

Scratch Built: Live Steam NORTH PACIFIC COAST RR Engine #21

BY

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[\(Live Steam/Topic: NPC #21 Live Steam Builder's Log\)](#)
[\(Live Steam/Topic: NPC #21 Live Steam Builder's Log - Con'd\)](#)
[\(Live Steam/Topic: North Pacific Coast #21 Finally Painted\)](#)

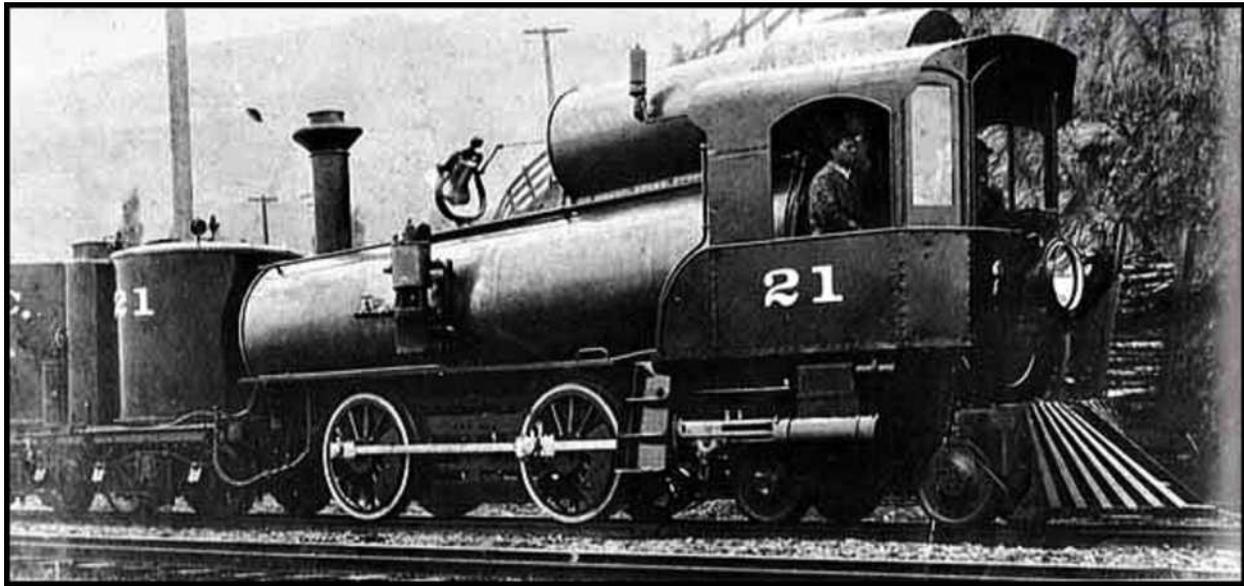


Back on Feb 13, I posted that [I'd bought a Sherline CNC milling machine](#). It was with this project in mind that I bought it.

The Prototype:

First a little background... I've been a fan of the North Pacific Coast Railroad for over 25 years - ever since I got into narrow gauge in fact. This is partly because I grew up in Marin County and the NPC existed in my old stomping grounds, and partly because it was a unique California narrow gauge railroad that, like the SPC, was built "first class all the way." With the exception of the SCLCo, all of my NG layouts, both real and imagined, have been based on the idea of the NPC surviving into the 30's or 40's and never having been broad gauged.

I've also been a big fan of NPC #21, the "*Thomas Stetson*", ever since I first saw a photo of her.



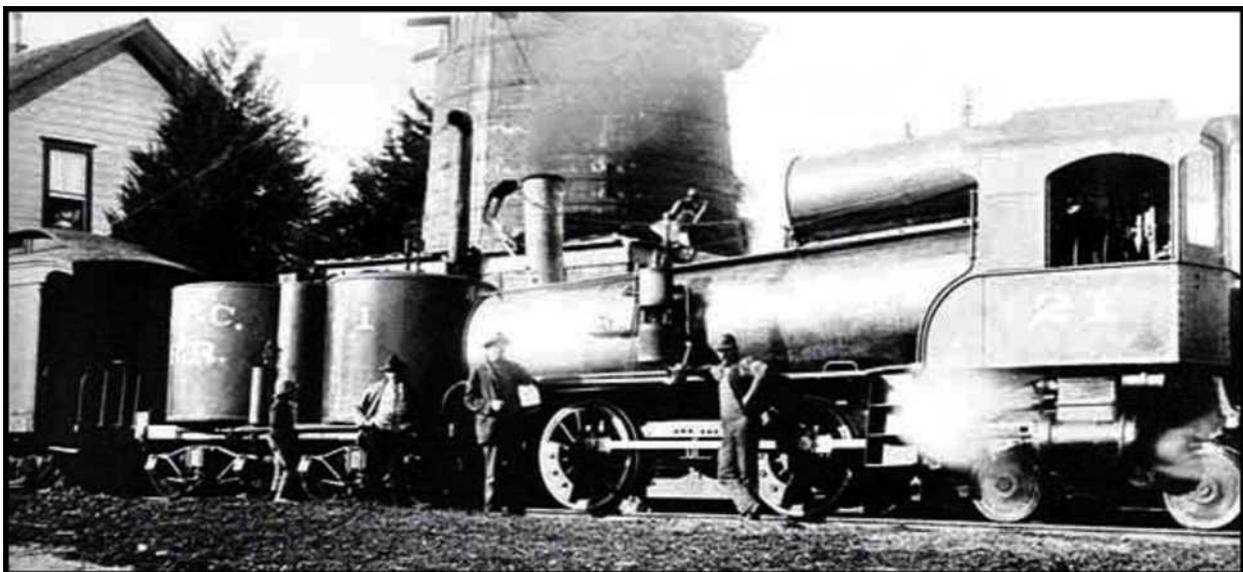
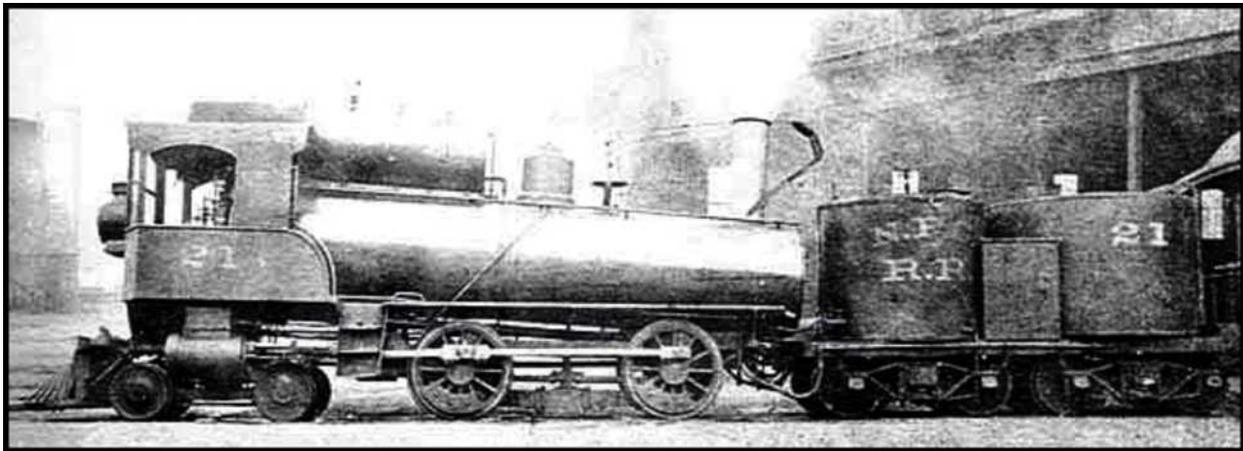
Known up and down the line as *The Freak*, this "ugly duckling" was unique in many ways. Built by the NPC's Master Mechanic William J. Thomas in the Sausalito shops in 1901, she was one of (if not *the*) world's first cab forwards. She was also one of the (if not *the*) first oil-fired locomotives on the west coast (if not in the world), and set the standard on the NPC. All future locomotives on the NPC would be oil fired. She was the first loco with automatic air and with 200lbs boiler pressure.

She used a marine water-tube boiler instead of the conventional fire-tube boiler design, a fact that contributed to her odd appearance since the conventional steam dome was replaced by the "steam collection cylinder" (for lack of a better name).

Rather than a conventional rectangular tender, her tender was essentially a flat car frame upon which rode two vertical cylindrical tanks - the front one carrying fuel oil and the rear one carrying water. The tender also sported a toolbox on the fireman's side and two vertical air tanks on the engineer's side.

Only in existence for a few years (1901 to 1905), there are only a few photos of her known to exist, and these show her evolving over her short life with the headlight being raised to allow for an oval cutout in the cab front (possibly to get more air to the firebox). She sported at least two different stacks, and had a sand dome installed later in life. The whistle also was moved.

The prototype photos...





A few drawings of her have been made, the best of which is probably the HO scale drawing appearing in *Narrow Gauge to the Redwoods* by Bray Dickinson. 1:48 drawings also appeared in the Gazette, but I've found a number of errors in this set, and have used them only as a rough guide.

Bob Baxter has already built an electric version of this locomotive. During this time, Tom Farin (also an NPC fan) put together some [web pages](#) with such prototype information as could be found, along with some speculation and educated guesses on different aspects of this locomotive. Finally, Keith Wiseman produced a white metal kit (sans motor) in HOn3. Bob Baxter has already built an electric version of this locomotive. During this time, Tom Farin (also an NPC fan) put together some [web pages](#).

(09 Apr 2007) I've chosen to build #21 in her earliest version, as shown in the first photo of the previous post. Things have progressed, as will be shown, and I've kept it more or less a secret until now. I've never done anything like this in my life, having very little machining experience, and no CNC experience. I've done a little work with brass, usually in the form of making one or two parts for a primarily wood model, but nothing extensive.

I haven't done much silver soldering in 25 years other than to assemble one Bangham whistle for my two-cylinder Shay. In fact, the closest I've come prior to starting this project was to build an On30 logging Mallet from Backwoods Miniatures, and that consisted mostly of folding parts along their photo-etched fold lines and soldering them with small iron.

So, I wanted to make sure this was something I could reasonably hope to do before going public. 😊

I generated my own set of CAD drawings in AutoCAD, based mostly upon the HO drawings in Dickinson's book, but with a few changes of my own made after studying the prototype photos. So far I've had little success generating the g-code using one of the "translation" programs that I've tried (and I've tried several), so I've ended up writing it all by hand, using AutoCAD's "ID" command to get the X-Y coordinates.

A few people have seen this stuff in the form of email updates. What I'm going to do now is to post these email updates in (more or less) their original form, and in chronological order, along with the dates they were sent out. Future updates will be made here directly.

Going in, I want to say a big public **thank you** to Dave Hottmann and to Bob Starr, both of whom have been an unending source of information, advice, techniques, and encouragement to this metal-working newbie, and without whom this project would never have gotten off the ground!!

(2/7/07) Update #1 - **First Mockup:**

I have created full AutoCAD drawings of the cab, running boards, and other parts I'll need to fabricate. I plotted the drawings; cut them out, and made a mock-up from them to make sure things went together correctly. I should have printed it on stiffer paper.



I already have a working live steam 4-4-0 (one of Dave Hottmann's Accucraft Mogul conversions) so the running gear, boiler, etc. is already built. Most of what I'll be doing is cosmetic, though I do have to reroute the steam and exhaust lines. You can see the Mogul/American conversion behind the mock-up.

I wanted to make sure that my perimeter calculations for the curved area of the roof and the resultant length of the piece were correct. I'm starting to formulate ideas on how to actually fabricate the brass cab with internal bracing and reinforcement.

This is actually starting to take shape!! My CNC milling machine should arrive Friday, and the CAD drawings will be used to generate the machine path.

As you can tell, I'm getting really jazzed!!!

(2/21/07) Update #2 - CNC Mill

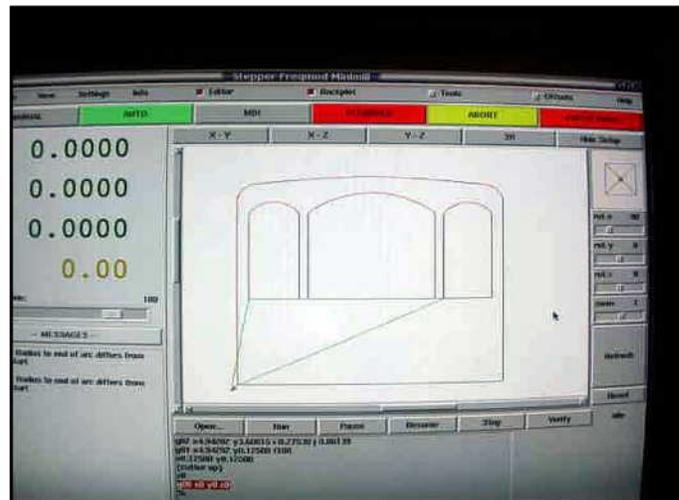
Two weekends ago, I got the workbench assembled and the mill set up.

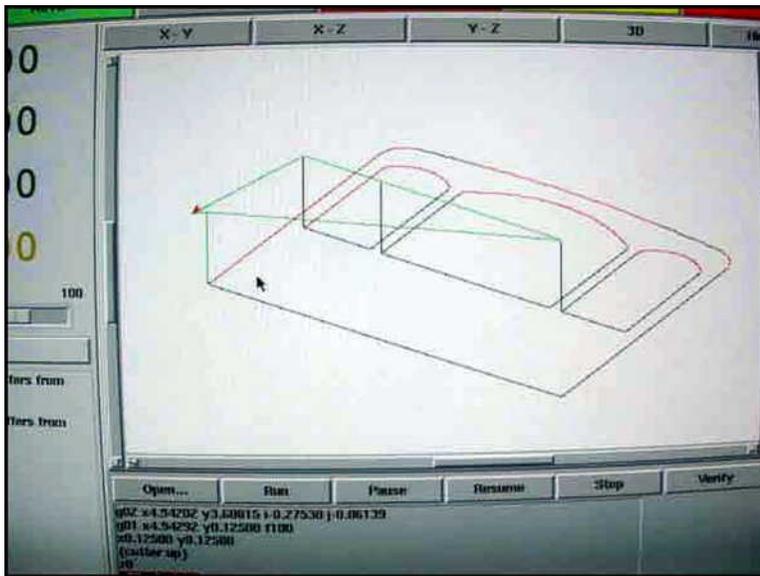


Last week, I got the computer hooked up to the mill and I started going through the instructions and learning g-code so I can program the thing to make the parts I want. I also watched the mill move under computer control for the first time. COOL!!!

This evening, I created the first g-code file, which will cut the front cab walls. The CAM software that came with the mill has, among other things, a g-code editor for creating/editing the g-code, and a window called "Backplot" where you can run the g-code and watch the tool path, feed rate, etc. The software also controls the mill itself.

Here's a couple of shots of the screen showing the cab tool paths generated by the g-code I wrote. The first is looking down on the X-Y axis...





... and the second is a 3D view showing cutting tool travel in the Z axis...

A small portion of the actual g-code is visible below the tool path image window. The tool starts from home and moves to start cutting in the lower left corner of the left window, then cuts the center and right hand windows. It then returns home and pauses for a tool change and possible changes to the fixtures holding the brass to the table, then cuts the outline and returns home, at which time the cutting of the part is finished.

I also watched the mill (minus cutting tool and material) go through the motions to cut out this part. In case you can't tell, I'm really JAZZED!!!

