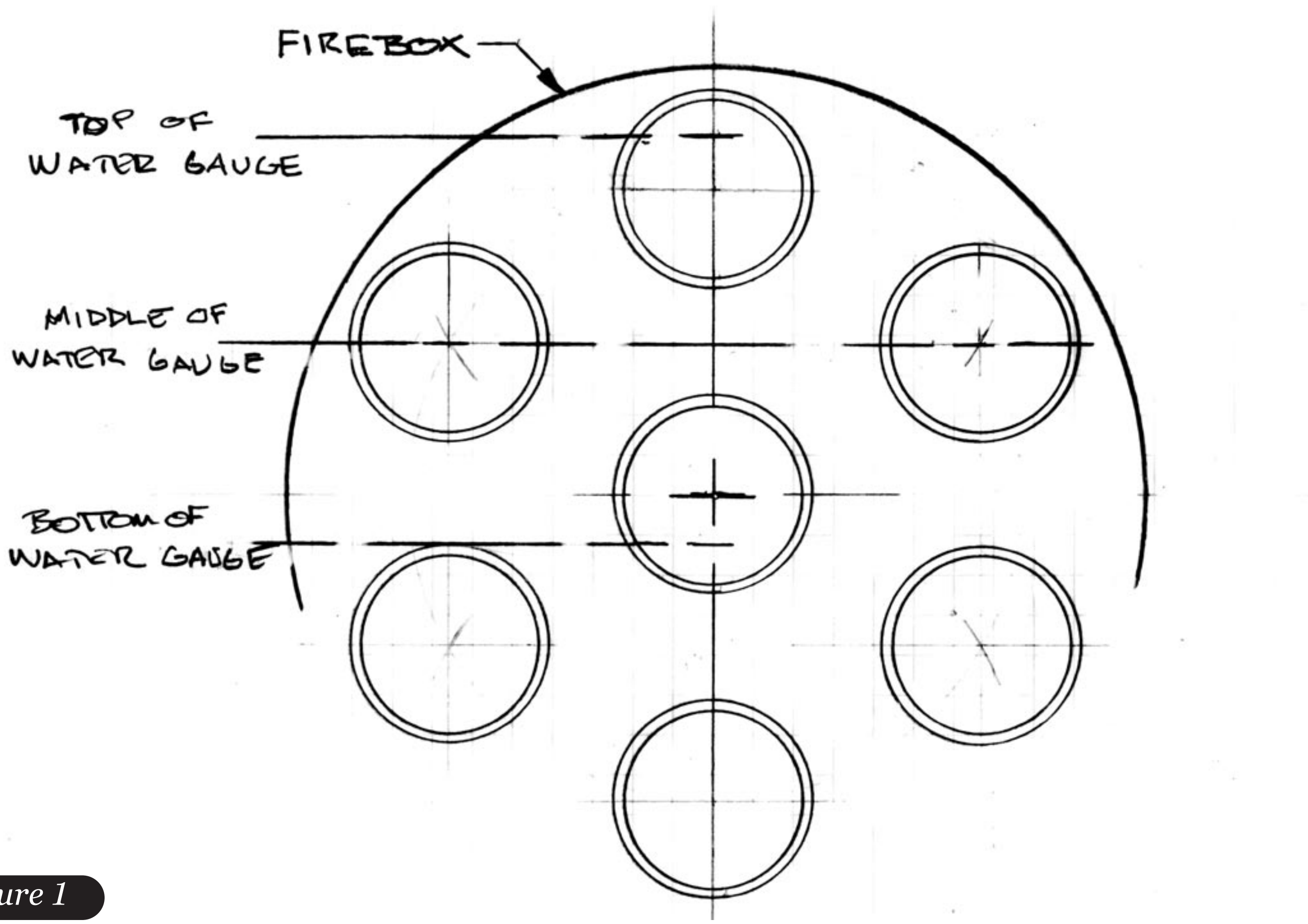


Figure 1

the reservoir. If water sloshes into the rear "dry" section, there are drain holes in the bottom of the tender. The reservoir in the tender holds about 15 fluid ounces (430 ml). This modest volume is the limiting factor in the length of a run without stopping.

You must close the boiler blowdown valve at the bottom of the water level sight glass in the cab (lever pushed toward the front of the loco) before filling the boiler with water. My loco required this valve to be tightly closed to eliminate dripping when the boiler is under pressure. You must also close the water bypass valve on the right side under the cab of the locomotive before using the hand pump to fill the boiler. It takes about 110 strokes of the hand pump (about 6.7 fluid ounces or 200 ml) to fill the boiler to three-quarters full on the water level sight-glass, as recommended in the instruction manual.

The steam oil reservoir is disguised as a horizontal air tank under the "walkway" on the right side of the locomotive. The filler is a screwed-in plug in the walkway. This is a non-adjustable dead-leg lubricator without a drain valve, so you must use a syringe to suck out any accumulated water and steam oil before refilling with fresh steam oil, also using a syringe. My P-8 uses a modest amount of steam oil, so it may not need to be serviced after every run.

Lighting the ceramic burner is similar to lighting the wicks in alcohol-fueled locos. Unlike many poker-burner butane fired locos, you can't open the smokebox door, because you light ceramic burners from the firebox, not in the smokebox or stack. Be sure that the throttle, blower and blowdown valves are closed and the cylinder drain cocks are open (levers vertically down). Place the draft fan in the stack, open the firebox door, put your ignition source (flame or spark) in the firebox and open the butane flow valve about a quarter turn. The burner should start immediately, at which point you should turn on the draft fan and close the firebox door. I found that having a hemostat or long-nose pliers at hand is helpful in opening and closing both the firebox door and the boiler blowdown valve at the bottom of the water level sight glass. Once the burner stabilizes, you can then open the butane valve to one-third turn to bring the boiler up to operating pressure.

I noticed two minor leaks in the plumbing in the cab after a few runs. One was the "banjo" fitting on the boiler that supplies the top of the water gauge. The other was the fitting on the back head into which the throttle valve threads. Both were quickly fixed just by tightening the hex nuts with appropriate (eight and 10 mm) wrenches.

The steam pressure gauge comes "off the peg" in less than a minute and goes past 25 psi in less than two minutes, at which time you can remove the draft fan and crack open the blower valve to provide the draft air to the burner. The boiler reaches its "pop-off" pressure of about 70 psi quickly, in less than three minutes. The locomotive has two pop-off valves, shorter than the usual Accucraft valves and more like typical Aster valves.

Put the "Johnson Bar" in the forward position and slightly open the throttle valve. Hot water and wisps of steam should exit the cylinder drain cocks. It may take moving the Johnson Bar forward and back a bit, and a gentle push on the locomotive to move the cylinders and valves into positions that will drain both ends of both cylinders. When the cylinders are clear the locomotive should start to move on its own. The cylinders should be clear of water after just a dozen feet of movement, when you can close the cylinder drain cocks (horizontal position) for the rest of the run. Close the blower valve when you are ready to send the locomotive off on its run - the cylinder exhaust will provide sufficient draft air through the boiler tubes while the locomotive is moving on its own. If you stop the locomotive, reopen the blower valve to maintain the draft.

As the instruction manual says, one has to supply lots of butane to the burner to keep the pressure up, about one-third to one-half turn open, depending on the load and speed. This is a passenger train locomotive model with large drivers, so it seems happiest when running at a fast clip, but with more break-in time, a slower pace likely will be possible.

During the course of a long run, I had to add water to the tender water reservoir regularly. I added up to 40 fluid ounces (1.2 liters) of additional water to the tank during 45-minute runs, until the butane ran out. Using my Goodall valve pump water bottle, I can refill the reservoir without stopping the locomotive, while walking briskly alongside. The small water reservoir in the tender is one of the few criticisms I have of the locomotive.

There is a lot of empty space in the tender that could be used for water supply. In earlier Accucraft locomotives, almost all of the tender volume is used as a water reservoir for the locomotive.

Running my P-8 with the water level at the mid-point of the water level gauge (as I do with my poker-burner locomotives) doesn't allow its boiler to generate all of the steam it is capable of and so will limit the load-pulling capability of the locomotive. A high water level is needed to keep the top boiler tubes and uppermost part of the firebox covered with water and thus generate the maximum steam from the boiler. While running at a high water level, regularly glance at the exhaust stack of the locomotive – if the boiler is being overfilled, the train will slow down suddenly and you'll see small droplets of water collecting just inside the top of the loco's exhaust stack. If this happens, immediately open the axle pump bypass valve to reduce the amount of tender water being pumped into the boiler, then close it again after you can see the water level at the top of the sight-glass. Finding the "sweet spot" on the bypass valve adjustment is part of the challenge!

Since the P-8 is a passenger train locomotive, a realistic "consist" is important to me. I have six 1:32 scale brass 60 ft Harriman-Standard passenger cars made by the Finescale Locomotive Company in England. These are beautifully detailed models, but also heavy (4.5 to 7.5 pounds each). The axles on all but one of the cars have plain (or "sleeve") bearings. As a result, this consist needs a locomotive with good tractive effort to pull a 35 lb (16 kg) load at speed, particularly around tighter curves. Using a fish scale, I measured the rolling drag of the six cars at about 13 oz on straight track and 18 oz on my layout's tightest (10 ft radius) curve. The P-8's six-axle tender weighs an additional 7.5 pounds (3.4 kg) filled with water and fuel, also running on plain bearings.

The P-8 handled the six Harriman cars plus an "Express Refrigerator" car (a prototypically correct consist) without a problem, making 45 minute runs on full tanks of butane. The locomotive also easily pulled a dozen lighter-weight (about two pounds each) freight cars with plain bearings.

When in passenger service, Southern Pacific used P-8s to pull a dozen car consist. My 1:32 scale P-8 would likely also pull a dozen heavy brass model passenger cars if all of the wheels ran on ball-bearings.

In summary, the Accucraft Southern Pacific P-8 meets my expectations in every way. My criticisms are few and can be managed. The quality and design sophistication exceed that of any of my earlier Accucraft locomotives. It looks terrific and has great details, operates smoothly and hauls a heavy load for long runs.

This locomotive model most definitely re-creates my memories of watching mainline steam passenger locomotives and trains in the 1950s!

The P-8 made its public debut at the National Summer Steamup this year and garnered a lot of attention. Here we see (l-r) John Trabucco, Rich Threlkel, Cliff Luscher, and Jim McDavid in discussion following a run.
Carla Breitner Photo

Workshop Project

Rebirth of the 455

Text and Photos by Jeff Campbell

I'm sure you have all heard the term “barn find" -- when a rare and classic car is found tucked away in somebody's "barn" after being inactive for years. And then some lucky enthusiast, beyond their own belief, finds it and brings it back to life. This is the story of a great small scale live steam engine barn find, and its new owner’s disbelief of owning it.

Original Owner Larry Bangham (l) and the author, Jeff Campbell, spending time discussing the history of the locomotive.

Background

I have only been in the live steam hobby for about ten years. (I can hear some of you old-timers chuckling.) Way back then one of the first people I was lucky enough to get to know was Larry Bangham, a great guy and a technical wizard who is more than willing to share his understanding of any given engine. But more than that, he has a level of creativity that he interjects into his projects that is just unreal. We will get into that in a moment.

I was invited to a steamup at his house where he gave me a quick tour of his live steam collection — it was extraordinary. One engine in particular caught my eye. A huge D&RGW K-27, No. 455, with a green boiler. With its high level of detail one could have easily assumed it was an Accucraft

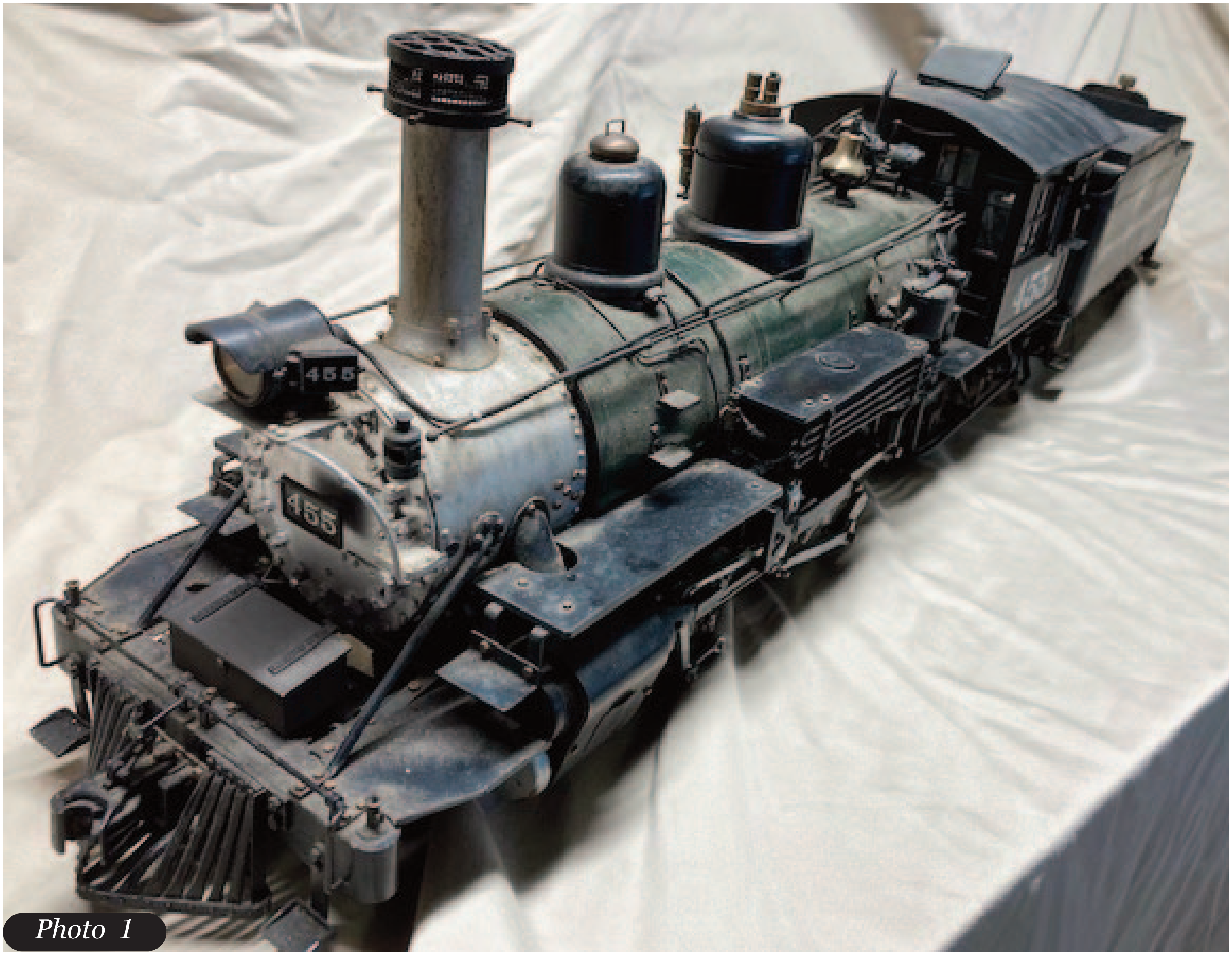


Photo 1

model, but no, it was somehow different. Larry explained that it was one of a very small run (10 engines only) made by an English gentleman named David Bailey, of DJB Engineering, in 2002. It was beautifully detailed and coal fired to boot. What a dream. Although he hadn't run it in years, Larry wasn't interested in selling it, so that was that. But the loco found a place in my brain and never went away. Soon after that Larry started backing away from the hobby in order to pursue another love, playing jazz piano.

Then years later some friends started arriving at steamups with interesting new engines that they said they had bought from Larry. Hmmm. I was just getting interested in coal so I thought I would call him and just "ask" about the K-27. What the heck. I must have caught him on the right day because he invited me to come on down to his place to talk about it. I found out later that others had asked him to sell the 455 in recent years and he had declined. Just lucky I guess.

What a day. You know how excited you get when a new engine is going to be acquired. I was a mess. When I arrived Larry was his normal charming self as he started explaining the many features of the 455. The list was extensive. But it had been over a decade since he fired it so there were a few things he didn't remember about it. There was no owner's manual so it was going to take some locomotive archeology to figure it all out. That's ok, pure fun.

Almost as an afterthought he mentioned that there were some cars that go with the 455. On a shelf were a scratch-built gondola and tanker, and an Accucraft box car. He gathered them up and without explaining why said something like "You'll need these to keep water in the boiler." Okay,.. what? He needed to get going so after making sure he was truly all right with parting with it, we agreed on a price and I took it all home, so excited with my new acquisition (**Photo 1**).

That's the back story on the barn find and what made it so exciting. Now let's talk about the engine and the mechanical archeology. There was no manual, but Larry had written the cover article on the engine back in *Steam in the Garden No. 69, March/April 2003* (**Photo 2**). That's where I got most of my info. Here we go.

Photo 2

Locomotive Details

The DJB Industries DRGW K-27 is a 1:20.3 scale engine with 3/4-inch cylinders and a one-inch stroke, under D valves that are cross ported to simulate piston valve gear. It has a true Walschaert valve gear that can be notched for more efficient steaming. It has a 10 flue boiler that holds 1.5 liters of water and twin super heaters. It has a wet firebox that measures a huge 4 1/2 inches deep by four inches high by three inches wide (**Photo 3**). Although the boiler was produced by Cheddar Models to David's specifications, all of the castings on the engine were made by David himself using the lost wax method. There are tons of them.

The engine is 21.5 inches long, 5.6 inches wide, and 7.5 inches high. Total length with tender is 34.5 inches, and the engine can handle eight-foot radius turns. The tender itself can hold another liter of water as well as coal and radio equipment (**Photo 4**). The wheel box covers on the tender operate and are actually used to oil the axles. All axle boxes on the engine are gunmetal and fully equalized, including the front bogey, which is a work of art all by itself (**Photo 5**).

The cab has a water glass, blow down valve, regulator, blower valve, and a pressure gauge that is visible through the operating roof hatch (**Photo 6**).There is a Goodall valve under the sand dome, Bangham whistle under the steam dome, tender pump, axle pump, and cylinder drain cocks (**Photo 7**). Side frames and rods are all laser cut to perfection. The cab and tender are made of nickel silver and are highly detailed. A huge steam oil tank with adjustable flow valve is disguised as an air tank under the highly detailed superstructure.

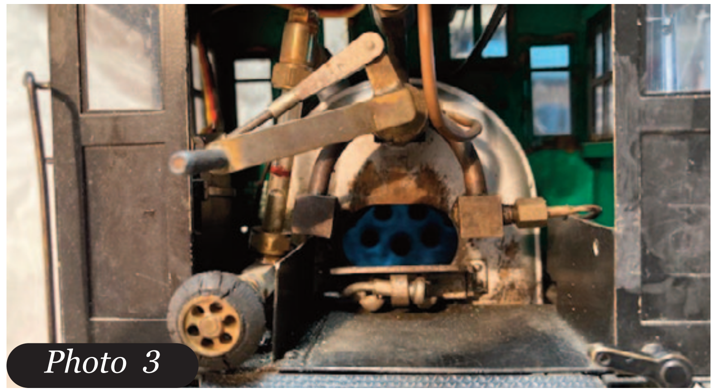


Photo 3

Photo 4


Photo 5

Most of this stuff is pretty standard, but then there are some extra details that are rarely seen on other locomotives. For example, each rod is drilled above the crank for an operational oil cup. Even the axle pump has a cup that is to be filled before each run, that drips onto the eccentric. The front bogey has centering levers and the rear truck is fully articulated. The wheels are all cast bronze, with scale foundry identification on the outside and full detail on the inside. The stainless steel grate and ash pan with triangular shaped grate bars provide maximum draft (**Photo 8**). Although I haven't tried to

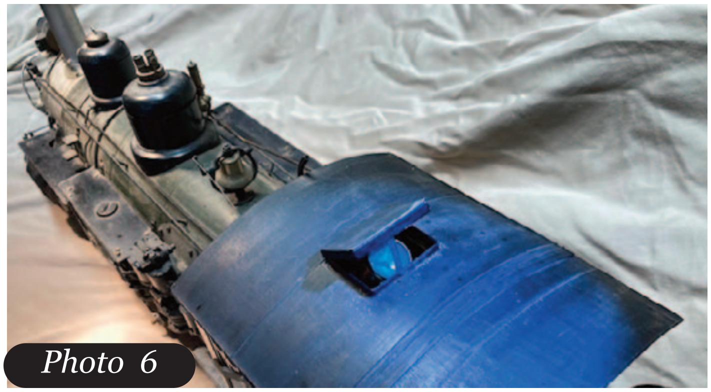


Photo 6

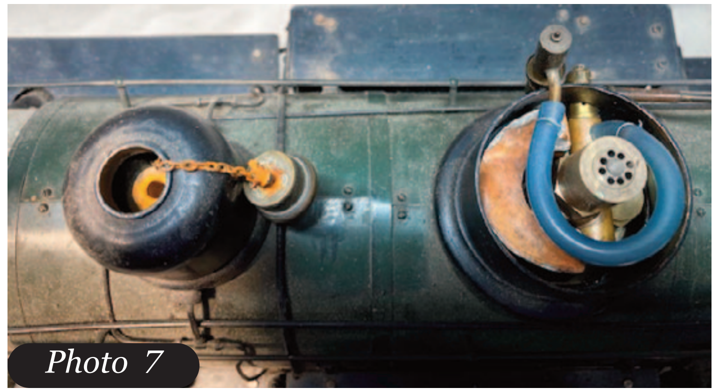


Photo 7

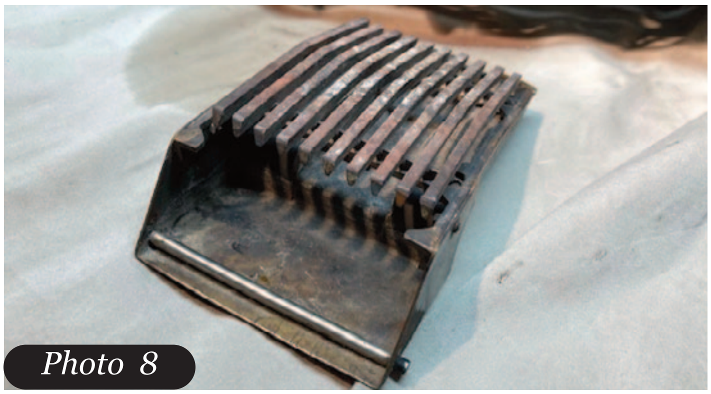


Photo 8

Photo 9

Photo 10

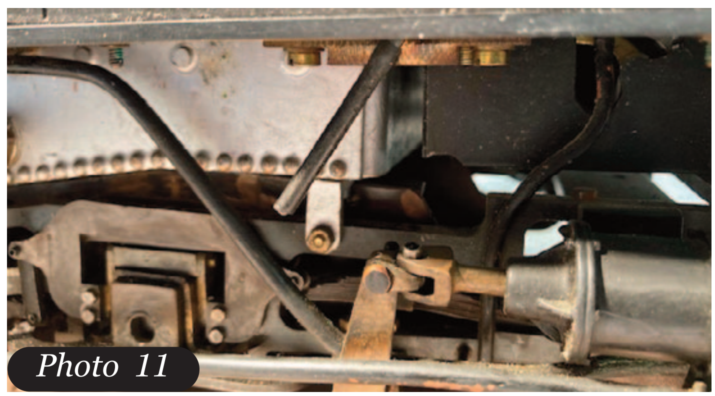


Photo 11

use it, No. 455 has a four-channel radio that operates the throttle, reverser, drain cocks, and the Bangham whistle (*SitG Issues #66 - 84*) hidden in the steam dome. Yes, it sounds great. There is an operating headlight that has the perfect tint. All of the windows slide and have glass installed. There are even side cab sun shades that can be opened and retracted and held in place with Velcro (**Photos 9-10.**)

And then there are the modifications that Larry added. Geeeez. He hinged a quarter of the rear cab roof so the fire box door could be more easily accessible. He didn't want to use the radio control so he attached small levers to the regulator, reverser, drain cocks, and whistle so that they could be adjusted by hand. There is also a lever outside and below the cab that allows the operator to open and close the fire box door (**Photo 11**). What a great idea! No burnt fingers here.