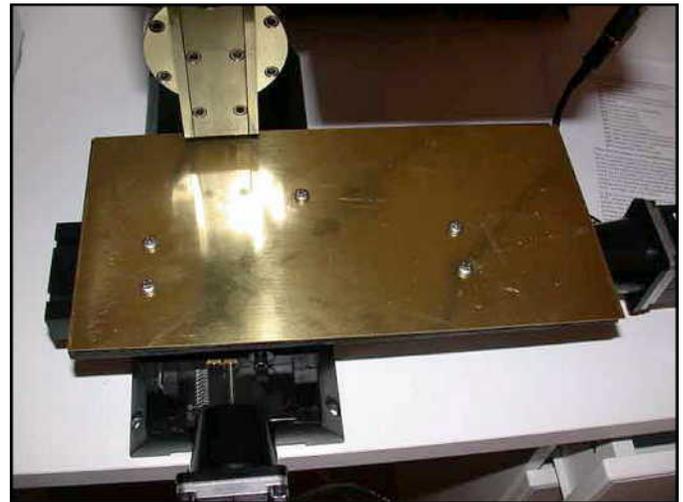
My brass sheet came in today, and I've ordered some 1/8" acetyl plastic which will mount to the milling table and back the brass sheet. It will also serve as a clamping fixture. I should have it by the end of the week. All that remains is to buy a 1/16" diameter end mill to cut the windows. The outline will be cut using a 1/4" diameter cutter. Offsets for these tools is already built into the g-code.

(2/25/07) Update #3 - **First Metal has been Cut:**

I finally got some metal cut this evening. I cut the roof/side cab walls for #21, the first part I've actually cut out using the new CNC.

Sherline sells 1/2" aluminum tooling plates designed to be bolted to the mill table. These have 10-32 tapped thru holes every 1.6", and I used this first to give me something to screw into. On top of the tooling plate, I added a 12" x 6" sheet of 1/4" acetyl plastic as a backing plate. I did that for two reasons... (1) it machines very easily and wouldn't dull my cutting bit, and (2) my part is slightly wider than the 4" tooling plate and I wanted to support it everywhere a cut was to be made.

I drilled 5 holes in the acetyl plastic that aligned with five holes in the tooling plate, and drilled matching holes in the #22 gauge brass sheet I was going to cut (also 12" x 6"). These holes were positioned so the cutter would clear the screw heads. I bolted both of these to the tooling plate.



I taped a plot of the drawing to the work piece to align the cutter's "home point" for the cutting process, and to be sure the cutter would clear the screw heads.

I did a few "dry runs" (everything except the actual cutting) with my finger on the "Abort" button to make sure everything would work as planned, and made necessary adjustments.

It was time to run it for real. The cutting process went smoothly and took a little while as I was using a 1/8" diameter end mill and had the feed set slow.

Here's the finished cut...



... and here's the completed part...

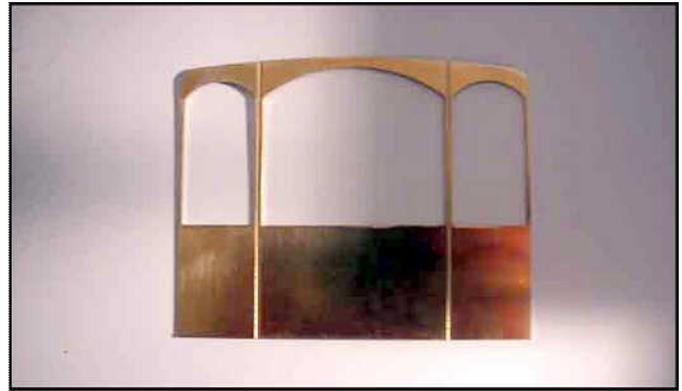
I absolutely LOVE this tool!!! 😊

(09 Apr 2007) Update #4 - **Cab Front Walls** - 2/27/07

I got the cab front walls cut out last night. There was a little cleanup to do around the insides of the windows with a file. BTW, I've modified the window profiles since the mockup to more closely match the prototype.

One of my concerns has been trying to fold the angled front walls after cutting them out. The cross section here is pretty small... 0.090" to be exact, and the 14° bend goes right in the middle. I bought a Backwoods Miniatures logging mallet kit a few years back (another project half-finished) and I remembered they had etched fold lines included in their flat parts. So I got the bright idea of using a small Dremel ball cutter in the mill chuck to cut a similar fold notches into my front wall.

Here's the part (inside view)...



(09 Apr 2007) Update #5 - **And the Cab Lower Sides** - 2/25/07

(09 Apr 2007) Update #6 - **Cab Sub-Floor** - 3/2/07

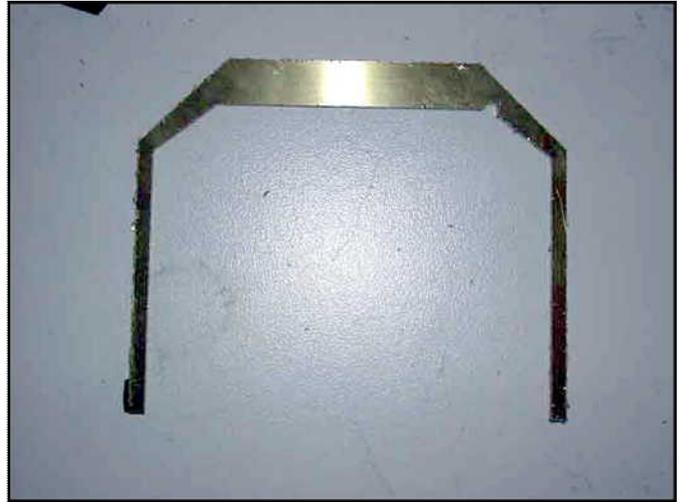
Tonight I cut the cab sub-floor. This will (a) act as a bottom former and place to solder the front and lower sidewalls to, and (b) provide a place to attach the front hinge so the cab can open forward like a semi.



Mark Scrivener had warned me that this 260 brass can be miserable to machine. So far I've had no problems because I've been cutting 0.025" stock. This piece however was cut from 0.064" stock, and the problems became apparent immediately. The above piece was the second piece I cut.

Here's the first piece...

I guess I tried taking too much material off in a single cut. On the first piece, I was taking off 0.032", or half the thickness. The cut came out terrible, with what on wood I would call "splintering of the edges" - is this called "galling" in machining? Also, I didn't have the part adequately clamped and it broke loose, allowing the end mill to chew into the upper inside right-hand corner.



Here's another shot of the edges of both parts...

The part on the left is the second part, with the first one on the right. Quite a difference.

On the second part, I reduced the depth of the cut to 0.016" and increased the total number of passes to four.

At least I learned something.

(09 Apr 2007) Update #6 - 3/6/07

Crap!!! I went to solder the cab front to the floor support (the last part I made) and it didn't fit! 😞 Further investigation revealed that I used the wrong tool offset when I wrote the g-code for the floor support, so I'm going to have to make another one. I wrote the g-code for a 1/4" end mill, but ended up using a 1/8" mill to reduce galling. Unfortunately, I forgot to correct the g-code for the change. My first "mistake" on this project.

At least it's a simple piece with no rivet detail, etc. Far better to have to remake it than the cab front or roof.

I picked up my Little Torch oxy-acetylene set today... torch, regulators, tanks, caddy... the works. I made another test tonight silver soldering a couple of scraps - a piece of 0.025 to a piece of 0.062 - the same thickness I'll be silver soldering on the cab itself. It turned out far better and was a lot easier with the new torch than the previous test with the pistol grip butane torch.

Here's the unit I got...

<http://www.littletorch.com/caddy.html>

Bottom of the page # 23-1004A

BTW, I've gotten all the rivets embossed on the front cab wall. Still have to do the roof. There are a couple of other issues I also need to work out with the lower side panel design so the cab can properly hinge forward. I may end up making these lower panels in two pieces instead of one so the curved handrail at cab rear can stay put when the cab swings up. I'll know more after I get support piece remade and the the front wall soldered to it.

(09 Apr 2007) Update #6 - **Reply to email response** - 3/7/07

> *Looks almost like a miniature version of my full size oxy acetylene torch.*

Yeah, that's pretty much it exactly.

> *How hot do the propane ones get versus the new acetylene version?*

From their home page...

Produces a perfectly controlled, stable flame hot enough to melt commercially weldable metals, glass and ceramics with thread-thin flames up to 6000° F.

Smith Equipment's Little Torch welds an unlimited range of materials, brazes and solders the tiniest elements with ease, yet produces enough heat to weld steel up to 1/8" thick or melt 3 oz. of silver.

Not sure about the propane version but I'm sure it's substantially less. Also, the smallest two of the tips aren't recommended to be used with anything other than acetylene or hydrogen.

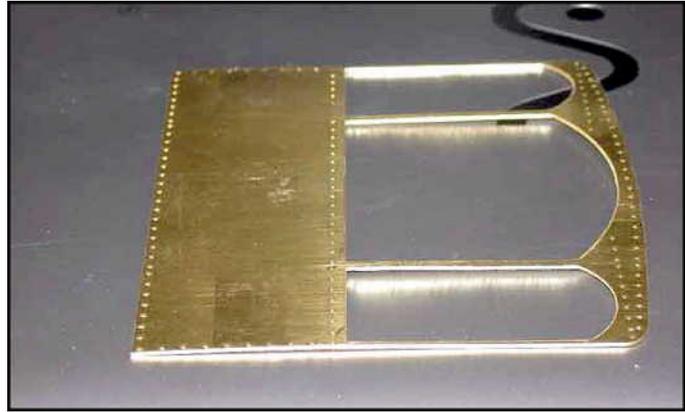
> *And what melting point silver solder are you using?*

Stay-Brite 4% 430 degrees. I also have some 0.032 stuff from OSH that melts at 1250 degrees F,

> *Your first mistake :) - I have a feeling that I would make lots of those kinds of errors if I was doing it!*

Yeah, I suppose it had to happen. [>:(] I'm just glad it was a simple piece as opposed to one of the others. I can rewrite the g-code for this piece in 5 minutes and have another cut in 1/2 hour (including setup).

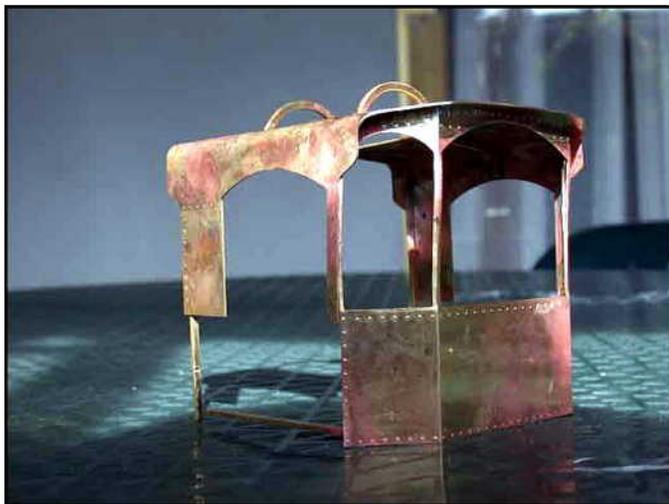
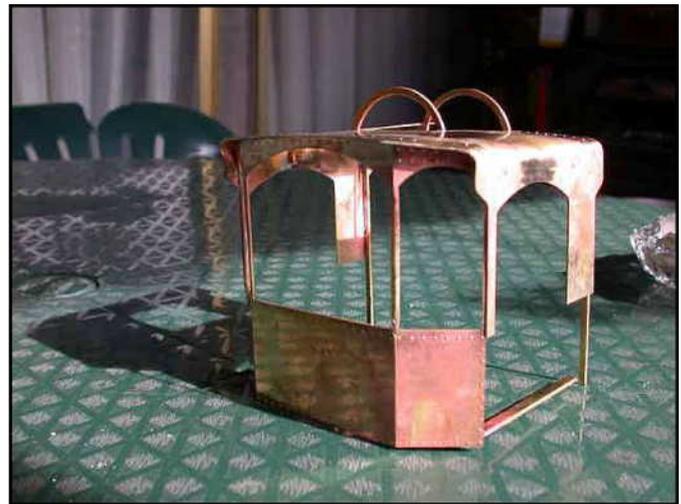
BTW, here are a couple of pictures of the front wall riveting...



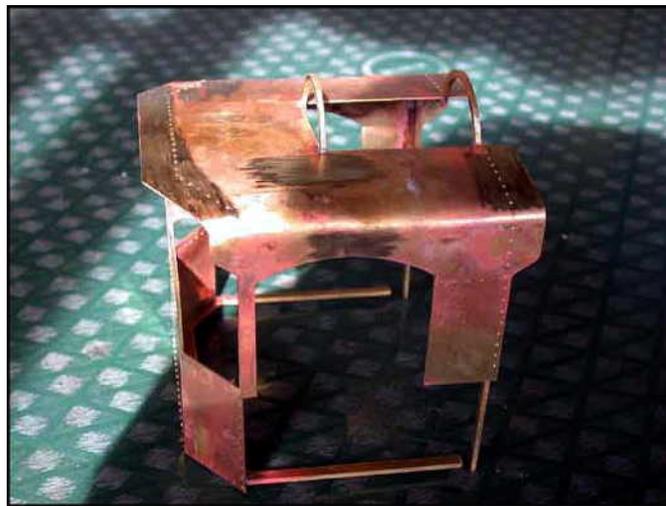
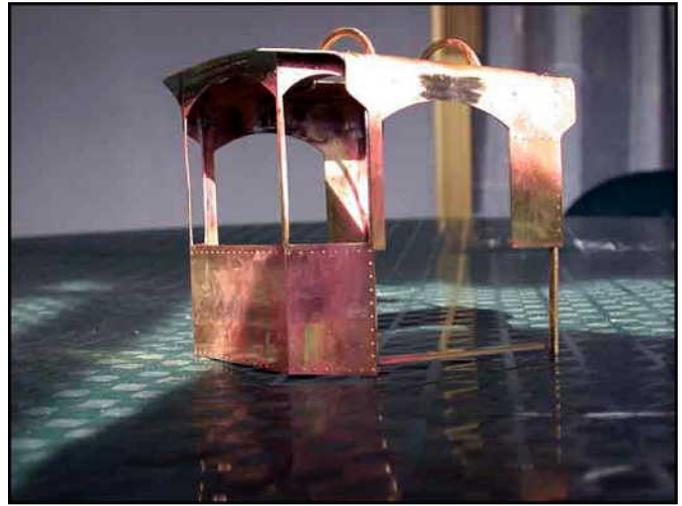
(09 Apr 2007) Update #7 - 3/12/07

Things have been moving right along and the cab is roughly 80% complete. I spent the day today assembling the parts I've made.

The new little torch is fabulous and as I gain experience, things are getting easier with every joint (please forgive the grungy finish... paint will make a world of difference). This isn't to say I haven't made mistakes. 😊



There are also a few imperfections, as with the left window stanchion here. I plan to bend these all back into position once I'm done. I stupidly tried to hold the roof in position by clamping from the bottom of the cab to the roof, and those narrow little stanchions bent. 🤦 They have been the biggest pain in the ass of the whole project. As I feared, they didn't bend in the brake and stubbornly remained straight. 🙄 I finally ended up filing the profile into them.



Here's a shot of the inside. The middle and rear braces with the half-loop to support the top cylindrical whatever-it-is each took about 50 minutes to mill out. Being made from 0.06" material, I had to do each in four passes to prevent galling. Listening to the shop vac run for 50 minutes straight is no fun at all. 🤔

I made a discovery though... it's better to have the mill moving against it's normal cutting direction on the part side of the cut. It produces a much nicer finish on that side of the cut. Unfortunately, I already had the g-code written to do just the opposite by cutting from the other direction, so I had to do some filing. Next time.





Lastly, here's a shot with one of the side panels taped in place for effect. I'm getting there. 😊

(09 Apr 2007) Update #8 - 3/29/07

It's been a little over two weeks since my last update, partly because (a) other things (like a St. Paddy's Day party on the resultant hangover) took one of my weekends, and partly because I was waiting for a tool. I ordered this Grizzly combination 12" shear/brake/slip rollers...