But most interesting of all is the external water pump system. Larry found out quickly that this engine goes through water like the Colorado River. Unfortunately the axle pump can't quite keep up and the tender hand pump is only moderately effective. The Goodall valve works of course, but Larry was looking for a more elegant solution. And here is where we get into his technical creativity.

Remember the three cars that he included? Each has a function. The box car has a drag device in it (a series of belts, gears, a flywheel, and a large fan) that are used to make the engine work harder. It has the draw pull of about ten cars. Neat. But get this. The gondola has another water pump under the fake coal load that is operated by an electric motor and planetary gear (available from Micro


Live Steam Station is the newest and largest online store for all your live steam needs: Accucraft, Aster Hobby, Maxitrak, and mor
LIVE STEAM STATION
Southern Pacific P8
1:32, Alcohol or Butane
Kit $3995, RTR $4495
LNER B1
1:32, Alcohol Fired
Kit $3100, RTR $3600
BR 4-6-0 5MT
1:32, Alcohol Fired (Black Only)
Kit $3100, RTR $3600
USRA Mikado Heavy
1:32, Alcohol Fired w/ 6 Free Cars
Kit $4400, RTR $5500
N&W 4-8-4 J-Class
1:32, Alcohol Fired or Electric
Alcohol $5950, Electric $5250
DB Class 45
1:32, Butane Fired
RTR $4995
Adams Radial Tank
1:32, Butane Fired
Kit $1995, RTR $2160
Tiger 0-6-0 with Tender
1:32, Alcohol Fired
Kit $3250, RTR $3800
Smooth Sided Pax Cars
1:32, Alum Body
$340/Car, $2040/Set of 6 Cars
BR Mk1 Passenger Cars
1:32, Plastic body, Metal Trcks
$275/Car
L&SWR Coaches
1:32, Brass
$800/Car, $3040/Set of 4 Cars
3 Bay Hopper Car
1:32, Plastic Body, Metal Trucks
$119/Car
D&RGW C-25
1:20.3, Coal or Butane
RTR $5250
D&RGW C-18
1:20.3, Butane Ceramic
$3095-$3395
Baldwin "Mabel" 0-6-0T
1:20.3, Butane Fired
Kit $1249, RTR $1499
Ruby #1 0-4-0T
1:20.3, Butane Fired
Kit $599, RTR $649
New version 2022
Jackson & Sharp Coach
1:20.3, Ball Bearing Trucks, Lighting
$295/Car
Drop Bottom Gondola
1:20.3, Plastic Body, Metal Trucks
$220/Car
3-Bay Hopper
1:20.3, Plastic Body, Metal Trucks
$150/Car
Box Car
1:20.3, Plastic Body, Metal Trucks
$170/Car
Wheel & Tie Car
1:20.3, Plastic Body, Metal Trucks
$150/Car
Gondola
1:20.3, Plastic Body, Metal Trucks
$140/Car
Open Ended Gondola
1:20.3, Plastic Body, Metal Trucks
$140/Car
Long Logging Car
1:20.3, Plastic Body, Metal Trucks
$110/Car
"Talyllyn" Railway 0-4-2ST
1:19, Butane Fired
RTR $1700
Quarry Hunslet 0-4-0T
1:19, Butane Fired
RTR $1600
'Cranmore' Peckett
1:19, Butane Fired
RTR $1795
War Dept Hunslet 4-6-0
1:19, Butane Fired
RTR $1900
RGS #6 Goose
2.5" Scale, 7.5" Gauge
$4950
Forney SR&RL & WW&F
1:13.7, Butane or Coal
Butane $3200, Coal $4200
2-4-0 7.5" Gauge Ride-on
2.5" Scale, Coal Fired
Kit $15000 RTR $18000
Austerity 0-6-0T
5" & 4 3/4" Gauge
Kit $5800 RTR $6050
LIVE STEAM STATION | 33260 CENTRAL AVE, UNION CITY, CA 94587, USA |

Photo 12

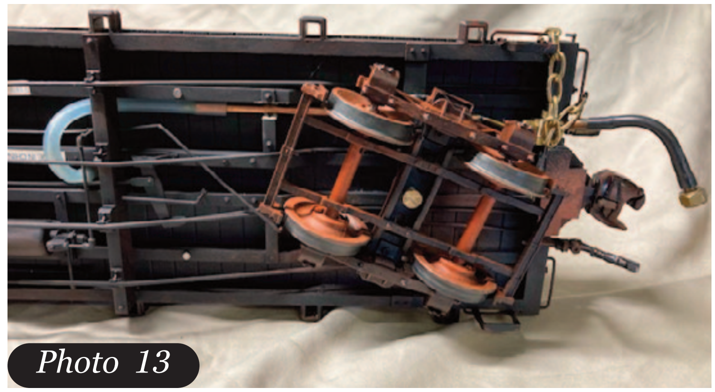


Photo 13

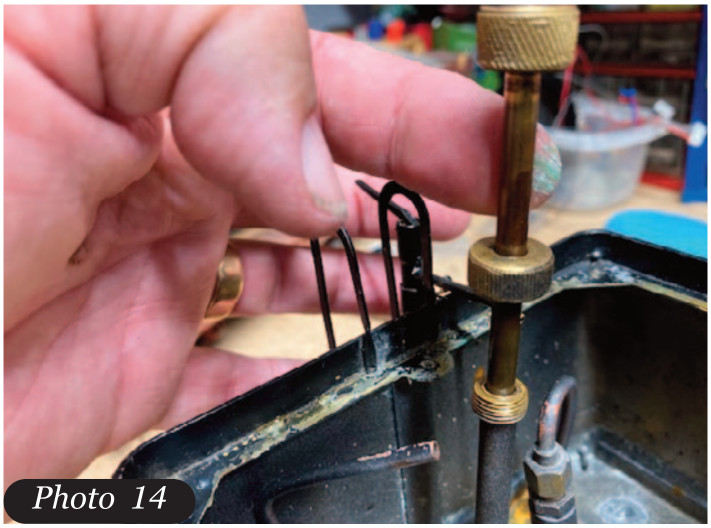


Photo 14

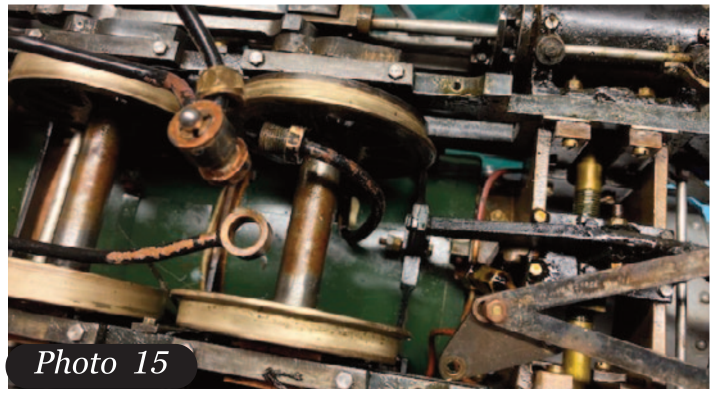


Photo 15

Mark) and powered by RC car batteries (**Photo 12**). A small switch above the coupler turns it on and it pumps water to the tender. The tender has yet another valve which allows the operator to send the water into the tender tank or directly to the boiler. This extra water is of course coming from the scratch-built tank car that holds another liter of water (**Photo 13**). So the gondola is plumbed behind the tender and the tanker is plumbed behind the gondola with quick connects, thus providing twice the amount of water as the tender alone. Wow. It's kind of a lot, you need to get emotionally prepared for a run, but is it ever trick when it's working.

This, I believe, gives us one of the clearest views inside Larry's mind. Come on! Who thinks of this stuff!

Digging in

Of course, there were some problems encountered. This engine had been sitting for quite some time. Estimates vary but it was at least ten years so I wasn't expecting things to go completely without issue. If you're in this hobby you must like to tinker on equipment, right? The primary tinkering necessary on the 455 was around the water pumps. The hand pump in the tender would work if the engine wasn't in steam, but no amount of up and down would move water against 60 PSI. This is a vertical displacement type of pump which I have since found out isn't the most effective design anyway (**Photo 14**). After disassembly, cleaning, and lubing it was only slightly more effective. The balls looked good upon inspection so I got bored, and not knowing what else to try I just let that one go. I do, after all, have four other ways of getting water into the boiler.

Well, then the axle pump was having trouble keeping up as well. Hmmm. I had more luck here. With some coaching and emotional support from Rob Lenicheck I completely disassembled the axle pump and looked for obstructions. I found two. There was a small bit of thread sealer keeping the intake ball from full movement (**Photo 15**). I cleaned and replaced the ball valve and tried again. It was better but it still seemed like the water was struggling to move from the tender to the axle pump no matter which pump was used. Time to look at the main water feed line.

Oh yeah, it was definitely clogged. Even blowing air through it was tough. Ok, rotor rooter time. I took a very thin wire and snaked out the main water feed line and found what could only be described as boogers. Ah ha!

After I cleared the feed line, air and water both moved through more easily. Now the axle pump can be counted on to at least "keep up" at slow speed and prime the boiler if running at a scale 80 miles per hour. Being that this is a D&RGW K-27 I try not to run at 80 MPH, so I just keep a constant eye on the water glass at all times, and use the electric pump in the gondola when necessary. Despite the leaks, clogs, and getting squirted in the eye with water once, getting it back in running order was all fun. And despite how long it had been sitting the running gear all moved freely and needed no unusual measures to make it happy. After some further cleaning and oiling it was ready to go.

“With its huge fire box, the locomotive demonstrates its ability to be a free steamer and is a powerful puller.”

Have you heard the story about the Big Boy #4014 that was sitting at the Pomona Fairgrounds railroad museum for fifty years? The UP decided to restore that particular locomotive because one individual at the museum continued to lube and oil all of the moving parts despite the fact that it wasn't an operational engine. I think Larry may have been doing the same thing for the 455. Despite the down time the mechanism runs like a top.

I won't go into the details of coal firing as this has been covered previously in *SitG* and by more accomplished steamers than I. The main thing is just to keep an eye on the water glass and pressure gauge (all the time). With its huge fire box the locomotive demonstrates its ability to be a free steamer and is a powerful puller. It has pulled the drag car plus eight regular 1.20.3 cars and ran at 1/3rd throttle for an hour. What fun.

Now that everything works it is a dream to run and I am very proud to be its new operator. Frankly, I can't believe it. It really does have that barn find feel and I am very grateful to Larry for passing on such a rare engine and for sharing his wisdom.

Sometimes ya’ just feel like lighting some butane and watching a pretty engine run around the track. But if you enjoy the challenge of really "operating" a coal fired locomotive, it doesn't get more realistic than the DJB Engineering K-27.

How to Design A Coal Fired Boiler

Text & Photos by Rob Lenicheck

A book published years ago was entitled "So You Want to Build a Live Steam Locomotive." I'm sure the old-timers in this live steam hobby are familiar with this title and its contents. The same could be said of coal boilers - "So You Want to Build a Coal Locomotive Boiler." Might sound intimidating? It needn't be. Many folks in our hobby have approached me about how to go about the process. While I certainly don't claim to have all the answers (there are many others out there who are experts at this craft) I have built quite a few coal boilers, both inside and outside the frame versions, and learned a few tricks to make the fabrication a bit easier.

So, where to start? Building a coal boiler is much the same strategy as painting a house: the prep is

80 percent of the job. If you do the prep work right the actual build is fairly straightforward.
I won't go into the decision regarding converting an engine vs. scratchbuilding it outright. The methods for the boiler are the same. But it can be quite satisfying to convert a butane engine to coal for a much higher level of interaction. Yes, the Dark Side will grab you.

There are several parameters which must be adhered to:

❶ Small-scale boilers are always made of copper, although, if you're very brave and talented, I have seen them be made of stainless steel.

❷ Coal emits an enormous amount of heat and, as a result, the engine for which you are building the boiler will go through an enormous amount of water. Therefore, it is prudent to incorporate an axle pump into your engine (unless you like to pause very frequently to pump water in through your Goodall valve).

❸ The firebox needs to be as big and deep as possible. Try to pick a design which overlaps the frame or has an outside frame, so that the firebox can be almost square. In my experience, inside-the-frame fireboxes in small scale, specifically 1:20.3 in my case, are challenging to run. Yes, it's possible to be successful in running them but beware – they require frequent tending and a great deal of coal-firing experience so that you're not an early candidate for Rogaine use.

❹ All small-scale copper boilers are put together using silver solder. Silver bearing solders, like Stay Brite, even though they contain silver, are soft solders and are simply not strong enough or have high enough melting temperatures to allow their use. Silver solder has another characteristic which makes it more suitable: while the soft solder joint acts like a superficial glue in the soldered joint, a silver solder joint actually penetrates the metal several molecule layers deep, creating a much stronger bond.

It is not imperative to have a complete machine shop to do the build. But several things you will need:

❶ A drill press will make the job easier. (But you will need to have a friend with a lathe to make the few fittings you will need.)

❷ Silver Solder: I recommend using Harris Safety-Silv 56. The "56" designation indicates that 56 percent of the solder is pure silver. Other silver solders incorporate cadmium and should not be used without adult supervision (and a chemical respirator).

Photo 1

❸ I use Harris Stay-Silv Black High Temp flux, shown in **Photo 1**. Flux is the main item which prepares the surface for the solder and allows it to flow easily.

❹ The main investment you will need to make is a propane torch. I have found no substitute for the Sievert brand torch and accompanying burner heads. I use the Sievert #3488 Pro 88 dual valve torch handle with various heads, small to extra large. BestMaterials.com has a good supply of Sievert stuff but you might be able to find some on EBay. You'll also need a regulator valve to attach


Photo 2

to the propane tank and a hose made for the purpose.

The burner heads shown with the Sievert torch in **Photo 2** are (from smallest to largest): 3838, 3939, 3940, 3941, 2941 (on torch), 2942, 2943. (Sievert now has a line of "turbo" heads which they claim work better than the regular heads.) A good way to determine the pieces you will need is by looking in the Sievert catalog, which can be downloaded from the Sievert website.

As an aside, some builders like to use an oxy-acetylene setup to solder their boiler together. These can work but they provide more of a pointed and hotter flame, which can present problems in and of itself. The Sievert alone works very well for all the joints in the boiler. I would not recommend the oxy-acetylene approach unless you are experienced and very brave.

❺ A small piece of three-quarter inch thick hardwood which is used to make the formers for flanging the boiler parts.

❻ Some firebricks to be used to support the parts while soldering(see **Photo 3**). These can be bought from McMaster-Carr.

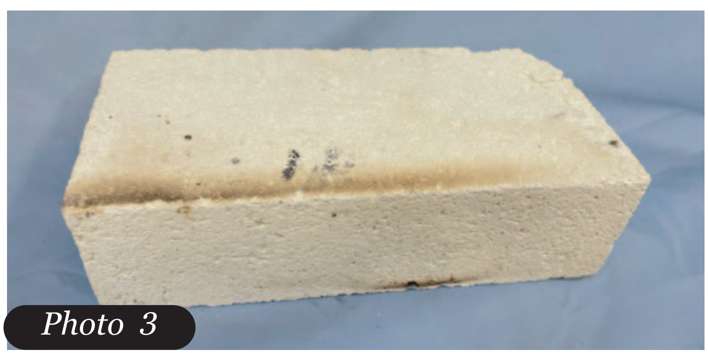


Photo 3

❼ Some round bronze material for the needed fittings which screw into the boiler like the water glass, blower, etcetera.

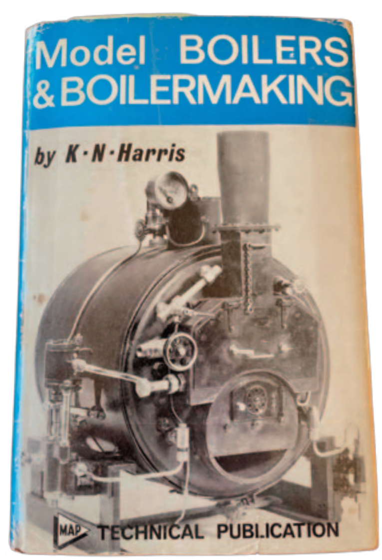
Now let's talk about material a bit more. The copper I mentioned earlier for the construction should be approximately 1/16-inch thick and needs to be pure copper. (*Brass should not be used at all, even for the fittings, because that alloy contains zinc which will leach out under heat and eventually cause a boiler failure*. Yeah, I know there are brass boilers out there in engines which are very old and proven. I just prefer to know the boiler I build is going to last beyond a few years.)


Photo 4

It's easy to start with a copper pipe for your boiler. There are three types of copper pipes generally available on the market today, K,L and M, and the wall thickness for each gets thicker as the pipe gets bigger. It's ok to use the thinner-walled Type L pipe for the smaller diameters (3/8-inch, one-half inch, etcetera). **Photo 4** shows the different sizes available. All of the flat plate copper you use should be 1/16th inch.

Despite the many years of collective experience we have gained through the years, designing a coal boiler is still a bit of a black art. But there are several sources which can provide good guidelines. One of the best is "*Model Boilers and Boilermaking*" by K.N. Harris which was published in 1967. It is still available used if you scour the used book stores (See **Photo 5**). Another source I have used is on John Baguley's Model Engineering Pages at http://www.modeng.johnbaguley.info/Loco%20design/design1.htm

John has included an interactive Excel spreadsheet link in the above webpage which you will find very useful.



http://www.modeng.johnbaguley.info/Loco%20design/design1.htm

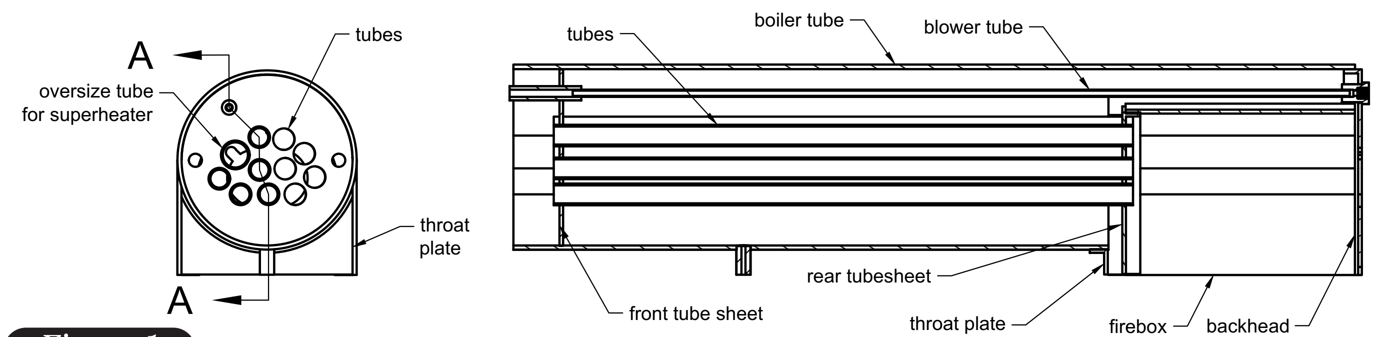


Figure 1

The biggest challenge in using these known sources is that they provide limited and perhaps conflicting guidance. The info which one provides doesn't necessarily agree with the other.

Let's familiarize ourselves with boiler nomenclature. **Figure 1** shows a boiler I just recently finished for a project I am scratchbuilding. The cross-section shows all the relevant parts you will be making. Many people I talk to about coal boilers are unaware that they are entirely different than a butane boiler. Coal boilers are open at the bottom and incorporate a grate onto which the coal sits while it burns. The opening below the grate allows air to come in from below to help it burn. (The smokebox must incorporate a blast pipe and blower which provide the air draft. If no draft is provided the coal will not burn.)

Figure 2 shows a comparison of the challenge of building an inside-the-frame firebox. Notice that the smaller boiler was designed for an inside frame application and, thus, has a fire box and crown sheet which is hourglass shaped. This complicates not only the fabrication of the boiler but also makes the job of soldering more difficult, because you may not be able to actually see the joint you are trying to solder. To make matters even more fun, the sides in almost every boiler have to be "stayed," meaning that the outside of the firebox is tied to the inside for strength against the boiler pressure. That may require you to drill the holes for the stays at an angle.

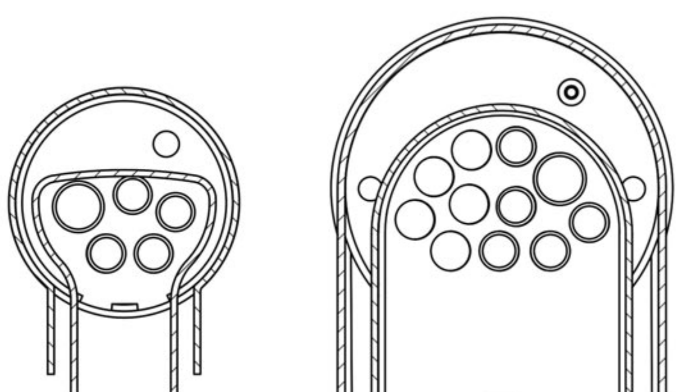


Figure 2

First design step: grate size

So, I'm going to tell you right up front that size really does matter. The smaller the grate, the tougher it will be to maintain the fire. But if the kitbash, alteration, or scratchbuild you have decided upon is your heart's desire, then we need to make the most of it.

If you're replicating a prototype engine you may be a bit constrained in the flexibility of your design. For instance, in the Uintah boiler design pictured in **Figure 2**, the firebox is as deep as possible (over one inch) and overlaps the frame on both sides to give it maximum area, all within the prototype envelope. But as you can see it does not leave much room for steam above the crown sheet. I have made several boilers with this constraint and they all run well. As a matter of fact, it's my opinion that, unlike the real thing, the crown sheet can be exposed without harming anything just as long as you don't run the boiler dry.