... and getting it delivered was a minor nightmare. The first one was four days late since Fed-Ex. Freight didn't realize it was being delivered to a business address (I have things shipped to work). When it finally arrived, the shipping carton (a simple cardboard box for a 120 lb. machine) was damaged and so was the tool (it wasn't secured within the box or padded in any way), so I refused delivery and sent it back. A phone call to Grizzly resulted in them telling me they "had to verify with the carrier" that I'd refused delivery before they would ship a replacement, and that took another 48 hours. Then Fed-Ex Freight forgot to complete the paperwork, so that delayed it another day. However, I finally got it last Tuesday and it was in good shape.

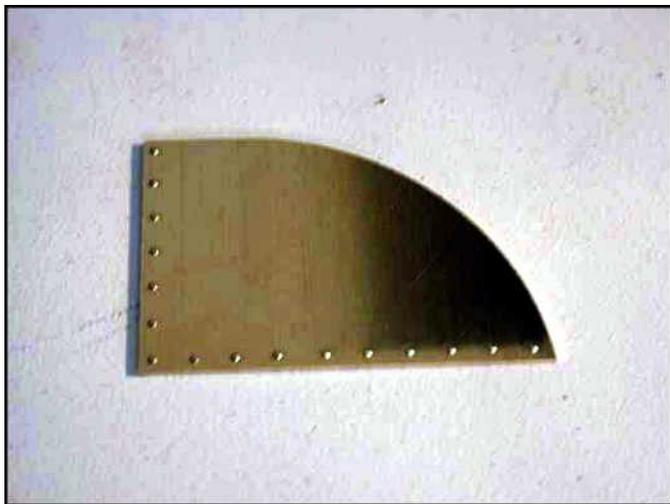


Okay, on to the cab. I had to remake the lower side panels. First off, trying to get the rivet pattern accurately placed was difficult at first. Rivets can't be embossed on the milling machine because the punch and die need to remain stationary while the work moves, and with the work secured to the milling table, there's no place to affix the die that won't move with the work. As a result, I used my Northwest Shortline Riveter. However, the fence I clamped to the table slipped and I screwed up one lower panel.

Another reason for remaking them is that the more I looked at the photos, the more apparent it became that I had the curved section behind the cab wrong. I'd followed other drawings (like the ones in the Gazette) and whoever drew it used a simple quarter-circle. But if you look closely at the prototype, you'll see that the panel is about 1/3 taller the curve is wide, and there's a vertical section at the bottom of the curve.

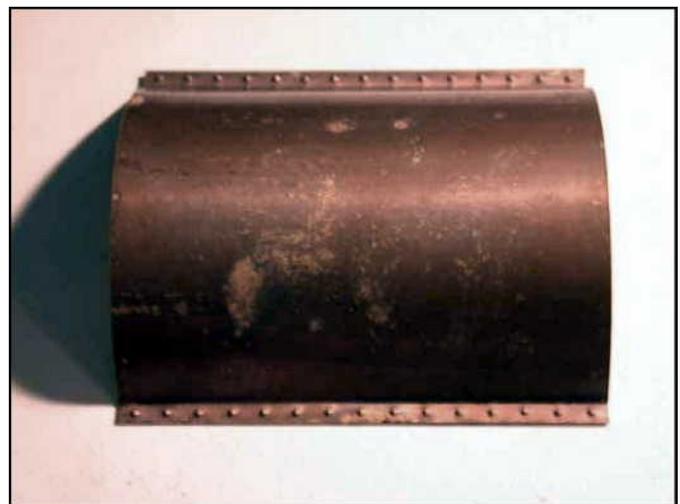
So, I drew up new plans in AutoCAD and wrote new g-code to cut the parts - in four pieces this time instead of two, because I want the curved section to remain attached to the running boards when the cab itself hinges forward.

The NWSL rivet set includes five sets of a punch and die each, plus an additional large punch with no corresponding die. I solved my rivet problem by chucking this extra punch in the mill's drill chuck, unplugging the Z axis stepper from the controller, and writing g-code that would go to each rivet location and then pause until I clicked the "Resume" button on the software. At each location, I'd manually lower the spinning punch into the piece to create a "center punch dimple" for the riveting punch later. After all the rivet locations were dimpled, I swapped the punch for a cutter and cut out the piece. Later, when actually embossing the rivets, it was pretty easy to manually locate the dimple by moving the piece around until the punch dropped into the dimple and then press in the rivet.



Here's one of the resulting curved walls...

Next I made the front piece for the steam collection cylinder shroud, and then the shroud cover itself.



This last was somewhat of a bear, and I had to make it four times before I got one I was happy with. Length is critical since it had to form somewhat a half-cylinder and there are flanges that stick out each side which attach to the cab roof. Getting a sharp bend at these flanges was also difficult. After two tries, I called Bob Starr, and he advised me to file a groove at the bend line.



Never being one to use muscle when there's an electric tool that will do the same job (hehehe), I went to OSH and bought an engraving cutter bit from Dremel...

Again, I chucked it up in the mill, wrote some g-code that would go to the beginning of each fold line, pause while I lowered the bit into the work, and then cut the line. It's actually just like what I did on with fold lines on the cab front (I don't know why I didn't think of it before Bob suggested it). I also used it to center-dimple the rivet locations on this piece and it worked well.

So without further adieu, here's the cab so far (again the curved sides are only taped in place for the photos)...



All that remains is to make the window inner frames and solder on the 0.050 and 0.025 half-round beading around the windows, and the cab will be essentially finished.

(09 Apr 2007) Update #10 - 4/2/07

I essentially finished the cab yesterday. Now it's on to the cab deck/running boards, and then I'll be rolling the boiler jacket and actually starting the disassembly of the Mogul/American conversion.

I have done some tedious and difficult things in my modeling career, but soldering the 0.025" half-round beading around the windows is right up there in the top five! What a total PITA!!! It took me most of the day yesterday to do the five windows. If I'd known going in what was involved, I'd have been sorely tempted to leave it off.



(09 Apr 2007)

That does it for the previous updates. Last weekend I took the Mogul/American over to Mark Scrivener's house and ran her for the first time. As I expected, having come from Dave Hottmann, she ran like a jewel. When I got her home, I completely stripped her down to the frame and running gear.

I made the main cab deck/running boards cut out at least in its basic outline, and I made a test boiler wrapper to get the piece length correct so there's no gap along the bottom once rolled. No photos of any of that yet, but I'll get some taken eventually. For the deck, I ordered a piece of 0.064" #353 Engraver's Brass. It machines like a dream compared to the 0.064" #260 stuff I used for the internal cab supports. I cut it out in one pass with no galling at all.

The boiler intersects the cab deck/running boards at a three-degree angle, so there is a conic section cutout in the deck where it meets the boiler. Before I can lay this out, I need to get the basic boiler wrapper made so I can determine the exact O.D.

That brings everything completely up to date. If you've gotten this far, thanks for your interest.



Comment Charles:

Dwight This project will do into the file of mastery of live steam excellence and uniqueness. Will be following the post, outstanding CNC work combined with craftsmanship putting it together. Congratulations thus far.

Comment Bruce Chandler:

Wow! That is one heck of a first project! Very impressive and very nice looking.

Comment Harvey Campbell:

Wonderful I was getting tired of the arguments about who had the best toys! Keep up keeping on.

Comment Eric L.:

Great start on a fantastically ugly prototype! I can't wait to see it finished.

Comment Tim Hytrek:

Looks great Dwight! the rivet detail sets it off.

"Originally posted by Eric L.

Great start on a fantastically ugly prototype!"

Yeah, that's a pretty common reaction to ol' #21. She grows on ya though (given enough time).



Thanks everyone. It's been intimidating at times, and frustrating at times, but always very rewarding and a great deal of fun. 😊

Here's the "Before" builder's photo at Mark's on Saturday... She don't look nuthin' like this now. Hehehe



Comment Paul H (HeliconSteamer):

Dwight, Nice modeling! Fantastically ugly and very charming at the same time. It is very refreshing indeed to see more new unique steam power appearing in a time that is growing to be more and more 'Out of the box and onto the track.' The more time I spend in live steam, the more appreciation I have for unique models that don't show up on every layout. Even a nicely detailed model stands out above its peers to me and is all the more appealing. Nice work and I hope to see this model as it progresses and your future products.

Comment Mike Reilley:

OK... the last part was a BIG tip. I didn't know you were going to cannibalize a perfectly good 4-4-0. BUT... that's way cool!!! Soooooo... do you have plans to slope the boiler and re-right the stack? And, I'm assuming that since the cab roof doesn't life up...this is to be an RC job. Looking forward to seeing it run at the Big Train Show... Great work Dwight!

Thanks Paul! 😊

Mikey - that just goes to show you how much attention you've been paying. 😊 The 4-4-0 was mentioned in the very first email I sent you, and it's shown behind the mock up. 😊

The boiler will indeed slope down towards the rear at three degrees (like the prototype), but the stack slopes with it (also like the prototype). It will indeed be R/C'ed, but the cab will hinge forward like a semi for access to the boiler fill plug (also the safety valve - Dave moved it thank God) and the lubricator. A cylindrical gas tank will occupy the oil tank in the tender, and I hope to carry water in the rear tank, and add a WLDS with a water pump someplace - perhaps in the water bunker under an inner tank. Since the boiler is reversed and the burner is in the front, and since the front is higher than the rear, the flue right at the burner will be exposed first if the water gets low, and there's no sight glass (I may have one added). There is, however, a clack valve already in place, so adding a water pump should be relatively easy.

I hope to have her relatively complete by the time of the BTS, but it will be close.

Comment Kovacjr:

WOW! That's going to be a really detailed Loco when finished...Great work on the CNC, amazing you mentioned you never used it before. Would have never guessed. Keep up the work and posting..

Comment Gary Woolard:

I'm stunned... I mean most folks with a new tool, even one as sophisticated as yours, would say "I'll think I'll start by building an outhouse"... or sumthin' like that. I know I would!

But the sheer audacity of your project is clearly bearing fruit as a really incredible #21! I have no doubt that your new CAD tools have made it easier, but 'it' is your ability to express a level of talent that I'll bet even you didn't know you had. 😊

Congratulations Dwight. Be very proud. 😊

Comment Gary Armitstead:

I'm very impressed Dwight. Looks like you have taken to NC machine work "like a duck to water"! Very cool. As a former NC programmer-machinist, I am astonished that you would attempt a project this complex. More talent you have been hiding.

Comment Bob Sorensen:

Dwight: Very nice work. That engine will look great and so unique. Really first rate.

Was looking around the internet for ways to clean brass for painting. One widely published version is to wash in hot soapy water, rinse completely, then dip in a solution of vinegar and salt. Boiling vinegar and salt is better (if you can stand the smell). Rinse again, let dry then prime with an etching primer.

I tried this technique and it appears to work. The parts I painted so far seem more durable. I found etching primer (spray) at AutoZone.

A CNC machine looks the way to go. I am giving up on fret saws and files.

Originally posted by xo18thfa (Bob Sorenson)

"A CNC machine looks the way to go. I am giving up on fret saws and files."

I have a strict code of conduct... "Never use muscles when there's a motor that will do the same job!" 😊 Thanks for the cleaning tips. I have soaked the cab in hot (150°) Sparex, and will do so again before painting. I have also used hot vinegar on a test strip, but minus the salt. I'll try it. 😊

I want to thank everyone for their kind comments and positive feedback. Knowing how to use AutoCAD (I used it daily at work for over twenty years) and having access to it has really simplified things considerably. I can take my X-Y coordinates directly off the drawing to any number of significant decimal places I care to use. 😊 I just wish I could find a Drawing-to-G-code translation program that worked right. That would make it even easier.

(11 Apr 2007) Update:

I took delivery of my Sherline CNC lathe yesterday, so I now have a pretty complete machine shop. The lathe will be used to make the rounded tops on the tender vertical tanks, among other things.

Got the basic boiler wrapper made last night. The locations for the handrail stanchions, stack, bell, and pipe from the steam cylinder were center drilled while it was still flat, and then I rolled it to size.

Slow progress (having to work every day sucks). I'm hoping to have the basic boiler jacket and deck finished by Sunday night. It will then be ready to mount to the frame. Lots to do inside the cab at that point - servo brackets, locating and mounting the lubricator and the Johnson Bar and making new linkage for it, locating the receiver and batteries, re-plumbing the steam line, etc.

Comment Gary Armitstead:

As you probably know, the drawing to G-code translator program you want is called a post processor. All of the major manufacturing software such as Gibbs, MasterCam, and Surfcam etc. have these built into or added to the main program. You run the tool paths and then "post" the tool paths. There's your code specific for the CNC machine you are running. You might check with the mill manufacturer and see what they can provide.

Thanks Gary. Sherline did indeed include a 3rd party program, but like the several other "freeware" programs I've tried, it doesn't do a very good job. Maybe I'm doing something wrong. Don't get me wrong, I love the Sherline tool itself, and everything they manufactured/provided works perfectly.

For now, I can make the things I want to make. 😊

Comment Paul H. (HeliconSteamer):

I certainly wish I had access to AutoCAD at the moment for modeling projects, but I figure I can wait about 5 months until I get access again. 😎 At present, I am still very much 'old school'. I basically don't use power tools in my modeling because I am a bit scotch and because I feel great accomplishment in doing everything by hand. But then again, I have not yet done any major metal working on my own, and that may change things some...

Comment insanerocketkid:

Nothing wrong with that. I sometimes draft freehand (or with a ruler and protractor) when I am not near my personal computer, and I have a genius idea at hand.... Gotta do what you gotta do!

Comment Gary Armitstead:

Dwight Ask the manufacturer what the "language" of the controller is. The machines I used, Haas, was a Fanuc-based controller. Some controllers on other make are Mazatrol, Yasnac and it goes on and on. There will be different post processors for different controllers. You may have to talk to someone familiar with this controller to get you the correct post. Depending on the make of controller, they all send G-code slightly different for different machines. It would probably not be available as "freeware". When I worked in industry with MasterCam, we were usually given posts (free of charge) for our machines. Mastercam is a \$15K software for the mill module ONLY. It's extra for lathes, routers and wire-EDM. And each has a different post processor. You might be having problems with the code because the post processor is not correct for the controller. It might give code that looks correct, but has glitches. There is a whole industry out there writing post processors! Hope you can get some help.

Comment Steve S.:

Hello Dwight. I always joke that I am a runner, not a builder. The real reason is because I am so jealous over guys like you that figure out how to use these tools and build such cool stuff. 😊 I have been keeping up with your project and am amazed at what you are doing.

(15 Apr 2007) I got the boiler wrapper done this weekend and was able to layout and cut the conic section cutout in the deck/running boards where the boiler slopes through it. Here are a couple of shots of progress thus far (the parts are sitting on a wooden block in the rear and the steam line to the cylinders in the front). 😊 It's actually sitting too high in the photos, but I'll fix that.

The Roundhouse handrail stanchions are perfect - just the height I was looking for (thanks Paul - HeliconSteamer).



I can see that the steam line sits too high and I'm going to have to bend it sideways somehow. Any ideas on how to do this without heating it or crimping it?

Comment modlmkr:

The question of CAD to g-code was raised a few replies back. I like <http://www.sheetcam.com/> its only \$150, includes posts for just about all the major machines, and is very well supported. It is only a 2D program, although it does good work on pockets of very complex shapes- like pocketing out around text to make raised letters. It now runs on windows, but the author has indicated he is working on a Linux version. I'm using it now on a run of Welsh Highland coaches I'm making to run behind a Garratt. It does include an EMC post

The Sherline uses a control called EMC, running on Linux. Few of the major CAM packages provide posts for it, but its very standard and usually a Fanuc post will be close enough.