Okay, having said that let's work backwards. You need to figure out how big the firebox can be in your new boiler. If you're scratchbuilding then you have the freedom to make the grate whatever size you want to fit the space you have. As a concrete example, taking a look at the design in **Figure 2** (the section view) the grate measures 2.35-inches by 4.0-inches (Yep, it's going to be a hefty brute!) My grate size is based on a scale drawing of the prototype I'm trying to replicate -- see **Photo 6**.

I have found little in the literature regarding the crucial relationship between grate size and steam production. This is where the Baguley worksheet comes in very handy as it can point you in the right

Photo 6

direction. Using this interactive worksheet you can put in your engine's parameters: cylinder bore size, piston stroke, number of cylinders, etc. All of these numbers are all put into the cells in yellow. The resulting numbers are calculated for you.

This is what the worksheet (**Figure 3**) looks like with my own numbers plugged in:

You can see that after putting in the parameters it asks for it comes out with four numbers: Ee, Eb, Eo, Kt. I'll explain more about these in a minute.

At this point in your design approach you may not have a handle on the number of tubes, their size or their length. So starts the guessing game. I suggest starting with using 3/8-inch diameter tubes, which is pretty standard, and 1/2-inch for the superheater if you use one. (Using a superheater is a bit controversial in that it is generally believed that most of the heat transferred from the coal happens in the firebox itself. But, on the other hand, it can't hurt, right?)

Laying out the tubes can be quite a challenge as you see from the sectional views of the two boiler examples shown in **Figure 2**. Try to layout the tubes so they are evenly spaced. That will determine how many you can fit into the space. And

Locomotive Efficiency Calculator

Enter the required data in the yellow boxes (all dimensions in inches)
Data in Green boxes is automatically calculated

Cylinder:	Bore	0.5625	Cylinder Swept Volume per revolution	1.879
	Stroke	0.945		
Number of Cylinders:		4		
Wheel Diameter:		2.087		
Grate:	Width	2.355	Grate Area	9.420
	Length	4		
Boiler:	Number of tubes	11	Cross Sectional Area of Tube bore	0.081
	Inside Diameter	0.322	Total Tube Area for Gas Flow	0.896
	Length	10	Tube Area as a % of Grate Area	9.51%
			C/A	12.42

Calculated Figures:	Ee	0.096	Engine Factor
	Eb	82.594	Boiler Factor
	Eo	7.893	Overall Factor
	Kt	96.447	Tube Factor

Notes:

			Range of Values
Suggested optimimum values:	Ee	0.15	0.12 to 0.18
	Eb	80	70 to 90
	Eo	12	10 to 14
	Kt	80	65 to 85

C/A is the ratio of heating surface of the tube versus volume of gas in the tube.

Figure 3

then take a guess as to how long to make the tubes based upon the boiler length. The inside diameter number is derived from taking the average of the ten 3/8-inch tubes and one ½-inch tube:

Average tube inner diameter = {(10*0.311)+.437}/11
= 0.322 in.
Where 0.311 = 0.375 – 2*wall thickness of 0.032 in.
And 0.437 = 0.5 – 2* wall thickness of 0.032 in.

Plugging in all these numbers yields the numbers you see the worksheet.

Now, getting back to those four parameters for the outcome (Ee, Eb, Eo, Kt). Baguley describes each as follows:

"Looking at Eo:

High values for Eo indicate that the steam usage is greater than the capability of the boiler to produce it and such locos may tend to run out of steam.

Low figures for Eo indicate that the boiler may produce more steam than necessary leading to constant blowing off.

Looking at Ee:

High values of Ee indicate that the grate area is too small for the cylinders and the boiler will be have to run with a very hot fire to produce enough steam resulting in clinker formation and burning of the grate. Such locos may run well for a time but will eventually loose steam as the grate becomes clogged.

Low values of Ee indicate that the grate is too big for the cylinders and the loco will have to be worked really hard to get sufficient draught through the fire to keep it hot enough.

Looking at Eb:

High values of Eb indicate that the boiler may be a bad steamer, probably due to incorrect tube sizes and/or length.

Low values for Eb indicate that the boiler may be a good steamer but this may be the result of too free a gas flow leading to other problems such as clinkering and fire lifting.

As you can see, none of my numbers except the Eb meet the suggested criteria. So this is where the black art of designing a coal boiler becomes apparent. The outcome comparisons are based on empirical data, data collected in studying many successful boiler designs. But my own experience has led me to believe that the Eb number is the most reflective of a good design. I think the reason for this is that both the Ee and Eo numbers can be influenced on other ways by adjusting the blast pipe hole and/or opening the firebox door slightly to cool the fire down.

Now let's take a look at the design suggestions in the Harris book. The grate area is 2.35 inches X 4.0 inches = 9.42 sq inches. On page 131, Harris states that the "gas area through the tubes should not be less then 1/7th of the grate area and may, without detriment, be as high as 1/6th." Taking this number and dividing by the recommended 7 then equals 1.35 sq inches. Now, this is where it gets a little murky. Since I know I want to use 3/8-inch diameter tubes with one ½-inch flue for the superheater pipe I can do a basic SWAG (a precise engineering acronym for Scientific Wild-Ass Guess) for what Harris needs: the total gas area through the tubes.

I know that the wall thickness of both sizes of tubes is 0.032-inch. Again, looking at the Uintah cross-section above, you can see that 10 tubes and one flue for the superheater is about all I can cram into the space. So, starting with the premise that I want to use 10 of the 3/8-inch tubes, using the inner diameter of each size to make the calculation and knowing that the area of a circle is:

$$A = \pi r^2$$

the total gas area is:

Total gas area = 10 * π * (inside radius of 3/8" diameter tube)²
+ 1 * π *(inside radius of ½" diameter tube)

$$= 10 * \pi\left(\frac{3}{16} - .032\right)^2 + 1 * \pi\left(\frac{1}{4} - .032\right)^2$$

= .914 sq in

According to Harris this means that the ideal grate size is about a max of seven times this number, or 6.4 sq inches. This means that he recommends a smaller grate size. Oops, I say. The only way to make this a bigger number is to add more tubes, which physically cannot be done. However, because these empirical numbers are not cast in stone and others I have built have deviated from the ideal, I went with my original design of 9.42 sq inches, mainly for the reason that I wanted a buffer of steam production offered by a larger grate area.

Second design step: determining tube length

Okay, so from here there is another calculation which needs to be determined: tube length. The length between the tube sheets is important to ensure the gas flow out of the firebox. Both Baguley and Harris calculate this parameter but get different results. Harris recommends that correct length is determined by:

$$= \frac{L}{D^2}$$

Where L is the tube length and D is the *outer* diameter = 60 to 80

For my boiler example I used a nominal size of 3/8-inch diameter for this calculation, which gives me:

$$= \frac{L}{D^2} = approx\ 70$$

Therefore, doing some fancy math:

$$L = \frac{70}{(.375)^2}$$

Which calculates to 64 for an 11-inch length up to 78 for a nine-inch length. I ultimately decided to split the difference and chose a 10-inch length.

The Kt number from the Baguley worksheet uses the inner diameter of the tubes so his number is not the same as Harris'.

Summing up, probably the order of the steps for the design is to start with what the grate size and depth are going to be. Again, the bigger the better. And carry on from there. As you can see from the results of the two methods there is still quite a bit of controversy in what constitutes a valid design. Or, in other words, it appears that as long as you're in the ballpark the boiler will be a good steamer.

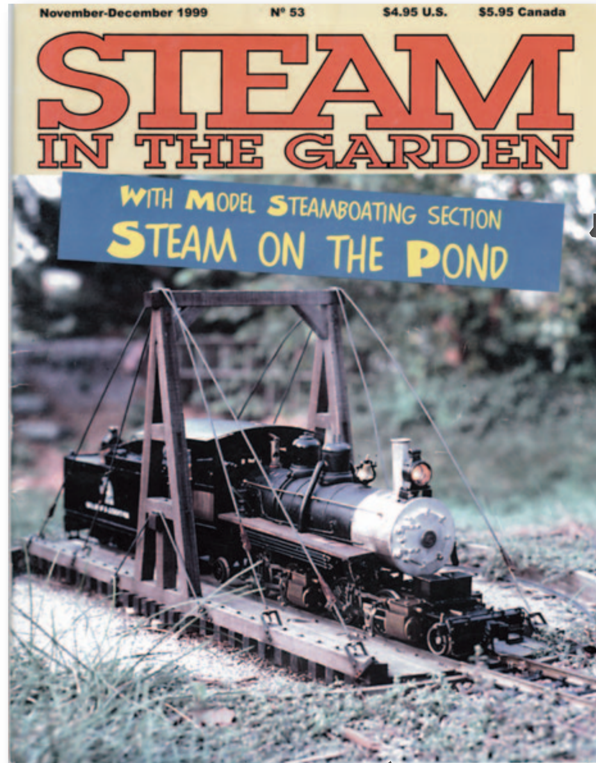
One more thing to mention: When trying to maximize the number of tubes on the tubesheets I have found that I didn't have to worry about the distance between the tube sides to an adjacent tube. As long as there is enough material there to fully surround the tube AND there is enough room for the solder to flow it will be fine.

Well, that's about all there is to it: two very simple but critical calculations for your design. I can tell you from experience that I somehow managed to ignore the relationship between grate size and tube gas flow when I built my first inside-the-frame firebox boiler. The steaming results were disastrous – it simply could not draft well enough to produce the required steam and keep the coal burning. But, hey, after redesigning and adding another tube I got to hone my silver soldering skills. A lesson well learned. Happy designing!

Staring into the "belly of the beast" of one of Rob's coal-fired projects.

Rebuilding a 23 Year-Old Mallet

Text by Les Knoll



My 2-4-4-2 articulated logging Mallet graced the cover of the final *Steam in the Garden* issue of the twentieth century. Building started in 1998 and the locomotive made its first appearance at steamups and at Diamondhead in 1999. I gave a clinic on its basic construction at Diamondhead that same year.

Over time, as my knowledge in the hobby grew, various parts such as wheels and axles were replaced with higher quality equipment. To give an example of what I DIDN'T know: I originally used Lionel drivers and quarter-inch steel rounds for my eight drivers. Discovering Walsall, a supplier of drivers and axles in the UK, as my source for finely machined drivers was a Godsend!

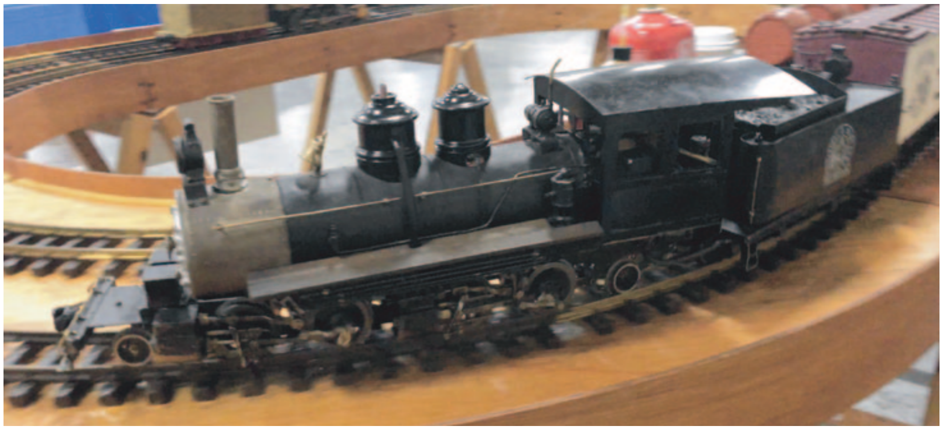
I owned a Pearse Nevada at the time, and used its construction as the model for my Mallet design. The 2-4-4-2 chassis utilized Roundhouse Engineering cylinders and valve gear. Since the two four-driver frames had a shorter wheelbase than any locomotive Roundhouse produces, side frames, connecting rods, main rods and return rods had to be made specifically for this locomotive. I originally used mild steel flat stock available from McMaster Carr.

The locomotive represented several innovations at the time of its construction. Since most of what was available in live steam were small switcher style locomotives and Moguls (except for some high-priced alcohol fired offerings from Aster), a logging articulated with its four cylinders and large 2 5/8-inch diameter x 11.25-inch long single flue gas fired boiler was something unusual. A boiler that size with a single flue was most unusual; I don't know of any others that were made at the time.

Time passed, and this locomotive is now old enough to drive, vote, and consume alcohol, even though it is gas fired. ☺ At the 41st Narrow Gauge Convention held in Hickory, NC near my home, my Rivendell & Midland Railroad was on the list of those available for open house or layout tours. My wife Ruth provided excellent food, drinks and hospitality, and my friend and fellow steamer Hampton Harper handled the task of running the railroad while I hosted and answered all my guests' questions about the railroad and locomotives, and provided on-the-spot maintenance as needed.

Hampton is quite familiar with my locomotives, having run all five of them a number of times both at the Apple Valley Railroad Club in Hendersonville, NC and on my Rivendell & Midland Railroad. He knows when they are performing up to snuff and when they aren't. After the open house was over, he told me that the Mallet seemed to not be up to full power. I had to take his word for it, since he ran the locomotive, a favorite with the open house crowds, so skillfully that no one, not even myself, knew there were any problems.

Before the open house I had completely rebuilt my 2-8-0 Rio Grande style Consolidation with new side frames, connecting rods and valve gear, all cut by Denver Waterjet. The Mallet was scheduled for such a rebuild, too, but it was still running OK and



Left: Les's Mallet at the 41st National Narrow Gauge Convention showing its tight cornering ability on the LGB 15000 radius curves of the Steam in the Garden demo track.

Scott E. McDonald Photo

there was not enough time to rebuild both locomotives before the open house.

After the open house, it was time to tackle the Mallet rebuild. The side rods were so egged-out and worn I was amazed the locomotive ran at all. These and the side frames were originally hand cut from mild steel flat stock using a Dremmel tool and the axle holes and other features were located and drilled by hand. Needless to say, inaccuracies abounded. Still, the locomotive ran, and seemed to run well when built. There were occasional problems with shortage of steam and recovery, but after all, this was a single flue boiler. Currently available boilers this size are now all fired by twin flue systems. My single flue was a first.

I ran the Mallet myself after the open house to confirm what Hampton had told me. He was right of course; there was a shortage of power and steam recovery was slow.

Starting out with 40 PSI, I would run one trip around my 101-foot mainline with a six or seven car train and upon return, the pressure dropped to 20 PSI. The front engine was running erratically, and pulling power had diminished.

To solve the boiler recovery problem once and for all, I decided I would tackle it from two aspects: increased firing capacity of the boiler and greater efficiency of the front and rear engines. I started 'from the ground up' with the front and rear engines.

Examining the Mallet's lower works with its badly worn linkages, it was a miracle that the locomotive ran at all. Axle bearings were so worn that you could wiggle the wheels, and holes in the main and connecting rods had become more like slots. I also discovered that in my original hand built (no machine tools) version of the lower works, the wheel bases of front and rear engines were different! The front engine wheel base was 1/8-inch shorter than the rear. No wonder I could not get correctly made return rods to work right! The 'correctly' made return rods wouldn't work on the rear engine, either because on that one, I incorrectly located the pivot bearings for the expansion links! I had not discovered these errors in 22 years of running the locomotive. Despite this comedy of errors, I had enjoyed a nicely running little Mallet for those 23 years, all the time wondering why some of the strange adjustments I made resulted in a smoothly running locomotive.

All the chassis layout errors were corrected when the Mallet chassis was completely rebuilt. The only original chassis parts were the frame spacers, wheels, axles and cylinders. With previous geometric errors corrected, the front and rear engines now had identical wheelbases and running geometry.

Roundhouse Engineering supplied the "O" rings and replacements for some valve gear parts. Denver Waterjet supplied the sideframes, connecting rods, main rods and return rods, all of which are specific to this locomotive's drive geometry. Stainless steel was used instead of mild steel, giving the linkages better wear properties. McMaster Carr supplied all new axle bearings, fasteners and other components. Alloy steel crank pins were also used. These had worn to nearly half their diameter in over 20 years of use. The threads in the drivers for these cranks are now 5-40 UNC instead of 6BA, so replacement cranks can be obtained stateside.

Timing in the two four-driver chassis was not at all the mystery it had been when I first built the locomotive, thanks to my fixture system which has been described in articles in SitG. Roundhouse Engineering's instructions for centering the "D" valves were also referred to in timing the valve gear.

I have a rather high standard for my valve timing and performance. I must be able to run a chassis suspended on a stand (no load, no rollers) on a single cylinder in both directions on less than 5 PSI air pressure. To aid in this, I add oil in the air line and oil the piston rods and valve glands. Each of the two cylinders must be able to power a chassis in this way. When both are connected, the results are usually a smooth running chassis.

Sometimes minor timing corrections are often required. These consist of "D" valve centering adjustment and/or return crank adjustment. I determine whether "D" valve position is a problem by pushing the valve rod either forward or back with a small screwdriver while running. If I get better performance with pushing either way, the centering adjustment of the "D" valve is changed, one half-turn at a time, until optimum performance is reached in both directions. Forward and reverse must run equally well since I perform switching and other operations during a steaming session.

As for the return cranks, perfect theoretical timing may not always be the best. To adjust this, I determine which direction is running well and which is not. If forward is not running well, turn the return crank inward, towards the axle, just slightly, and air test. If reverse is not running well, turn the return crank outward, again ever so slightly, and try again. Usually there is little or no adjustment required here since near perfect positioning is achieved with my fixture system, but... sometimes a little tweaking is needed. There are a number of variables in valve timing, and sometimes a change in one can make up for a less-than-perfect setting in another.

The chassis/lower works rebuild turned out so well that I could put the bare chassis (no cab or boiler) on the rest track and have it propel slowly forward and reverse by 'lung power' only! I'm no Louis Armstrong or Doc Severinsen so my lung power is not exceptional (although I haven't smoked in nearly 50 years) so this is a sign of a well-tuned, efficient lower works.

I tried this newly rebuilt lower works with my existing boiler, and there was improved performance, but not as much as I wanted. Even with this new found efficiency, there was room for improvement in boiler recovery.

To make an existing boiler produce more steam faster, a more robust firing system is necessary. To make more steam, you gotta have more heat energy. My first thought was to have a dual flue boiler built with the same outside dimensions as the present boiler. In a way I would be admitting defeat, because for so long I had a single flue boiler performing tasks normally reserved for its dual flue brethren.

I submitted proposal drawings to several boiler builders and corresponded at lengths as to what could be done. The general consensus was that a dual flue boiler would be the solution to the problem, but one builder, Justin Koch in here in the US, suggested I might look into burner performance on my existing boiler as well.

When I originally built the boiler for the Mallet, I fired it with a standard Roundhouse burner: approximately 11/32-inch diameter, 2 ½-inches long with a number of rows of small holes. The jet was a #6 (AMAL designation). This got me up to 40 PSI and lifted the safety, but there was not enough steam being made to even power the locomotive running light. Knowing nothing about firing mechanics, I thought the project was doomed until Geoff Coldrick of Geoffbilt fame, who had custom built my first Shay for me, told me that a longer burner would give more steaming capacity. I cut off the burner tube on the Roundhouse burner and made several different lengths of burner tube with slots instead of small holes. The outside diameter of the new burner was 1/32-inch, to fit over the 'stub' of the old one. This worked fairly well, and the locomotive project was saved. I was still using the Roundhouse AMAL #6 jet with no further modifications. I later graduated to a #7 and later a #8 jet, and a slight increase in performance was noticed. My burners were brass with silver soldered ends and would eventually wear out. Sometimes the replacement worked as well as the one it replaced, sometimes, not.

After talking with Justin Koch about my burner 'adventures,' he said that a #8 jet should well supply my needs, but I needed to make sure I was getting enough air through the inlets in the jet mount; and considering I was using a somewhat larger than original jet, a larger diameter burner would also improve performance.

My first experiment was increasing air inlet volume. Justin said he had to do this on a burner he worked on where the jet size was increased from #3 to #5. Examining his numbers showed that the air area was effectively increased by 95 percent with a 23 percent increase in jet area. Notice I am not talking about jet DIAMETER. It is the AREA of the jet hole that determines flow. Area is proportional to the square of the diameter, so doubling the diameter would yield four times the area and, everything else being the same, four times the flow rate. Justin also increased the diameter of the burner tube because of the increased volume of gas flow.

Applying basic engineering principles to the data I could obtain, I theorized that the air/fuel volumetric ratio should likely stay closely the same to keep things operating as they should. I contacted the AMAL Carburetter Company in the UK, the manufacturer who set the size standard for many of the gas jets in use today. Although I could not get actual numeric data on diameters I wanted, I learned that the flow rate of jets is proportional to their AMAL number. This means that if I have a #6 jet and #8 jet, the #8 will have a flow rate of 8/6ths, or 133 percent, of the #6.

If my Roundhouse burner was constructed correctly for the #6 jet, with a #8, I would have to add 33 percent more air inlet area. I could either enlarge the existing holes or make two additional ones to bring the air flow up. There were two holes in the burner, at 12:00 and 6:00. I drilled two smaller holes at 3:00 and 9:00 to bring the inlet volume up to that theoretically required for the #8 jet.

With this change alone, the change in performance was significant. For one thing, the burner was quieter. It made me think that it was not working as well, but such was not the case. I found I could raise steam from a cold boiler somewhat faster, and boiler steam recovery significantly improved

In experimenting with burners, I also found that there is a definite limit to the length the burner may be. Overly long burners may not light at all, or the flame may not go back into the flue. Increasing gas flow can result in the flame either being turbulent, blowing out, or worse yet coming out the front of the flue like a blowtorch. All these conditions result in less heat transfer to the water and the 'blowtorch effect' can cause damage to components in or near the smokebox. I had made some of these 'overzealous' burners and the result was serious damage to my headlight's electrical system.

After a number of experiments, a burner tube ½-inch in diameter and 3 5/8-inches long was found to give the best overall performance. There are 12 slots spaced ½-inch in diameter and 3 5/8-inches wide. The slots extend to the center of the burner tube, or 180 degrees.

I have a heated water bath in my tender which feeds hot water from the boiler to a bath around the gas tank. This usually produced a tremendous increase in the sound level of the burner with smaller diameter burners. With more air in the mix, there is nowhere near that 'roar' of the flame, and if you are not careful, increased pressure can blow the fire out. You can hear an increase in sound when hot water is added to the tank bath, but not as much as with previous burners. The burner sound appears more even in intensity through the range of pressure settings on the gas valve.

This new firing system is taking some time to get used to. I occasionally need a higher gas pressure to light the burner. I do not add hot water to the gas bath as much as I used to, and must get used to the idea of a quieter flame actually doing more work. When hot water is in the bath, I must be careful in increasing the gas flow since the flame could blow itself out.