The demo package included with Sherline is Vector. It is a very capable package, and has very good support, but it is VERY strange to use. If you can break through the way it works it does a lot, but it frustrated me until I gave up. It seems to have a very polar view on the net- you either love it or hate it.

Comment flatracker:

WOW Dwight!! She sure is going to be beautiful (already is), and a real RARE engine! 😎

That will sure be a unique engine to run on anyones RR and sure to bring a lot of interest at ANY event! 😊😎

*Your workmanship is excellent, and all that you have learned will serve you well in other building projects, and I'm sure we will see several in the future! At least I hope so!! 😊😎
GREAT WORK! Really a neat project. 😊😎*

Comment Stan Cedarleaf:

Wow, Dwight. What a trip to go through these posts!!!!!! While I couldn't begin to try anything like this, I can sure appreciate what you're doing. My whole family has been in machine tool but I didn't make the grade. 😊😎😎 Great job. I'll be following it from now on.

Comment Paul H. (HeliconSteamer):

Dwight, Glad the stanchions were what you wanted. I am eager to see your final product to see if I could do something of that nature with a different prototype using my existing CAD and modeling skills. The future lies ahead...

Thanks for pointing me to those stanchions Paul. My only problem is that I bought too few of them. Hehehe I bought 10 and I need 12 (I forgot the four for the handrails behind the cab).

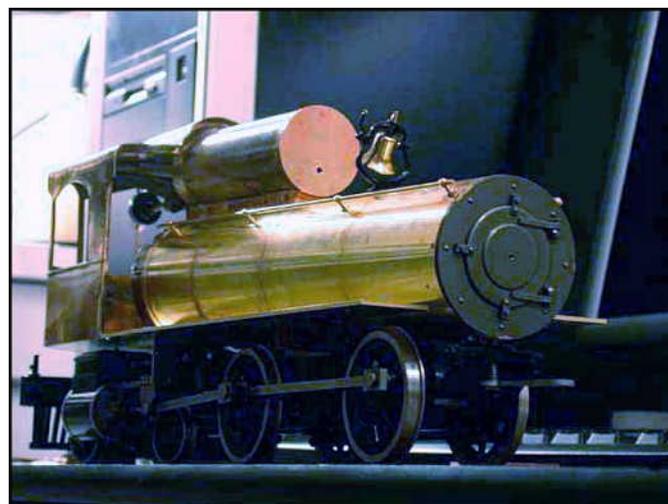
Comment Paul H. (HeliconSteamer):

Ah, well, these things happen. And fortunately, it is a problem easily solved. Just think, Dwight, now you will have 8 stanchions for your next loco project (locomotive, not crazy).

I made some good progress this weekend! I decided to remake the boiler wrapper as I just wasn't happy with the first one (more on that in a minute). The good news is that the second one came out far better than the first and I'm happy with it. 😊 The bad news is that it cost me at least one full day and the BTS is fast approaching. 😞

I also made and mounted the steam collection cylinder atop the boiler, got the steam line from the valve chest bent to where I think it needs to go, got the height fixed, and am (I think) ready to start putting the pieces together with the running gear.

Overall shots...

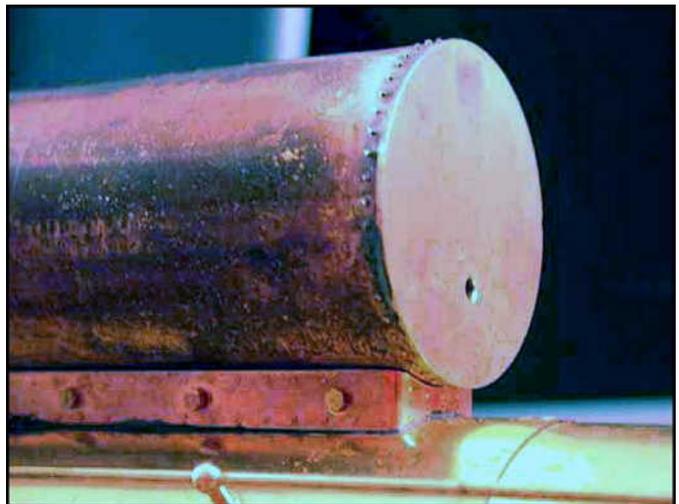


Try as I might, I cannot see any rivets nor boiler bands on the prototype photos. Since the rivets and seams in the cab show up very well, I must conclude that there weren't any. There are, however, faint seams visible running around the boiler jacket. To simulate this, I wrapped the boiler wrapper with four 0.005" brass sheets running around it.



This was the problem with the first wrapper. I tried holding the sheet in place while I soldered it along the underside, and I ended up with slight gaps where one 5-mill "band" was slightly bigger around than the one next to it. It was a small gap to be sure, but it still bugged me enough to start over. This time I taped the bands around after lining them up well, then drilled through both the bands and the wrapper along the underside in three places per band on each side (six per band). I tapped these holes #1-72 and secured them with #1-72 x 0.125" hex head brass screws. Only after all the bands were in place and I was satisfied with the fit did I come back and solder them to the wrapper.

Here are a couple of close-ups of the steam collection cylinder...



and here's the support which fits it to the boiler before folding it up and attaching it...



There's a second set of vertical pieces inside which are silver soldered to the steam cylinder which fit inside the support, which is silver soldered to the boiler. The outer and center hex head screws attach the cylinder to the boiler in three places on each side. The other two screws are dummies tapped into the support, silver soldered, and cut off flush with the inside surface.

The hole in the back of the cylinder is for a pipe, which comes out, goes through an elbow and a globe valve, and goes into the boiler.

Here's the inside of the cab with the cab removed... I was lucky that I could bend the steam line around and swivel the fitting without it cracking off. 😊

Dave Hottmann - I used no heat either! 😊



Comment Duncan:

Nice stuff, Dwight!! I presume that you'll test fire this thing before you get it around real humans??? 😊

Comment Bob Starr:

Looks good Dwight! I knew you would conquer those problems.

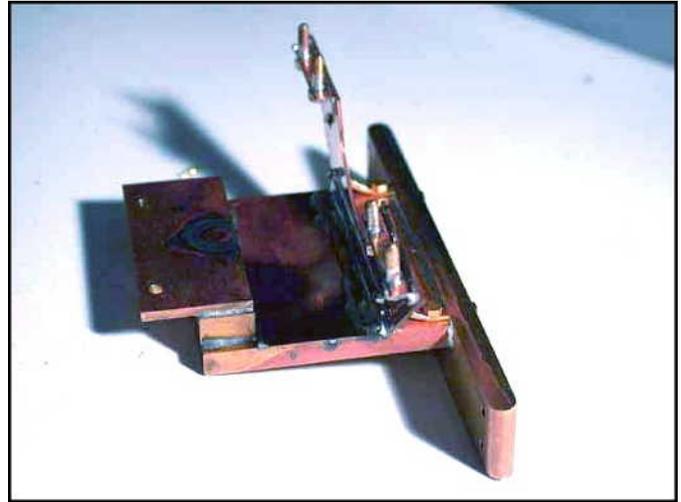
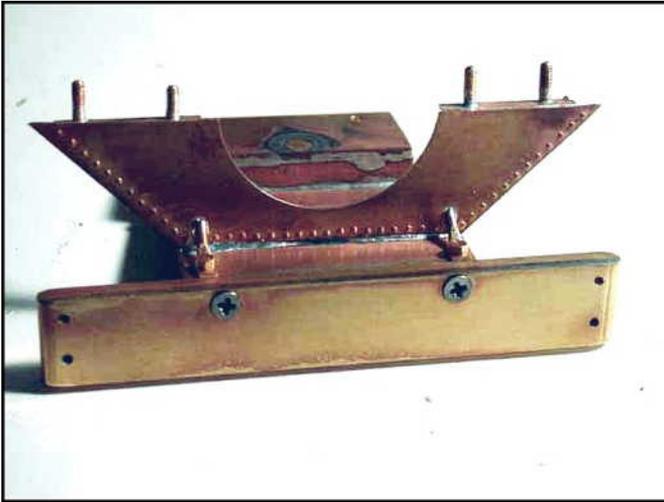
Comment Winn Erdman (placitassteam):

Dwight, That is quite the project for the first on new equipment. Very interesting and cool loco. Looking forward to the finished product.

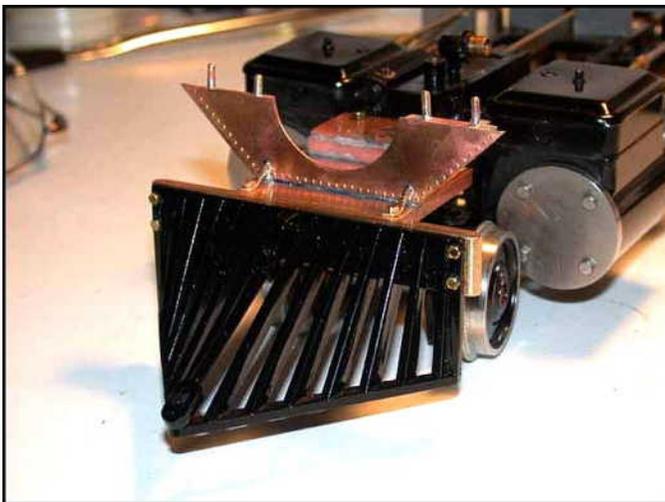
(07 May 2007) It's been a few weeks since my last update. That's because I spent a fair amount of time trying to figure out how to replace and drop the pilot. The Mogul pilot was not only too wide, but it also set too high by quite a bit. Since there's a trapezoidal plate with a semi-circular cutout under the cab, this would never do as that plate would be way too short to look right.

I started by slicing off the front of the locomotive frame just forward of the cylinders using a Dremel cutoff wheel. Then I had to engineer a new pilot deck that would support the cowcatcher at the right height. I also had to get a new cowcatcher. Dave Goodson was good enough to send me a couple of Bachmann 4-4-0 cowcatchers (a big **thanks** to Dave)!!! This pilot isn't exactly right either, but it's a helluva lot better than the Mogul pilot, and it will do until I have time to make a correct one out of brass. Though plastic, it should be okay because there isn't really any heat out front (at least I hope so).

Anyway, here's the new pilot deck...

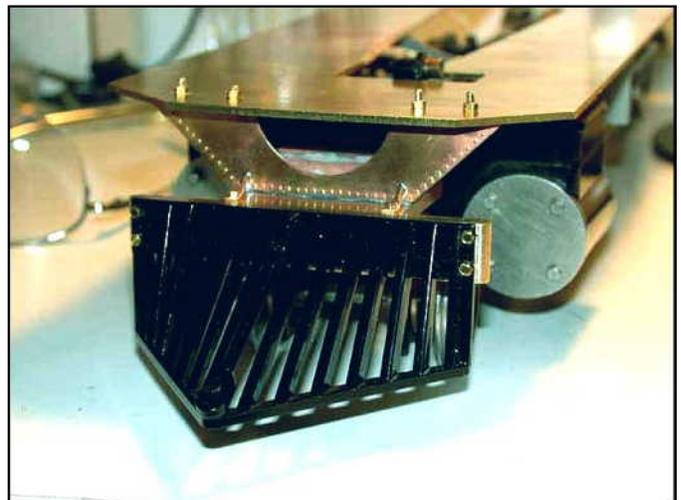


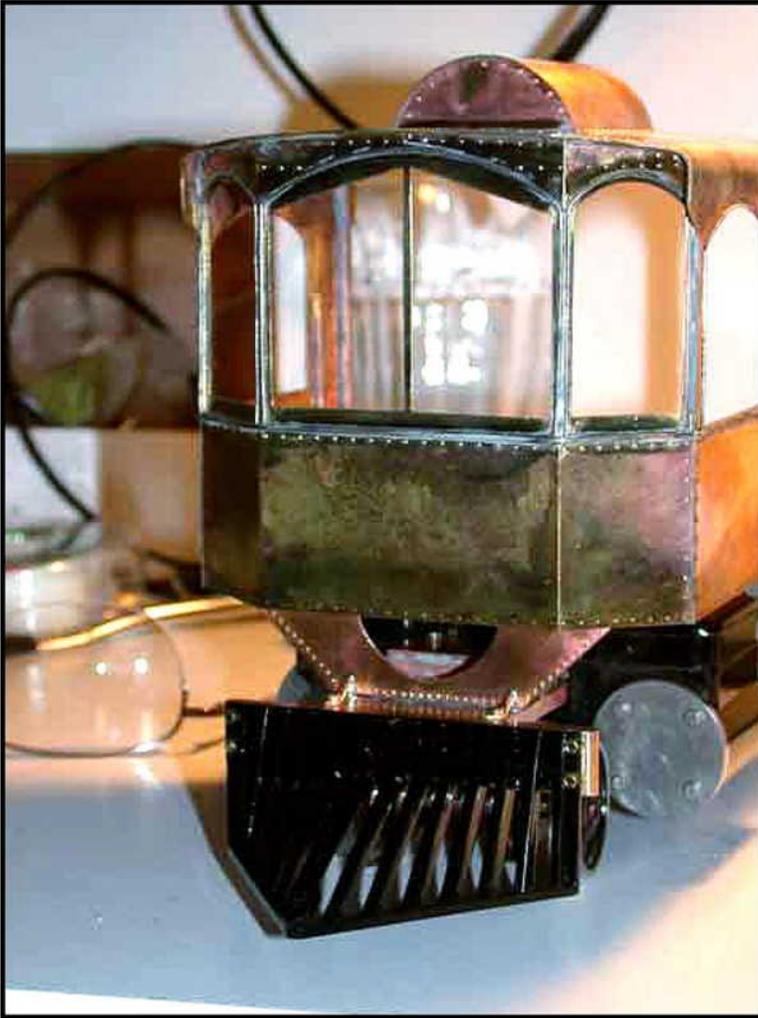
The Mogul had two hex head screws just forward of the cylinders to mount something-or-other. I used these to mount the new pilot deck. A step drops the cowcatcher to the correct height and makes room for the aforementioned plate.



The four screws atop the plate secure the front of the cab deck/running boards.

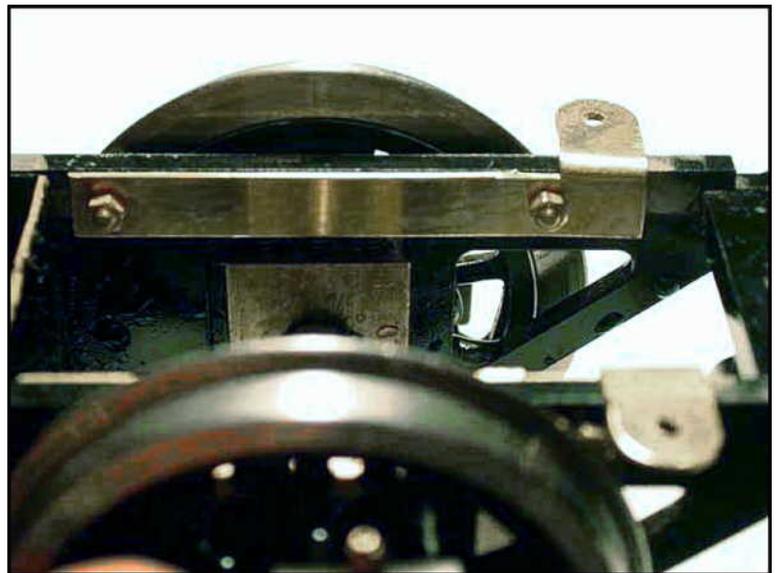
With the deck in place...

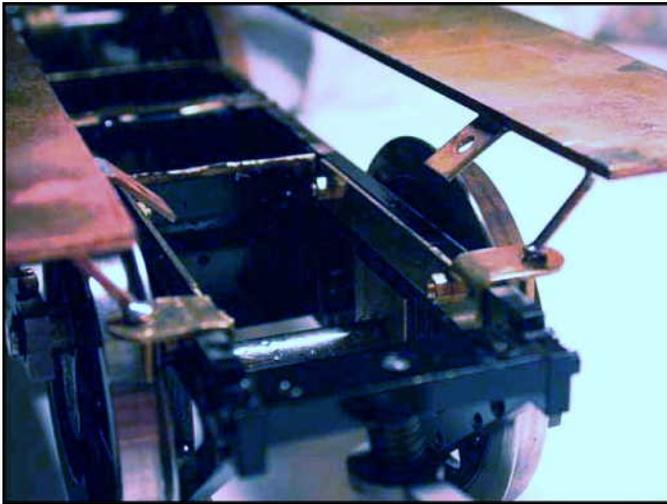




... and the cab in place...

There were four screws (two per side) on the rear of the frame just behind the rear driver. Again, I'd removed what was there, so I used these holes to mount a couple of brackets I made to support the rear of the running boards.





Two 0.062" rods were bent and threaded #1-72 to become deck braces.

These are threaded into blind holes in the bottom of the running boards and then a jam nut snugged against the running board. The whole thing is then silver soldered. The bottom will get #1-72 nuts.

I'm actually at a point now of assembling major components instead of making them. 😊 I started figuring out the Johnson bar linkage just before I quit for the night. I have to take the deck off again to mill a slot for the J-bar once I get it located, and to drill mounting holes for the lubricator once I get IT located, but it's finally starting to come together! 😊

Comment Alan in Adirondacks:

Dwight, More beautiful work. It really is coming together!

Comment Bob Starr:

Looks great Dwight!!!!

Comment Bob Sorenson:

Dwight: What kind of solder are you using?? Looks good.

Comment Mike Reilley:

I'm enjoying watching your efforts....and the photography is really good. This is a keeper thread for sure.

Thanks Gents. 😊

Bob - I'm using StayBrite silver bearing solder and a small oxy-acetylene torch shown here...

<http://www.littletorch.com/caddy.html>

Bottom of the page Item # 23-1004A

Comment Tim Hytrek:

Excellent work Dwight! It must feel good to see it come together like that.

Thanks Tim. Yeah, it definitely does! This is taking longer than I had hoped. 😞 Not to mention the frustration of trying to locate fittings. Now I'm trying to find one that will fit the gas tank I bought. Not much luck.

Luckily, Henner has offered to make one for me Saturday (and show me how in the process). I just need to pick up the taps. 😊

Comment Dave Goodson (Curmudgeon):

Not bad for a guy with a lot of hair.

I do think once it's painted, the pilot will be right. Unless you have someone show up with a prototype photo in their pocket!

I may have to look into some of those tools. Would have been far easier milling out this Version 3 Mantua frame to accept a Version 2 lower cover than the razor saw, carbide bit, and numerous files...

(14 May 2007) First Firing of Boiler - see...

http://www.mylargescale.com/forum/topic.asp?TOPIC_ID=46496

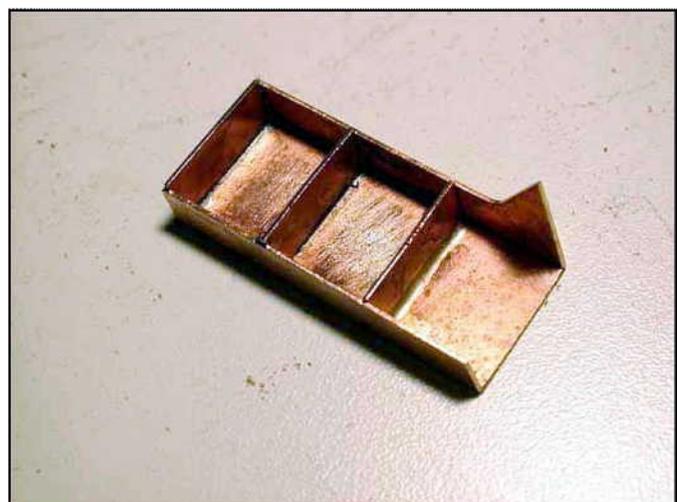
I made the steps tonight that hang down behind the cab. The flat stock with the step guides and fold lines milled in with a Dremel engraving bit...

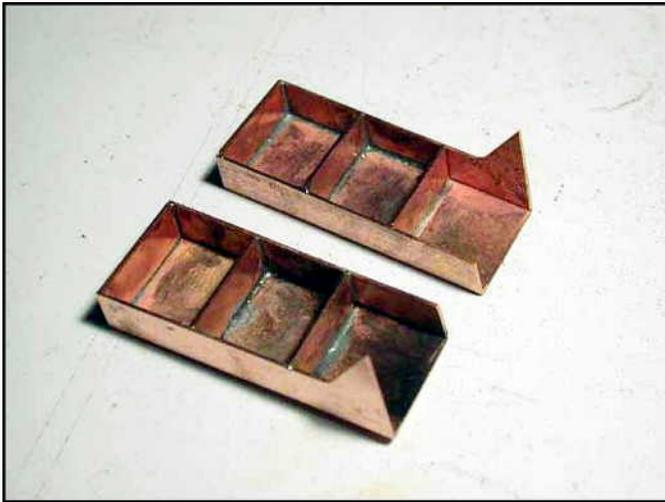


... and folded up...

The steps themselves were cut from 0.032 x 0.250 brass bar and silver soldered in place. The milled step guides helped ensure proper placement and the correct angle.

The completed fireman's side step...





... and both (mirror image) steps ready to be attached to the running boards...

I also made the two sides to finish enclosing the pilot deck. I'll post photos when I have them in place. 😊

BTW, I should mention that I went over to Henner's on Saturday morning and he popped out a cone and nut to fit my gas tank in jig time!! The guy is a magician on the lathe! Thanks Henner!! 😄

Comment Slipped Eccentric:

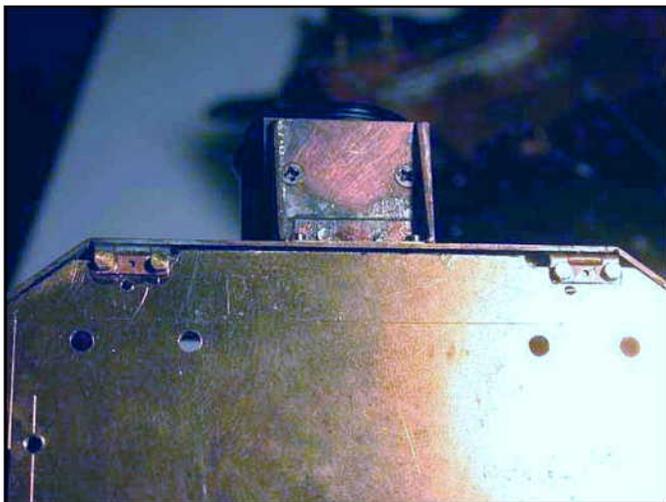
Looks great Dwight! It would almost be a shame to see you paint it rather than leave all that beautiful brass...

Comment insanerocketkid:

BRASS! BRASS! BRASS! Leave it naked! :)

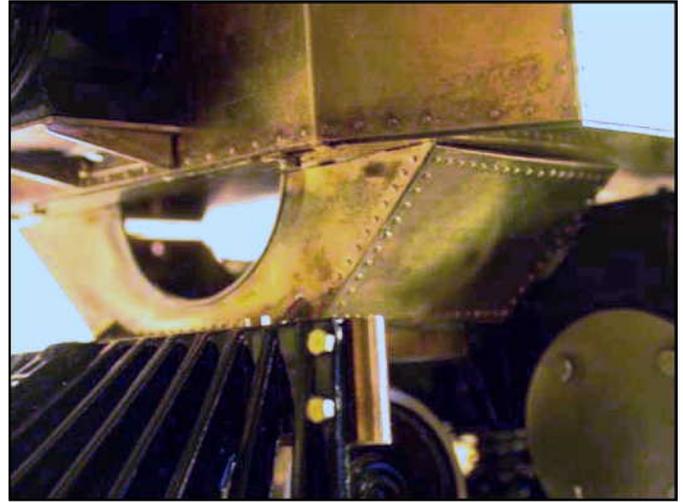
(21 May 2007) I got a fair amount done this weekend.

The cab hinges were installed...

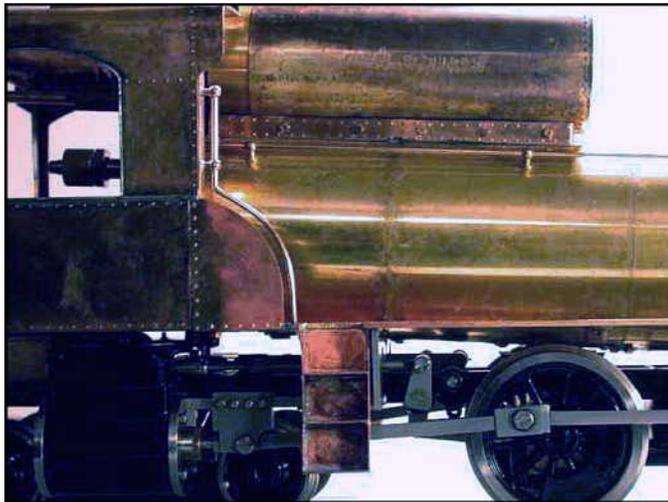


... and the cab hinged in place...

The firebox side panels (?) mentioned in the last update were installed, along with the half-round beading around the front half-circle cutout... (There are gaps because the deck is just sitting on the firebox and nothing's tightened down).



Unfortunately, when I silver soldered these into place, the angles and screws along the top edge of the front piece which mount the front of the deck heated up and fell off. 🙄 The first time I installed them, I match-drilled things. This time the cab deck was already drilled, so I had to make a jig to locate the screws and hold everything together while I soldered it all back in place again. That cost me the better part of a full day.

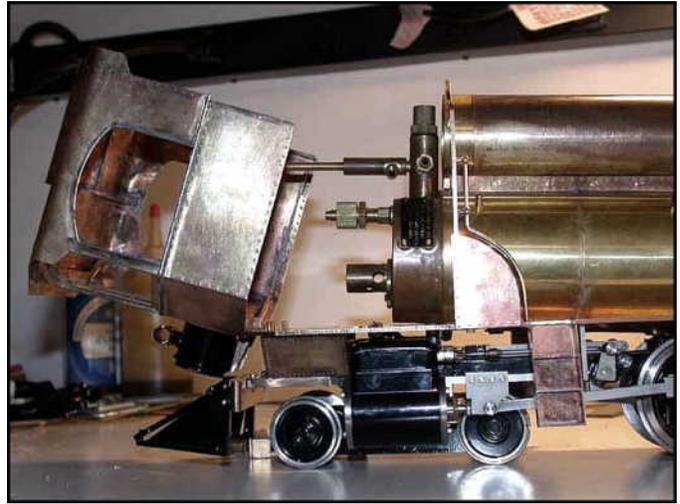


Anyway, the rear cab bulkhead was completed and mounted, along with the steps, the rear quarter-round panels, and the rear cab handrails... I still need to install the beading on the quarter-round panels.

Lastly, the headlight bracket was made and the headlight mounted, as can be seen in these overall shots.



Here's a shot with the cab swung forward. Next, the gas and water lines, the exhaust line and smokestack, and the servo mounting brackets and R/C setup.



Comment Dave Hottmann:

Whopping Gobs of COOLNESS!!!!!!!!!!

Comment Henner Meinhold:

Dwight, incredible progress!! Regarding your problem with soldering, I had good success with heat stop gels like 76685A65 Heat Barrier Putty 1 Pint Jar from McMaster. If you like, we can share a jar.

Thanks Henner - you'll have to tell me more about it next time I see you.

Dave - I couldn't have done it without you! Nor Bob Starr or David Fletcher either! All three of you have been enormously helpful!

Comment Towne Comee:

I sum up in one word - WOW!

Comment Mike Reilley:

I don't usually post attaboys... but THIS is an exception. While, perhaps the ugliest engine ever designed, this is a BEAUTIFUL model. Looking forward to seeing it in person.... Great stuff Dwight.

Thanks guys. 🤔

Comment Chris Walas:

Yeah, well, I GUESS it's okay... It looks FANTASTIC! Wonderful craftsmanship is always such an inspiring sight. Dwight, my friend, the coolest thing about this project is that you will wind up with the model YOU want! What a great reward. The sad part, of course, is that it's also the model I want! Can't wait to see it in person, pal!

(28 May 2007) This is the last weekend to work on this beast before I leave for the BTS on Thursday. I've gotten quite a bit done... but never as much as I'd hoped.

Okay, since last weekend... First up was getting the stack installed. I had a previously drilled 5/32" hole in the boiler wrapper locating the center of the smokestack (made when it was still a flat sheet). First order of business was drilling thru this hole and thru the bottom of the wrapper to locate the exhaust pipe. More on that later.

Once that was done, it was time to finish off the stack. Chris Scott had a spare three-cylinder Shay stack he was willing to part with (mucho thanks Chris). It was the right diameter, but a little too tall, and it has threads at the top where the spark arrester screwed on. Soooo, I chucked it up in my lathe by the mounting threads to machine off those arrester threads. Being as I am a complete newbie at this, I (a) didn't support the other end with a live center, and (b) got impatient and tried to take off too much material at one time.

The result was that I broke the mounting threads clean off!

There's always time to do it right the second time, as they say. I ended up drilling out the stack and mounting threads to accept 1/4" brass tubing and spliced it together with silver braze.



The repaired stack... I also turned off some of its length to get the correct height, turned off the band below the arrester threads, and added a nice half-round lip to the top.

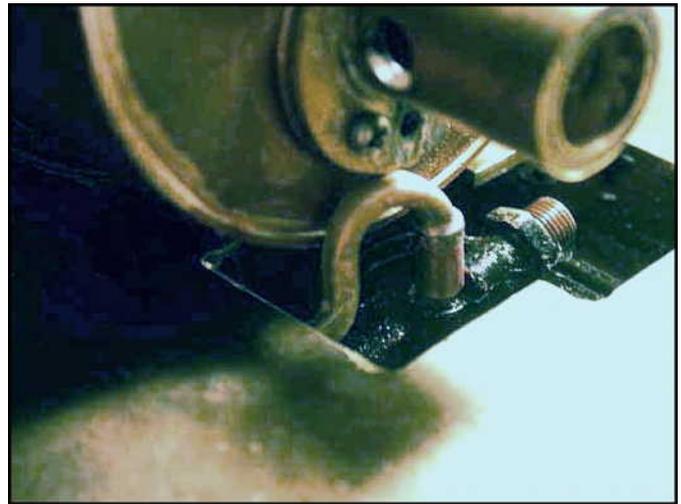
I drilled out the boiler wrapper to accept the stack threads using a Unibit (thanks to Henner and Eric for this tip). Copying the Mogul design, I lined the smokebox with 1/8 ceramic mat, and made a 0.010" brass insert to "spring" against the insulation and hold it in place. As with the Mogul, these are held in place by the stack. #21 *finally* has a smokestack! 😊



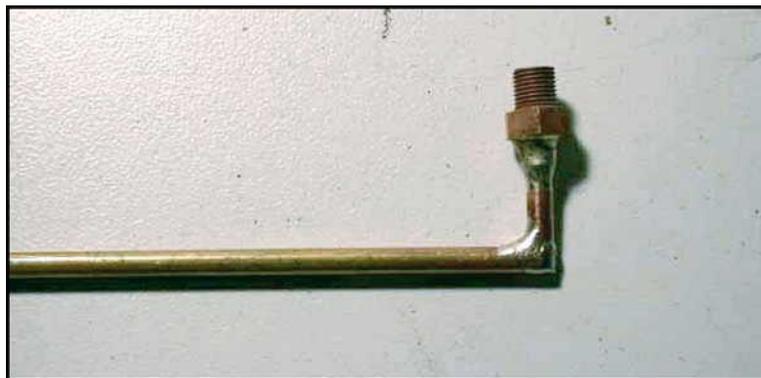


Next was finishing off rerouting the exhaust to the rear. With the stack in place, I could bend and install the exhaust pipe. I made this from 1/8" copper tube, and held it in place with a couple of straps made from 0.010" brass.