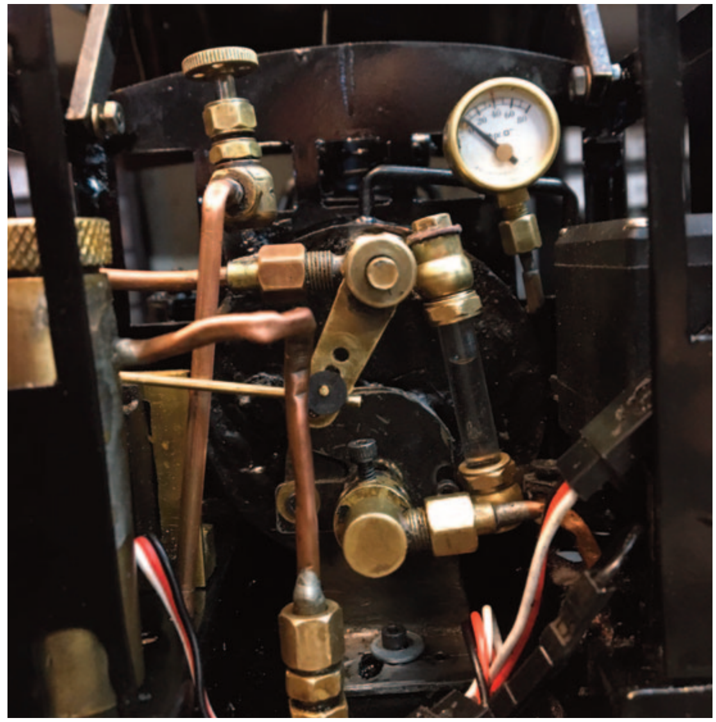
I can now pull six or seven-car trains at prototype speeds or slightly faster over my entire mainline for several laps, with no significant drop in steam pressure. My safety blows off at about 45 PSI now and for the most part I maintain 40 PSI so no steam is lost there. The front and rear engines are timed to the best efficiency I can achieve, so between producing more steam and using less of it, I am achieving my performance goals.

Now that I am going to use my existing boiler, there are a few things that must be done to improve it. Since the day the locomotive was built the boiler has had a small 4mm sight glass. It does not show the complete range of water level, but when it shows empty or close to it, it is time for a refill. With the capillary action of the water in the small 4mm tube, it was often impossible to tell what the water level actually was. I have lost one flue in this boiler due to it running dry, and do not intend to lose another, so a new sight glass was a major consideration.

I recently did some work on a Regner Heisler for my friend and fellow Apple Valley Model Railroad Club member Terry Ketcham. I noticed how clearly the Regner sight glass read, never seeming to be affected by capillary action. This sight glass uses a 6mm glass tube which is a significant improvement over the 4mm glass that the Mallet boiler had.

Jason Kovac of The Train Department was able to supply a Regner sight glass, although unfortunately not the exact same one as the Heisler uses which has a built-in Goodall valve. There is a Goodall/filler elsewhere on the Mallet, so this is not a problem. I had to do some adaptation to make the sight glass fittings with metric threads fit my 3/16-40 boiler bushings, but with that done, the new sight glass fits right into the area formally occupied by the old one. What a difference! Thanks, Jason for making these parts available.

I have always thought that the Roundhouse lubricator I originally used was a bit small to feed four of their cylinders at once. I had a spare Pearse lubricator on hand from my original Pearse Nevada which has a larger capacity than the Roundhouse, and is a better choice for the 2-4-4-2 Mallet. To make room, I replaced my original throttle servo, a full sized HiTec HS 645MG, with an EcoPower 640T waterproof miniature servo with metal gears. The duplicate HiTec used as a reversing servo has stood the test of time and was retained, but with a new twin inverted "L" bracket mounting system which replaces the Pearse method of mounting the servo. A piece of corrugated cardboard placed between the boiler and reversing servo acts as an effective insulator.



Above - View of the backhead with the new sight glass in place.

With the locomotive is running as it should, it was time for a repaint. The entire locomotive was torn down again and individual assemblies were painted with VHT high temperature engine enamel SP139 GM Satin Black, oven cured for one hour at 200 degrees. The smokebox was painted with VHT Flame Proof header paint, SP117 Flat Aluminum. It was also cured at 200 degrees, but the heat from the smokebox will cure it further (see photo below). It feels like I have a new locomotive, but it's basically the same wonderful little Mallet I've enjoyed for 22 years.

Bob's Bit's

Weekend Projects for Steamers
by Bob Sorenson
Photos by Bob Sorenson

Basic Boiler - Part 3

With fabrication of all the parts done, it's time to silver solder the boiler together and give it a test. For the soldering process we'll use a Sievert brand propane-air torch with a #2943 tip. The solder is 56 percent silver content, cadmium free (BAg-7), 1/16th-inch diameter wire. The flux is Harris brand "Stay-Silv" white and a citric acid pickle bath for the residue clean up.

It is generally better to solder in stages, doing the larger parts first, then smaller parts. Usually, one or two larger parts at a time, maybe two or three smaller parts. Expect to do five or six soldering stages and baths in the pickle solution for this job. Before starting, clean up all the solder areas with steel wool or fine sandpaper. Maybe even a rinse in acetone if the parts are oily.

First up is soldering the endplates in the boiler barrel. **Photo 1** shows three small lengths of copper wire around the edge of the boiler barrel. The boiler endplate rests inside the barrel on these wires to provide a stable platform during soldering. The copper wire is "paper clip" gauge and spaced about 120 degrees apart. **Photo 2** shows the endplate fitted on the firebox end and ready for solder. The copper wire shelf is important. The boiler parts will expand at different rates during the solder heating. Without the wires holding things in place, the barrel will expand first and the endplate will fall inside. Gravity is not a friend in this case. **Photo 3** shows the endplate fluxed with flue ready to solder. Seven or eight pieces of solder, about a quarter-inch

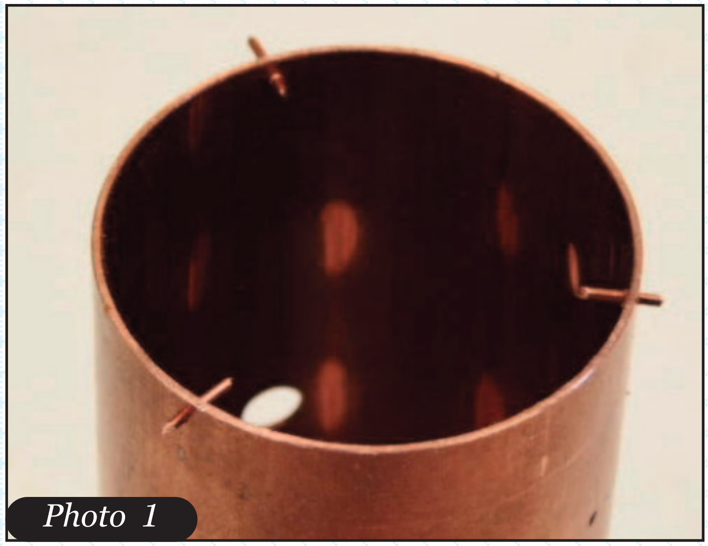


Photo 1

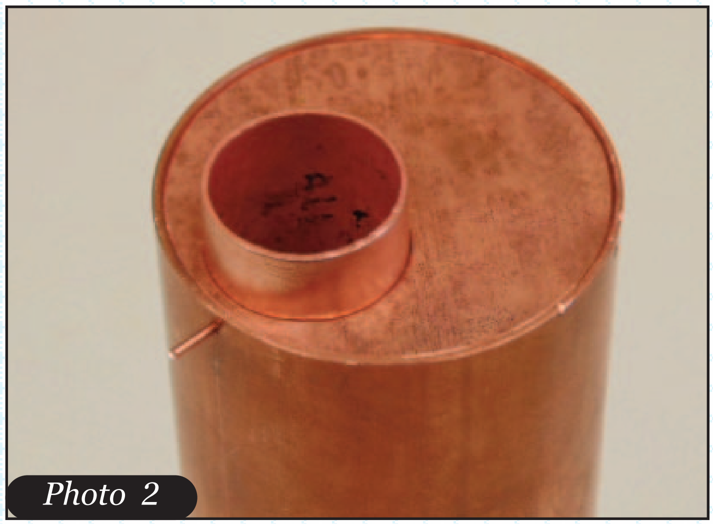


Photo 2

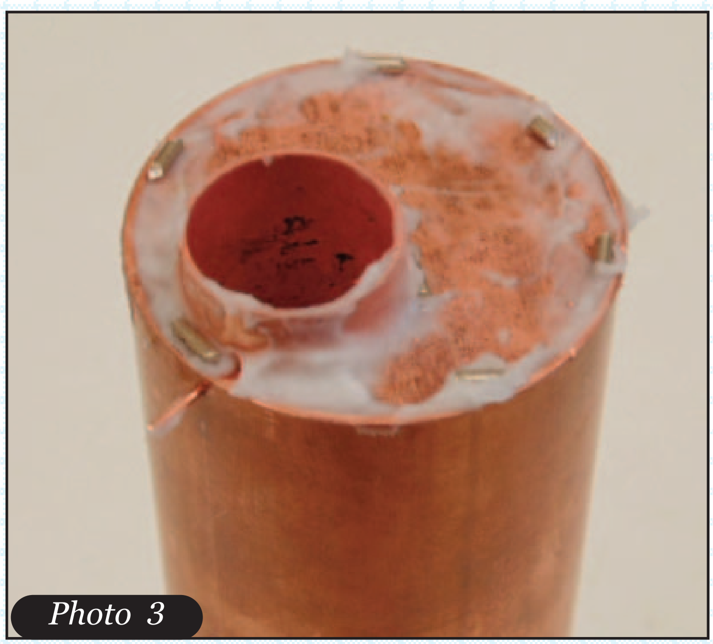


Photo 3

long evenly spaced is enough.

Slowly heat the endplate, barrel, and flue evenly. Observe the stages of the flux during heating. The water in the flux will boil off first, leaving flux powder behind. The flux will turn black and give an appearance of being burned. The flux then melts and turns light brownish. Eventually the flux becomes mostly clear and begins to boil. The copper underneath is very bright and shiny. At this point the solder is about to melt and flow in the joint. Sometimes a little nudge with a scratch rod will get the solder started. Once it starts to flow, it will flash around the joint very quickly. **Photo 4** shows the finished solder step. The un-fluxed parts turn black and a glassy residue is what is left of the flux. Give the assembly a swim in the citric acid bath for about ten minutes to clean everything up.

The smokebox endplate is next. It is done the same way as the firebox end; it just sits deeper in the barrel. Closely inspect the solder joints with a jeweler's loupe after the pickle bath. Good joints are smooth and consistent with no blobs, voids or pin holes. The endplates are the hardest parts to solder, everything else is straightforward. **Photo 5** shows the boiler bushings soldered in place. Do all three in one heating. A single piece of solder, about one-quarter inch long for each bushing, is sufficient. Solder the mounting bushings underneath to finish the boiler weldment.

On this boiler, the smokebox is part of the main barrel. Soldering the chimney in place is best done with a jig. **Photo 6** shows a hastily made ledge jig to hold the chimney tube in place during soldering. The jig is made up from bar stock and plate. Without the jig, the chimney will certainly fall out of place as the barrel expands from heat.