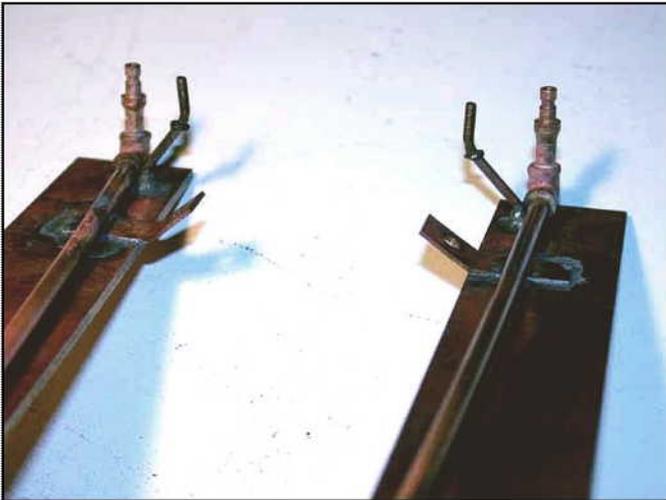
The "gooseneck" previously tested was bent to the final shape and joins the exhaust from the valve chest to the exhaust pipe running back to the stack.



I cut some 2mm brass tubing at 45° and joined them to make the gas line to the burner. I drilled out and reused the Accucraft bushing from the super-heater.

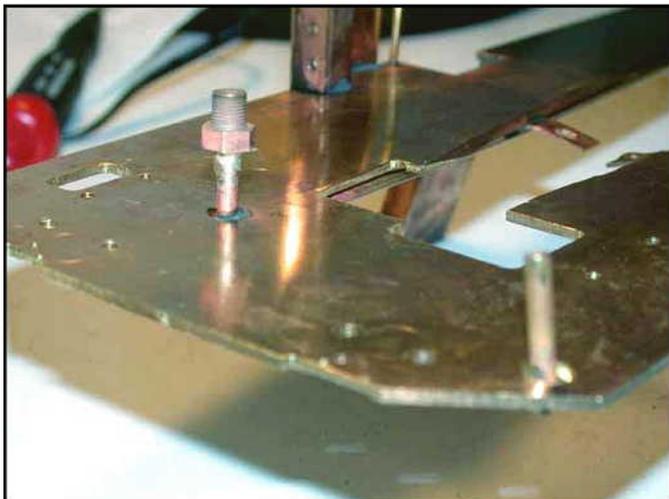
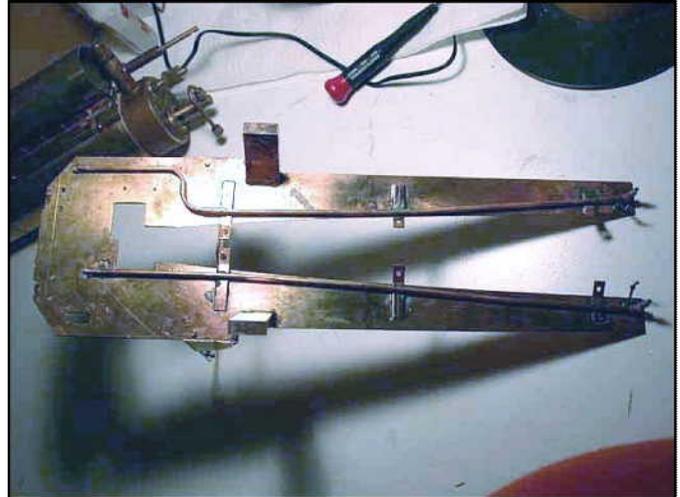


I bought a couple of the pipe fitting trees pointed out by James (jrobnett) in Thanks James. I cut out a couple of the elbows and drilled them for 2mm brass pipe. [This thread](#).



I also bought a couple of Quick-Connects from John Synnestvedt, as the prototype has elbows here. The gas and water lines have elbows and plugs, which will accept (via the Quick-Connect Couplings) hoses from the tender. All these lines are silver brazed. It's amazing how long it takes to bend, shape, and solder these.

Here's the underside of the deck with the water (top) and gas (bottom) lines silver soldered in place.



I had to carve out notches in the Stainless crosshead support to accept these btw, along with the exhaust line. Here's the top of the deck with the water and gas lines... The water line will connect to the clack valve in the backhead with some neoprene hose.

Another update tomorrow after I get her back together.

Comment insanerocketkid:

Lookin' purty good! I especially like the cast elbows you used. Looks very great!

I can't wait to see the end result. It will definitely be worth the wait, for us followers and the builder! Don't worry about trying to impress us with your skills by rushing, worry about getting it done right! It sure is interesting seeing people try to rush and finish projects ahead of time, but sometimes, you just gotta take your time, I've learned. This is probably a reason that crews that are restoring steam locomotives have to backtrack quite a bit -- because they are trying to hurry and get the loco under steam with minimal effort!

Originally posted by insanerocketkid

"Lookin' purty good! I especially like the cast elbows you used. Looks very great! I can't wait to see the end result. It will definitely be worth the wait, for us followers and the builder! "

Thanks Mike.

Originally posted by insanerocketkid

"Don't worry about trying to impress us with your skills by rushing..."

You think that's what I'm doing? Wrong. You probably didn't mean this the way it sounds (I hope), but it strikes me as a rather unkind thing to say, doncha think?

Originally posted by insanerocketkid

It sure is interesting seeing people try to rush and finish projects ahead of time, but sometimes, you just gotta take your time, I've learned.

In most things, patience has never been one of my virtues. Modeling is often, though not always, an exception. Frankly, after going on this since mid-February, I'm starting to get tired of working on it. When I started, I was hoping to be done by now, and I still have at least another month to go. I admit that I have self-imposed deadlines, the first of which I will miss now, and those deadlines have driven me to work on it when I haven't really felt like it. Usually that means I have to force myself to get started. Once I *have* started, I get into it and it's still enjoyable. If that constitutes "rushing to finish it" then so be it, but it has nothing to do with trying to impress anyone but myself. I'm now 56 years old and gave that "impress people" stuff up long ago once I discovered I didn't need to.

This Builder's Log has been my attempt to share my current project as others do, my successes and my mistakes, and to show that if I can do it, anyone can do it given a desire. Justin [made a beautiful spoked pilot](#) with nothing more than a drill, a hacksaw, and a file. **That's** skill (not to mention far more patience than I possess).

Comment insanerocketkid:

I guess that didn't come out the way I wanted. I posted that message about 15 minutes after waking up.... I guess I should establish a rule as to not post until I've showered ;) In any case, you're doing a fantastic job!

Thanks Mike. I figured you didn't mean it the way it sounded. Hehehe

Originally posted by insanerocketkid

"It sure is interesting seeing people try to rush and finish projects ahead of time"

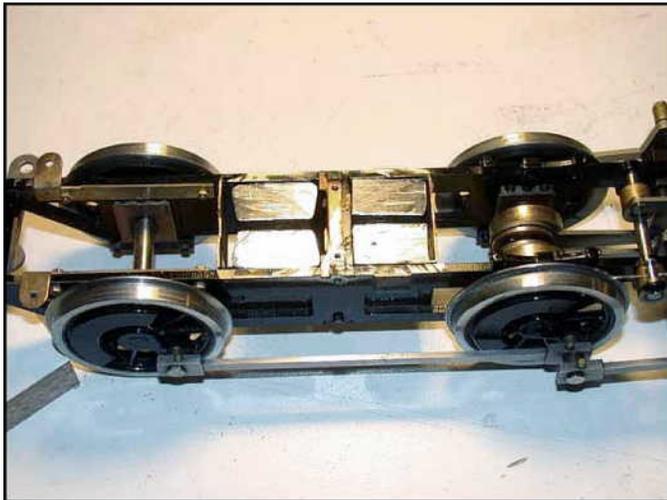
Like posts for instance? 🍅🍅🍅😊

Comment Alan in Adirondacks:

Dwight; As a fan of west coast narrow gauge, I think the work you are doing is fantastic. You have much more ambition than I, and the results really show. Keep up the good work!

(30 May 2007) I've been working furiously on this thing trying to get her running before I leave for the BTS tomorrow morning. I worked on her all day today from about 8AM to 9PM. Finally at 9PM, she was back together and ready for a test.

The locomotive is front-heavy, so to add weight, I got some solder bar from work. This stuff is about 1" x 1/2" in cross section, is 60% lead, and is made to fill solder pots. I cut four piece around 1" long...



... and JB Welded them inside the frame between the drivers.

Here's the inside of the cab. There's not nearly as much room in it as I originally thought there would be.



The Rx and batteries will ultimately mount back in the tender, with servo extension wires connecting to the cab.



Finally it was time to connect the gas, put in water and steam oil, and test her for leaks. No leaks!! 😊😊

She ran, but not well. There are several problems I still have to solve...

1. The weights aren't enough. The rear driver is still off the rails. I need to figure out how to add more weight to the rear. Weights in the smokebox perhaps? There will be a lot of live steamers at the BTS this weekend and I'll pick their brains. Suggestions here are welcome as well.
2. The throttle servo crapped out almost immediately. It may be getting too hot. Also, I'm not satisfied with its movement. I need to make some adjustments here, but that will have to wait until I get back.

The tender is just a temporary frame to carry the gas tank. I still need to make the tender. However, the temporary unit demonstrates that the loco/tender gas hose connection works.

Anyway, here are a couple of overall shots of where she stands now...



Comment Rod Blakeman:

Dwight, The engine is a wonderful piece of work that you can be very proud of.

Regarding your weight distribution problem, you say the rear drivers are lifting off the rails ? That would indicate that the pilot truck is not supporting the weight. So an appropriate thickness spacer could be installed on top of the truck bolster or, if it is sprung loaded, a more robust spring fitted. The trick with springing is to get it just right so that all the wheels are carrying the weight 😊 and you do not end up with the front drivers lifted off the rails. Just a couple of ideas based on what you have described above, I hope it helps. 😞

Comment Charles:

Dwight Weight in smokebox will work. Get a thick cast iron pipe cut to length (of course drill holes /slots for pipes and exhaust) might need cleats to align properly as to not block any flues/air flow. We have utilize this in Aster K4 and NYC Hudson.

Comment Alan in Adirondacks:

I can't wait to see it! After Charles' and Rod's suggestions, if you still aren't satisfied there may even be a way to get a little down force from the drawbar. Possibly then letting the front tender truck float vertically, but using a spring on the bolster of the front tender truck to keep it in contact with the rails. Just a thought... It certainly is an impressive project!

Thanks for the suggestions guys.

Rod - The pilot truck already has a spiral spring around its mounting screw, which is more or less centered in the truck. The thought occurred to me try stretching it, but I wanted to check with people who know more than I do about how it will affect tracking.

Charles - cast pipe is a good idea. We have a cutoff saw at work for angle iron, channel, etc. that would work - if I can find the right pipe. Hehehe

I also thought of a sheet of lead (1/4" to start with) cut to size and wrapped inside the insulation spring. I doubt that it gets to be 621°F in there. 😊

Alan - I'd rather not rely upon pressure from the drawbar if I can get around the problem another way. I don't want the tender lifting off the rails and derailing. Looking forward to meeting you. 😊

Comment insanerocketkid:

Dwight, Can you take photos of your throttle sprocket assembly? More specifically, the sprocket that goes onto the throttle stem? I have tried to install a sprocket on my Mogul in the past, by drilling a hole in the sprocket (on the non-sprocketed part), and putting a 2-56 setscrew in, to clamp onto a notch that I filed onto the throttle needle stem... but it turned out that there was so much force that the plastic deformed, and the 2-56 setscrew just "Rode over" the notch, and was able to spin around freely. Perhaps JB-WELD would work??

Also, your throttle servo may have burned out if the radio was not set up properly. I've been struggling with my radio to get it set up properly so that it will close the throttle, and keep it closed (I tend to close my valves so that it is snug... but that might not be good for a radio Application?).

Mike - I use a 1/4" bore sprocket on the throttle shaft. I turn a bushing from either aluminum or brass (I've used both) to fit inside the sprocket with a hole sized to fit the throttle shaft. I JB Weld the bushing inside the sprocket, then drill through both and tap for a 4-40 set screw. No time to take a photo now (the camera's already packed), but if you still need one when I get back, let me know.

This will be my last post for a while. I'm heading out to southern CA. If I have Net access in the room, I'll be back on later tonight. 😊

Comment insanerocketkid:

Sounds simple enough. I wanted to do the same thing... Don't know why I didn't, actually.. Stupid, Stupid me! Maybe I'll do something in the machine shop here this summer ;)

Comment Rod Blakeman:

Dwight, Sorry this may be too late for you now, but rather than stretching the pilot truck spring, try adding a washer or two under the spring, this will increase the load without damaging the spring. Then it is easy to return to the original spring pressure if it still fails.

That's a great idea Rod, thanks! Wish I'd brought some washers with me. Hehehe

I'm here in my hotel room, which has broadband for \$9.95/day. Even with that, it's still a lot cheaper than what I paid per day at the Queen.

I left the house a little after 10:30 this morning and got here around 4:30 this afternoon, so I made good time. Stan, JJ, John, Tommy, and Mark were hanging around out front, and Paul Burch, Gary and Carla, and a few others came and went. After I checked in and got settled, Stan, JJ, John, Tommy and I went out for an Italian dinner, then came back and BSed for a while in the lobby.

Since I have broadband, I can upload photos of the steam event, which I will do starting tomorrow night in a new topic. 😊

Like I said Mike, she runs, but at the moment not real well. I think once I get the weight thing figured out, she'll run great! 😊 It occurred to me last night after I signed off that Bob Starr will be here today with his track, and he always carries around a coffee can full of nuts, bolts, and washers to put his track together. Maybe I can "borrow" a couple of washers. 😊

Edit: 06/01 8 AM... Good ol' JJ had some 1/4" washers - two of them under the pilot spring seems to have done the trick and all four drivers are now on the deck. 😊 Now I just have to see how that affects tracking.

(04 Jul 2007) It's been over a month since my last update. First there was the BTS, and then I took a weekend off. The BAGRS Roaring Camp Steam-up was in there too. What with one thing and another, I haven't had as much time to work on #21.

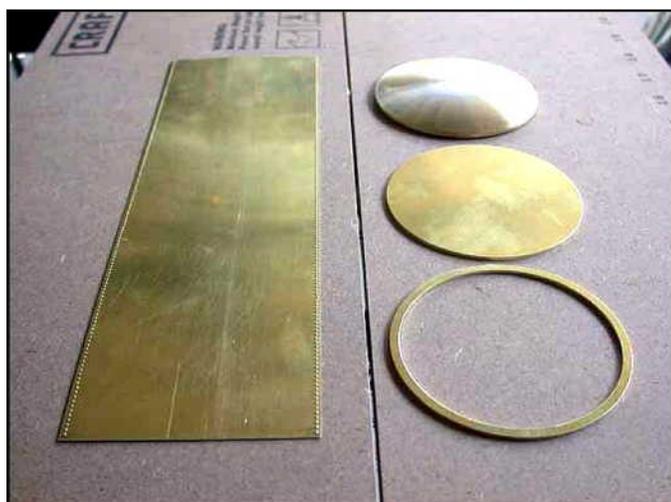
I have partially finished the tender tanks. These actually took quite a bit of time to complete.