Photo 4

Photo 5

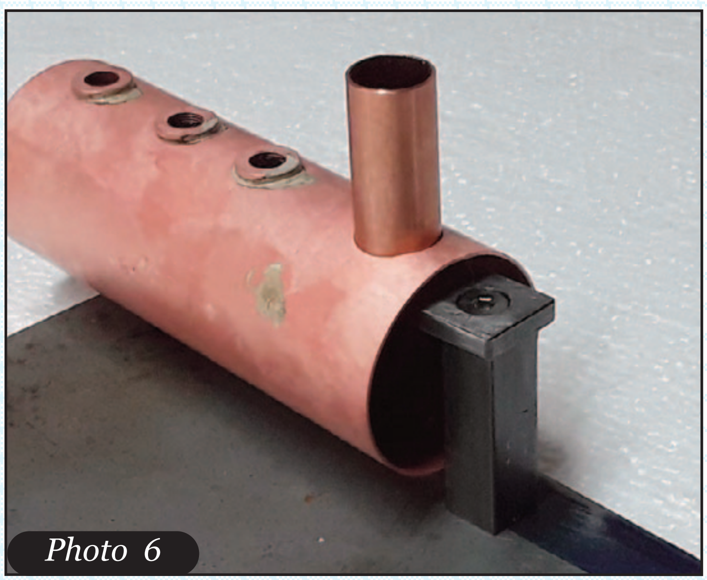


Photo 6

Photo 7 is the finished product. The citric acid pickle bath is very effective to clean off residue. A rinse under running water with a soft brass wire brush rub down produces this finish. Bright, clean and ready for paint.

The last step is a test. It is general practice to initially test boilers to twice their operating pressure. This boiler will operate at 10 PSI, so a test to 20 PSI is required. Start by plugging all bushings. Fill the boiler with cold water all the way up, leave no air bubbles inside. Install a pressure gauge; in this case a 30 PSI gauge is good. Normally, a water pump is used to pump additional water into the boiler to achieve pressure. Unfortunately, my water pump decided to crap out, so I went with an alternative method. **Photo 8** shows the test setup. Instead of a pump, apply a very small amount of heat into the flue. The torch is barely running, about a candle worth. Warm up slowly until pressure is reached. Hold the pressure for 20 minutes. If there are no leaks, the boiler passes. **Photo 9** shows a successful test with 22 PSI on the clock.

The question is, what happens if there is a leak? On these low-pressure boilers, a leak is obvious and will appear immediately. Most likely on a bushing. Water will either stream out of the insufficient joint or a fast drip will appear. No pressure will develop. Stop the test, drain out the boiler, apply flux and reheat the joint. In most cases no additional solder is needed and the joint will close up by remelting the existing solder. Do the test again. If no leaks appear at the five to seven PSI range, take it to 20 PSI. It will be fine. I built two of these boilers for this article. Both had leaks. One was on a safety valve bushing and other was on a copper wire used for the endplates. The solder did not flow all the way down the wire and when I filed off the excess wire, a

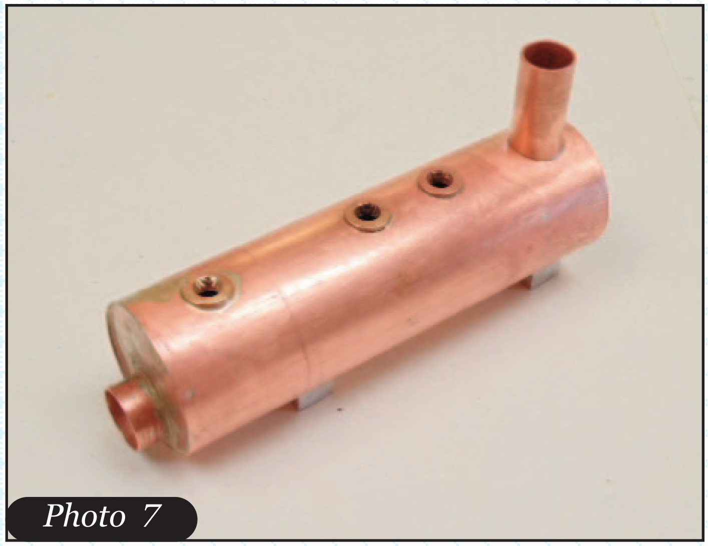


Photo 7

Photo 8

Photo 9

leak appeared. They both fixed without additional solder.

Here's a video of these two boilers in action at the National Summer Steamup. Doubleheading at the National Summer Steamup:
https://www.youtube.com/watch?v=JvyTmSmdfmw
That's about it. Take care,
Bob

Double Heading at the NSS 2021

TIMETABLE

Special or Annual Meets

Staver Locomotive Spring Steamup, April 21-24 2022 - Staver Locomotive, Portland, Oregon. Visit *www.staverlocomotive.com* for latest information.

National Summer Steamup, July 13-17, 2022 - Lodi Grape Festival and Events Center, Lodi, California. Visit *www.steam-events.org* for more information.

The Sixth Annual Gathering of North American members of the Association of 16mm Narrow Gauge Modellers will be hosted in Ohio. Date yet to be determined. Visit *www.northamerican16mmmodellers.org* for registration and venue information.

Cabin Fever Model Engineering Show January 13-14 2023 - Lebanon Valley Expo Center & Fairgrounds, Lebanon, PA. Gauge One Tracks available for steaming. Visit *www.cabinfeverexpo.com* for more information about 2023.

International Small Scale Steam Steamup. January 14-21, 2023 - 103 Live Oak Drive, Diamondhead, Mississippi. Visit *www.diamondhead.org* for more information.

Regular steamups

Crescent City High Iron. Steamups as necessary on an elevated backyard layout on Northern California's upper coast. Info: Don Cure, diamondd1947@msn.com.

Greater Baton Rouge Model Railroad Club Open House and Gauge One Steamup. Info: Ted Powell, (225) 236-2718 (cell), (225) 654-3615 (home), *powell876@hotmail.com.*

Puget Sound Garden Railway Society. Two steamups per month, one at the Johnsons' on the second Saturday and a steamup at a member's track on the fourth Saturday.
Info: *http://psgrs.org/* or call Pete Comley at (253) 862-6748.

Southern California Steamers. Winter events cancelled. Contact Jim Gabelich for dates, places and other pertinent information.
(310) 373-3096. *jfgabelich@msn.com*

THE CUPOLA VIEW

Spring Thaw

I started looking forward to Spring just as soon as I got the announcement that the Annual Boy Scout Train Show, which I have been participating in with live steam, was finally coming back for 2022. The pandemic hit their efforts hard and after two years we finally get to "Steam into Spring". If you want to know more about the efforts of one of our local troops, I wrote a piece about it for *SitG May/June 2011 Issue #116*.

Here's hoping all of our readers are doing well and that you will have a fantastic 2022. By the way, if you got something special from that jolly elf you want to share here, send those photos in!

Happy Steaming!

Scott

Cupola view' is written by Editor Scott E. McDonald: you can contact him at sitgeditor@gmail.com or P.O. Box 1539, Lorton, VA 22199.

Above - Lee Barrett's coal fired Accucraft K-28 with a rake of D&RG cars passes the weathered coaling tower.

High Desert Steamup

Submitted by Peter Comley

On a warm and sunny day in late November 2021 Lee Barrett held a steamup at his property in Anza, California. Anza is in the high desert and Lee has a 20 acre plot surrounded by low hills unspoiled by civilization. It all makes for some dramatic photographs; the emphasis is on the scenery and background and to make the trains look as real as possible. Enjoy the pictures!

An Accucraft C-25 owned by John Polen (previously enhanced by Mark Johnson) makes its way over a dry creek

The C-25 approaching the photographer.

Pete Comley's streamlined Darjeeling class B (yes, there really was one made in 1942 for the railroad). The body was made by Pete on a Roundhouse chassis, with some kit and some scratch built coaches

Bill Wilbanks' Accucraft F4 in the distance passing through the desert landscape. Shades of the Owens Valley?

From L to R, John Polen, Bill Wilbanks and Lee Barrett ponder the intricacies of coal firing a K-28.

Continued on page 59

CONTRIBUTOR BIOS

The magazine couldn't exist if it were not for the dedicated individuals who take time from the hobby to chronicle their endeavors, interests, and joy of live steam. If you get a chance to meet any of our contributors at a steamup, please thank them for their contribution.

Bill Allen - Bill lives in Woodside, California and first became interested in live steam in 2008 when he saw Richard Murray's layout at a BAGRS open house. He proceeded to buy a Ruby, C16 and Forney before deciding to start building his own. He bought a mill and lathe and with the help of some BAGRS members learned to use them and was soon making chips. Since then he has completed 20 projects, some of which have been featured in Steam in the Garden, and currently has a multi-part article running in Live Steam. All of his builds are one-of-a-kind as he only builds those which have never been done before and probably will never be done again in G Gauge live steam. Bill's prior hobby was building fine furniture and he uses some of those skills and tools in hie engine building.

Jeff Campbell - Jeff Campbell was infected with the train bug at an extremely early age. Thanks to his father, Jeff's first bedroom held a crib, dresser, and a 4'X8" HO layout. Years later, at the local fair with his family, Jeff noticed a G scale layout in the garden exhibits and a fuse was lit. Under the guise of getting his young son a "Toy Train" for Christmas, Jeff's empire was launched. Jeff's interest in live steam began while riding on the tender of a 2-4-0 at Disneyland. All the valves, pipes, and gauges were so intriguing and within weeks a kit form Accucraft Ruby was running in the back yard which turned him into an avid live steamer.

Mike Jones - Mike is the creative mind behind projects such as a once in a lifetime rendezvous with Halley's Comet in 1986, where he took 820 excited guests on 6 jet flights to view the comet's return. Mike has flown 4000+ hours, piloting Army helicopters over tall mountains, above steaming jungles, and across deserts and in combat. He holds a US Coast Guard Captains License for submarines and has worked on 5 submersible builds as a project manager and test pilot. During Mike's 23 years as a science teacher, students were carried to magical places from a drop of pond water under a microscope to the edge of the universe through a telescope. Mike has produced NASA funded, nationally distributed, planetarium shows that recreated epic voyages of star navigation by ancient Polynesians and futuristic flights to Mars. Mike continues to innovate and dream big dreams.

Les Knoll - Les started his railroading experience with a Lionel F7 freight set at Christmas at age six. This grew to a tabletop layout in the family basement, later to be supplanted by a theater pipe organ and a rock band practice space in his teens. Later in life the HO/HOn3 bug bit, and the first incarnations of his Rivendell & Midland Railroad, one of the first JRR Tolkien-based railroads in the US, took shape. The R & M moved outdoors with his discovery of live steam in the early 90's, and after two purchased locomotives, five scratchbuilt live steamers followed, ranging from a 14-ton Shay to a 2-4-4-2 logging Mallet. The current Rivendell & Midland is in the back yard of Les's and wife Ruth's lake home in North Carolina. Les is a retired Forensic Engineer and a Registered Professional Mechanical Engineer.

Rob Lenicheck - Being a Colorado native, Rob Lenicheck was born with narrow gauge steam in his blood. He started modeling in HO in junior high, thanks to a suggestion from a "friend", moving on to HOn3 in high school, and finally to On3 in his early twenties. Unknown to Rob at the time, the Gauge One live steam hook was set deeply about 20 years ago when that same "friend" revealed his collection. Rob now spends much of his time scratch building engines. He has degrees in Music Education and Mechanical Engineering.

Jeff Williams - Jeff Williams is a retired mechanical engineer living in Northern California. His love of trains began at an early age and included Lionel models, but also included talking his parents into detouring during any family trip to see steam locomotives on display or operating at railroad museums. He started with live-steam models 20 years ago, right after visiting one of the first National Summer Steamups. Jeff is very fortunate that his sweetheart Ann Stephens is also a lifelong railroad fan and fellow live-steamer.

Advertiser Index

Coming Soon!
Issue #179
May/Junel 2022

Cabin Fever — A large Model Engineering Expo returns after a brief hiatus.

Parting Shots

Steam Scene Continued from page 55

Below - Holiday Steamup at the National Capital Trolley Museum.

Above, Boris Rasputnis shows his collected audience the techniques for steaming up his Roundhouse "Sammy".

Scott E. McDonald Photos

Steam Scene is where your locomotives and steamup fun can be shared with the world. Send us your photos for display!