The tank top blanks had to be center drilled and cut out of 3/8" x 4" 360 brass bar.



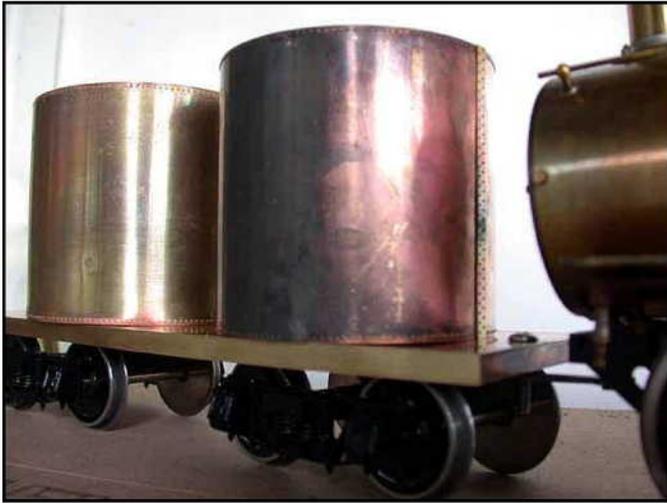
A blind hole was drilled in the center and bottom tapped 3/8-16. A piece of threaded rod was inserted and I had a way to chuck the blanks up in the lathe.

The arc profile was turned on my Sherline CNC lathe. This was done in multiple passes taking off about 0.010" per pass. All in all, I had to remove 1/4" of material, so each top required 25 passes to achieve the correct profile, plus an additional pass removing 1-1/2 mils to get a nice finish.



These are the basic parts for the smaller forward tank. On the left is the tank wall/wrapper with about 300 rivets. 🤪 At right (top to bottom) is the tank top, bottom, and the top ring that supports the removable tank top.

Some of the tank wall rivets spaced at 0.075". Again, I set this up in the CNC mill and used a Dremel engraving tool to locate and center-drill each rivet location. The rivets themselves were manually embossed using a Northwest Shortline Riveter.



Here are the tanks mounted to the tender frame...

The vertical joint strips with the zig-zag rivet pattern were made from 0.016" x 0.188" brass strip purchased at the hobby shop. Rivets were laid out in the mill and manually embossed as before.



And here's a shot of #21 sporting her new tender tanks. 🚂

YEAH!!! Now she doesn't look so funny with nothing but a flat car behind her! Hehehe 🤩

I still need to mount the butane tank in the forward tender tank and plumb it. Gotta get that done before the NSS. 😊 Still much to do. 😊

The plan is for the forward tank to house the actual butane tank plus the R/C receiver. The rear tank will hold the R/C battery pack and the BF Industries electric water pump, plus an inner tank to hold water. There are also a couple of smaller tanks on the engineer's side to hold whatever I need to pack in there, and a fairly large tool box on the fireman's side where I plan to put the R/C on/off switch and charging jack for the battery pack.

Comment Jerry Barnes:

Nice job on a unique locomotive. I've come to appreciate its look, as you've gone along.

Comment insanerocketkid:

Woof! I still state that you should polish up the brass, copper and any other metals, and then give them a glossy clear coat. This will preserve the natural luster of the metals, and protect them from oxidation! Yea for nak... unpainted trains! ;)

Thanks Jerry. Like I said before, she grows on ya... sorta like a wart. 🤩

IRK - now that wouldn't be very prototypical would it? 😊

Comment Stan Cedarleaf:

FABULOUS..... *Wow, it's a work of art, Dwight.*

Thanks Stan! 🤩

Comment Alan in Adirondacks:

Dwight, What a great job! The level of detail you are pursuing is incredible, and the live steam aspect is what really floats my boat...

Keep it up, and despite comments to the contrary, I think paint is in order. (and a Rod Hayward inspired weathering would be my vote)

Comment insanerocketkid:

I don't like Alan anymore.

All kidding aside, you're doing a wonderful job! You're lucky you're able to focus on one project at a time... ;)

Comment Howard Maculsay:

Originally posted by Dwight Ennis

"The tender is just a temporary frame to carry the gas tank. I still need to make the tender. However, the temporary unit demonstrates that the loco/tender gas hose connection works."

When you were running at BTS, you had a gas connection hose that split.

My first question... did you use quick disconnects?

Where did you acquire them?

And secondly, what kind of flexible hosing do you use to stand up under the Gas pressure?

Your 2-tank tender is really looking good.

Thanks again gents. I'm still considering weathering. The first photo in this thread is generally considered to be #21 on her trial run, and she does look fresh from the paint shop in it. Other photos show the paint seeming to have gotten a little flatter, but none show heavy weathering, so any I do will be light.

Howard - I did use John Synnestvedt's Quick Connects, and I bought them directly from him. Unfortunately, a hard drive crash a few weeks back wiped out all my emails and bookmarks, so I don't have his address handy. I'm pretty sure I still have it on my work computer, but it will be Monday before I can get to it.

If someone else doesn't chime in with it before then, I'll post it on Monday.

As for hose, I picked up some black hose at a local hobby shop, and this is the stuff that split. I subsequently used silicone fuel line (for R/C planes and cars) without further trouble, but it isn't black. The stuff I'm using now is from a length of neoprene hose that Eric Maschwitz (Eric M here on MLS) gave me. Not sure where he got it.

Comment Noel (MLS- livesteam5629):

Dwight; First great job!! I love it. The first true cab forward and 3ft gauge at that!! Second... where are the photos from the above post?? Third; go to your local lawn mower repair shop and get a few feet of gas fuel line (black) and it just a tad larger than the silly cone we use. It is rated for (?? psi) pressure applications. Try it, you will like it.

Originally posted by livesteam5629

"First great job!! I love it. The first true cab forward and 3ft gauge at that!!"

Thanks Noel. 😊

Originally posted by livesteam5629

"Second... where are the photos from the above post??"

Not sure I understand this one. If you refer to prototype photos, I posted one in the first post of this thread. Not very many exist I'm afraid... two during construction, two of the actual boiler before construction, and five of the finished loco. These along with drawings from various sources were collected by Tom Farin and posted [on his web site](#) a few years back when Bob Baxter and Chris Walas were building their electric models.

Originally posted by livesteam5629

"Third; go to your local lawn mower repair shop and get a few feet of gas fuel line (black) and it just a tad larger than the silly cone we use. It is rated for (?? psi) pressure applications. Try it, you will like it."

Thanks. Sounds like the stuff I got from Eric. I'll check it out! 🙏

Comment Howard Maculsay:

Originally posted by Dwight Ennis

"The tank top blanks had to be center drilled and cut out of 3/8" x 4" 360 brass bar."

Dwight...what is the final diameter of each of your tank lids?

Originally posted by Dwight Ennis

The rear tank will hold the R/C battery pack and the BF Industries electric water pump.

So, you must already have the BF Industries electric water pump in hand or at least you know the dimensions. If you do have the dimensions, what are they, please?

Where do you plan to put the other WLDS electronics? And what are the dimensions?

I've been trying to find out some dimensions from Bill Ford, but my emails must be going into his Spam trash bin.

Howard:

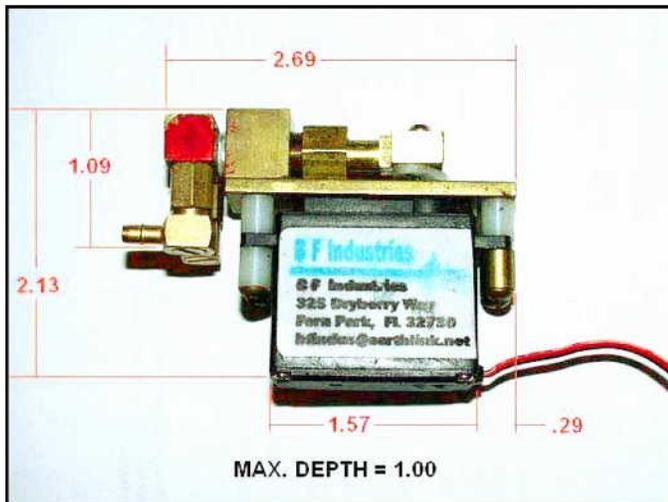
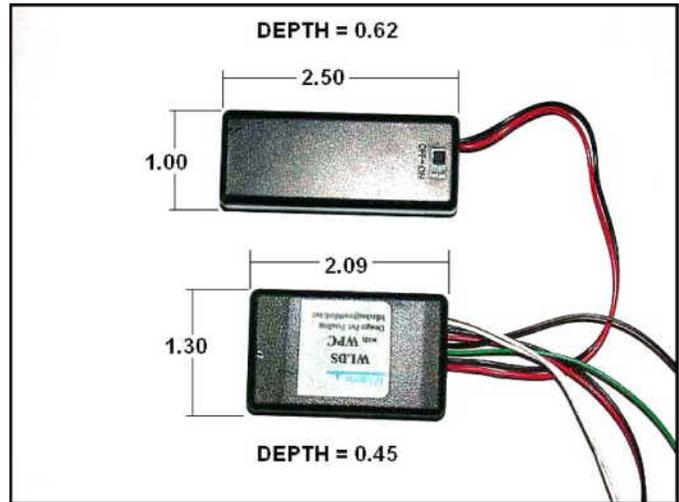
The smaller lid is 3.200", which is about 0.005" smaller than the small tank I.D.

The larger lid is 3.368", also about 0.005" smaller than the large tank I.D.

Both tanks are 3.125" tall outside. Inside usable height is around 2.88".

Here are the WLDS/pump dimensions...

WLDS (bottom) and battery holder/switch (top)...



Electric pump...

(Sorry for the red dimensions... I did this one first and it was too much trouble to change it later. 😊)

>"Where do you plan to put the other WLDS electronics"

I haven't decided yet. 😊 There are several options.

Comment insanerocketkid:

Originally posted by Dwight Ennis:

"The smaller lid is 3.200", which is about 0.005" smaller than the small tank I.D.

The larger lid is 3.368", also about 0.005" smaller than the large tank I.D.

Both tanks are 3.125" tall outside. Inside usable height is around 2.88"."

Uh, so this means the lids fall into the tanks, what with the lids being smaller than the ID of the tanks?? In theory, this would not make a lid, but a disc that floats on water if it's not too dense.

The lids make a tight (but not too tight) inside-fit to the tanks - a necessary compromise if one wished to access the butane tank within the smaller tank, and the batteries, water pump, etc. inside the larger tank without having to take things apart. 😊 Each lid rests atop an inner ring so as not to "fall in."

Comment Charles:

Dwight; Any photos of the setup in the "cans?" One of the most unique live steam engines in our community with each step adding to the interest and desire to see it in person!!

Thanks Charles. No photos yet of the innards. I just got the actual butane tank mounted and plumbed the gas line a couple of days ago, and I have yet to mount anything in the rear tank. I'll post photos as things progress. 😊

You can see one of the afore-mentioned "rings" prior to assembly in my last update. 😊

I think I will try real hard to make DH in January. I've never been and would dearly love to go and meet you and other steamers from the east, Michigan, etc. If that happens, this is the loco I'll be bringing with me. 🚂

(15 Jul 2007) I've been trying to get as much done as possible before leaving for the NSS on Wednesday. Most of the stuff I've done has been on the tender, and most of that cosmetic. 😊



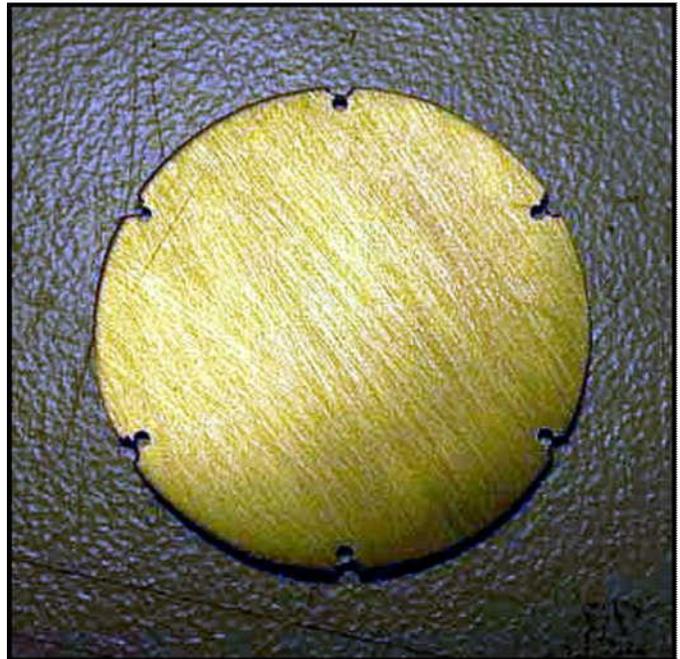
First the oil hatch. The prototype oil hatch was tangent to the curved surface upon which it was mounted while the water hatch was horizontal. To get the correct angle for milling out the tank top for the hatch, I bought the Sherline Tilting Angle Table.

An AutoCAD drawing told me the angle (12 degrees) and I set it up and milled a 3/4" hole to hold a piece of 3/4" brass seamless tube, making sure it was on one center line.



The hatch itself was milled out of a piece of 0.032" brass. A similar circular notch was milled in the bottom to ensure the hatch sat centered on the tubing.

The general consensus is that the oil tank on the prototype was pressurized with air. This was, after all, the first oil burner, and was therefore experimental. A gauge and what appears to be a pressure relief valve atop the tank could only have served this purpose. You'll note the six holes around the hatch perimeter notched through to the outside edge. These are for hatch dogs to hold it in place against the internal pressure. Here's the top of the hatch...



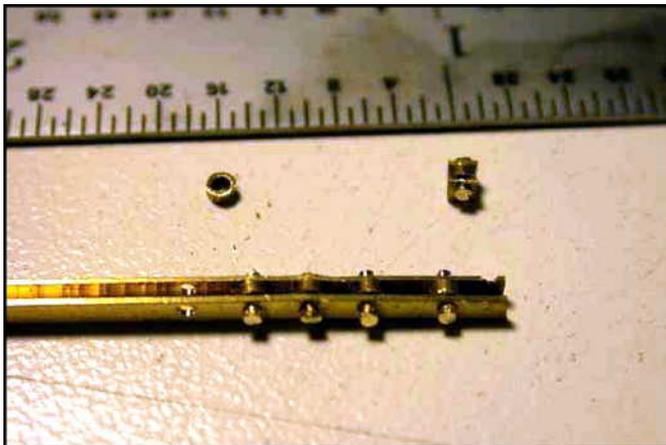
No good photos exist of this hatch. It's usually out of sight around the back of the tank. That being the case, I decided to wing it and use what I know about similar dogs used on vacuum and pressure tanks at work.

Some of our tanks have cast dogs - something like c-clamps with a pivot on one end and a screw on the other. This type pivots up and cradles the outside edge of the tank, with the screw on the top tightening against the top of the tank.

Other tanks have a simpler arrangement - a threaded rod mounted in a pivot. These swing up through a notch in the tank edge and a nut is tightened down to hold the lid in place. I figured the prototype was hand built in the Sausalito shops, and they probably would have opted for the simpler arrangement, so this is what I used.

For threaded rods, washers, and nuts, I got some brass Precision Scale O-Scale NBW castings. The pivots and their mounts I'd have to make.

I started with a piece of 3/32" x 3/32" brass channel, and drilled six 0.020" holes through the flanges. I then cut six pieces of 1/16" OD tubing 0.03" long (the distance between the channel flanges). Dropping a piece of tube between the flanges, I pushed some 0.020" brass rod through the holes in the tube and the holes in the flanges, capturing the tube. I then cut these into six dog pivots.



A complete dog is at upper right, a ring at upper left, and the channel assembly at bottom with four dogs ready to be cut off.

The NBW castings and dogs were JB Welded in place since I don't yet have a resistance-soldering tool. Here's hoping the epoxy holds - so far so good. I also opted to add two small grab irons for lifting the hatch off. Here's the completed hatch...

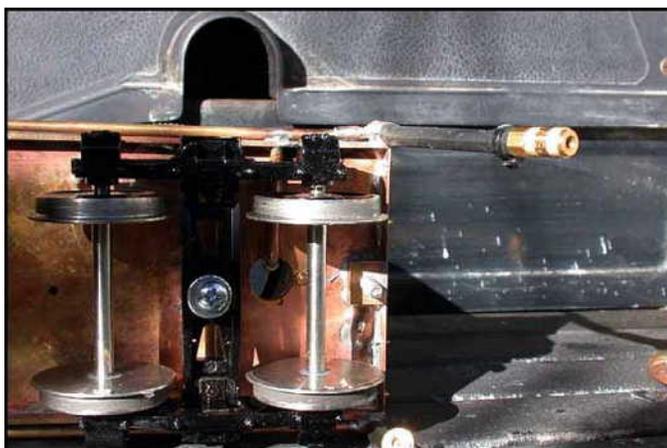
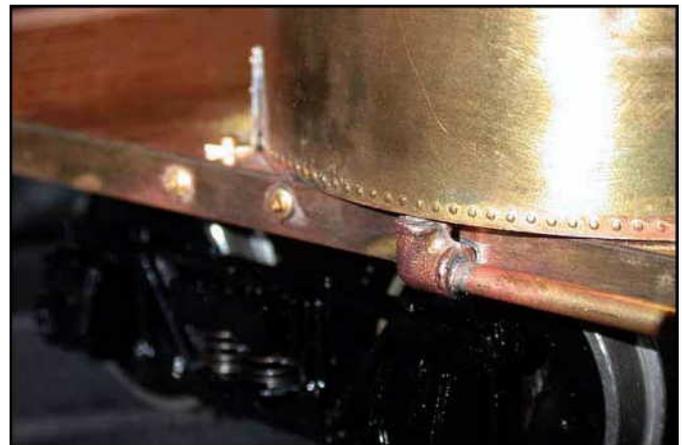


The pressure gauge I turned on the lathe. The elbows and tee are Trackside Details parts, and the pressure relief valve is from an Ozark brake detail set.



Here's the front of the tender with the gas and water lines to the locomotive. The gas line is on the engineer's side and the water line on the fireman's side. The tees here are PM Research. The globe valves are a couple of Accucraft parts I got from Cliff. The tank hold down L-brackets were formed from 0.025 sheet stock. The NBW castings on the sill are Trackside Details.

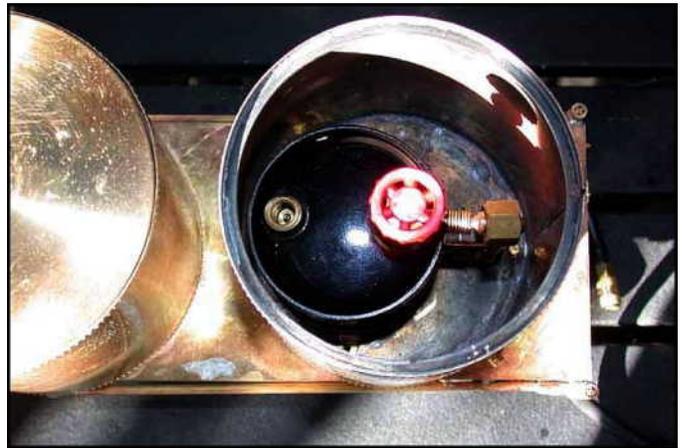
On the prototype, both lines are water lines and run back to the rear water tank, so that's how I made mine. Again, the elbows are PM Research.



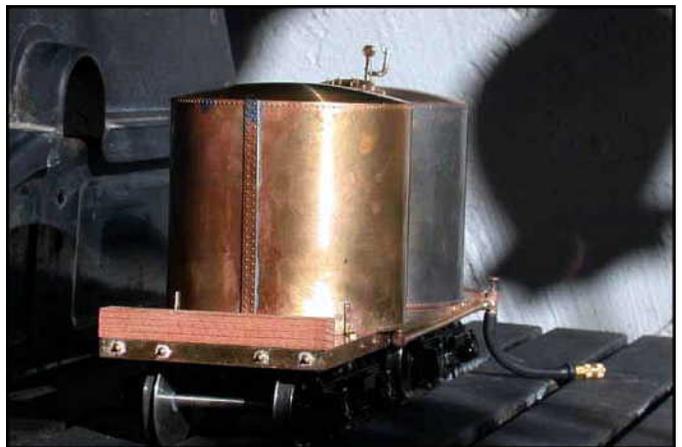
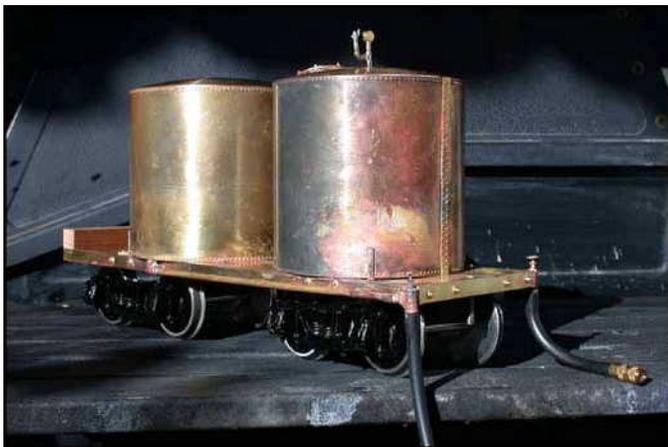
However, on my model, the engineer's side line is a gas line and has a split in the tube running to the forward tank and to the butane tank inside.

(The butane tank is just setting in there for the photo and nothing is tightened down.)

The remainder of the line running to the rear tank is purely cosmetic, and once inside is crimped off and silver brazed closed. The other side will connect to a hose running to the water pump.



Finally, here are some overall shots of progress to date.



Next comes the water hatch (which should be easier). 😊

Comment Jason Kovac:

WOW A work of art... Seems every time I see an update it just gets better and better. CNC really makes things easier huh.

I hope to see it in person someday. Now do you plan to cover all that nice work with black paint???

Comment Eric M.:

quote:

"Third; go to your local lawn mower repair shop and get a few feet of gas fuel line (black) and it just a tad larger than the silly cone we use. It is rated for (?? psi) pressure applications. Try it, you will like it.

Noel

Thanks. Sounds like the stuff I got from Eric. I'll check it out!"

Looking good as usual Dwight.

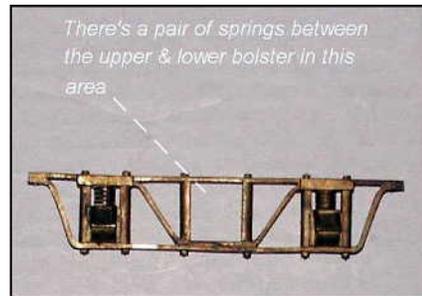
The tubing I gave you was from "Dollhouses Trains and More" in Novato CA. they sell it by the foot in the R.C. dept. I would check other competent R.C. car or airplane shops. It is "neoprene fuel line" for nitro cars, planes and helis. I bought it for air powering our Donkeys. It was cheap-- like \$0.80 a foot or something.

Comment Howard Maculsay:

Your workmanship continues to be an inspiration. Have a good time at NSS.

I've been meaning to ask about your tender's trucks. As you know I'm also building a water and fuel carrying tender for my [Class A Climax](#). I've been looking for a set of trucks with side frames that are a close match to the power bogies I'm using on the locomotive:

I can't clearly see yours in your pictures, but they look close. How's the match look to you? So, what trucks are you using? 🤖



Thanks gents. 😊

Jason - yep, I plan to paint her.

Eric - I found some real neoprene fuel line at Sheldon's - not the vinyl stuff I tried before. Looks like the same stuff I got from you and it's made by DuBro.

Howard - my trucks are the ones that came on the Mogul I started with. Here's a close-up... The wheelbase is 2-1/8" and the wheel diameter is 1.27"



Comment Charles:

Dwight I know we have discussed this prior, but this outstanding steam art that you have compiled through pre-made pieces and your own skills deserves a posting in the steamopedia. Thanks for the insight into the two cars. Hopefully soon some video of the engine in its full glory run a freight on the rails.

Thanks Charles. The photo of the butane tank inside the forward can was just for you. 🤖

I plan to get some videos of her at the NSS. As for pulling a freight... well... she still doesn't have a coupler. 🤖

The prototype pulled both passenger and freight it seems. I plan to build a couple of NPC specific passenger cars for her. "Narrow Gauge to the Redwoods" also has plans for a couple of NPC cabooses, which would look right at home behind her. So much to build, so little time. Hehehe

I'll PDF this builder's log after it's finally finished - still a ways in the future I'm afraid. 😊

Comment Semper Vaporo:

I bet you have a large supply of "Universal Couplers" in the "junk" drawer in your kitchen. If not, the next time you buy a loaf of bread or buns, snag a hold of the "Universal Coupler" that is used to hold the plastic bag closed. Granted the little wire in the plastic or paper tape tends to break after a few too many coupling/uncoupling actions, but another large supply can be obtained from that box of trash bags on the shelf. 😊

Comment Howard Maculsay:

*Originally posted by Dwight Ennis
"Here are the WLDS/pump dimensions"...snip*

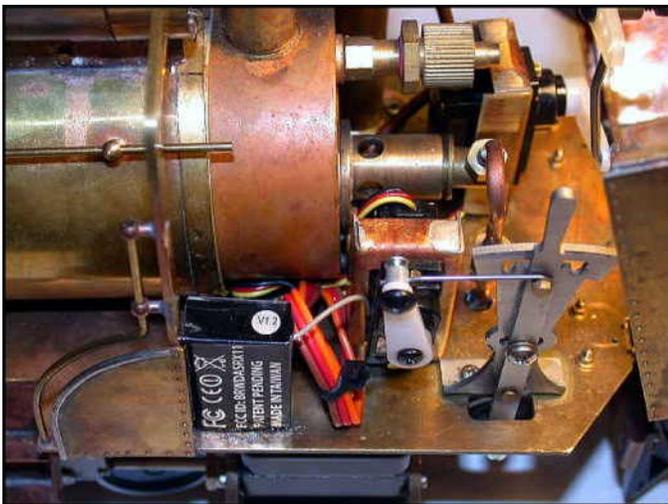
Dwight, I know you're at NSS, so don't bother with this now! But since I still can't get Bill Ford to answer email, I need one more dimension from you, if you please.

In reference to the WLDS boiler probe... I'm starting to acquire the materials to make my T-Boiler, so what size boiler bushing should I plan on using?

Howard - I'm pretty darn sure it's 10-32UNF. I can double-check when I get home. Isn't that info on his web site?

(09 Dec 2007) It's been quite a while since my last update. The truth is that I quite frankly burned out on working on this thing and took a few months off. 😊

I got the R/C installed and working and made the first test run today at Mark's. I finally broke down and bought a Spektrum DX7. I chose the DX7 over the DX6 primarily because of the receiver sizes. The DX7 has the later DSM2 technology and works with the AR6100 receiver (which is about the smallest Rx I've ever seen).



Here's the overall servo and Rx layout in the cab...



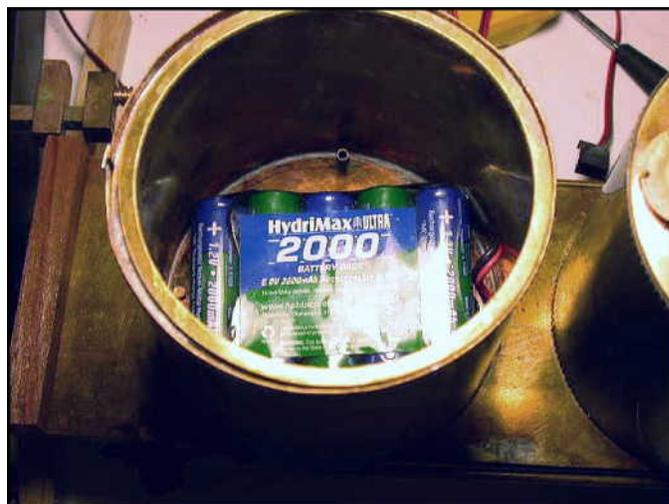
I elected to go with a normal pushrod for the throttle in this installation. Normally, I prefer to use sprockets and a chain, but in this case, the large sprocket is visible through the large front windows and looks too much like the steering wheel on a boat. 🚂

Both servos (throttle and reverser) along with the Rx are in the cab. A battery cable runs under the boiler the length of the locomotive.



This mates with a short cable running under the tender...

... to the 6 volt 2000mAh NIMH battery pack in the bottom of the rear tender tank.



The third, unused wire of this 3-wire cable will connect to the WLDS boiler water probe when I finally get it in.

I smoked (literally) the reversing servo during the test through not having its endpoints adjusted correctly, but that's already replaced and correctly adjusted now that I've figured out how with the new Tx. 🤪 No buzzing now at either end. 😊

Comment Vance Bass:

I sure would like to see this rascal run some day. Come to Diamondhead, won't you?

I am coming to DH this year Vance, but with all the TSA BS, I won't be bringing any locos. 🤪 Guess you'll have to come to Sacramento this coming July. 🤪 [Here's a video](#) from the last NSS. 😊

Comment Mark Scrivener:

Dwight, sure was great to see #21 under RC yesterday - sorry I had to run. Looking forward to seeing her at the big steam-up on the 15th. Get a coupler on there so we can see her pull!

Originally posted by Mark Scrivener:

"sure was great to see #21 under RC yesterday - sorry I had to run."

I burned out the servo about 5 minutes after you left. Hehehe Only did the one run.

Comment Henner Meinhold:

Originally posted by Dwight Ennis:

Originally posted by Mark Scrivener:

"sure was great to see #21 under RC yesterday - sorry I had to run."

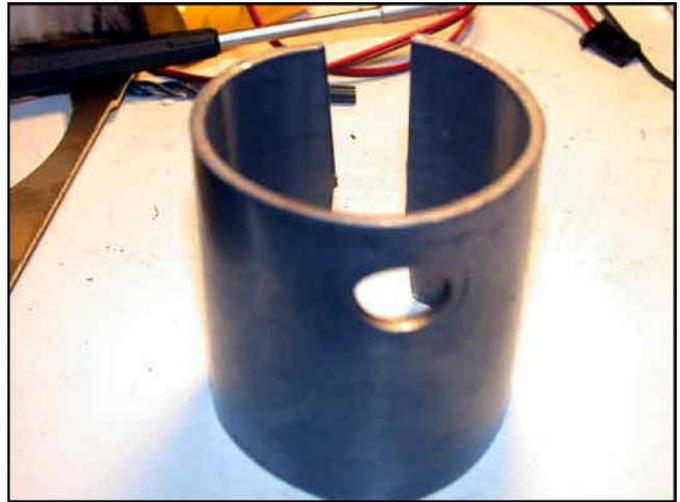
"I burned out the servo about 5 minutes after you left. Hehehe Only did the one run."

Dwight, still no DX6 with adjustable servo limits?

Henner - I bought a DX7 Henner, but hadn't figured out how to set the servo limits yet when I did the test run. All's fixed now. Turns out I had to set the reversing servo limits to 35% in forward and 47% in reverse, which surprised me. I can't remember ever having to set the limits so low with the 9CAP. At any rate, it's now properly adjusted. No servo buzzing.

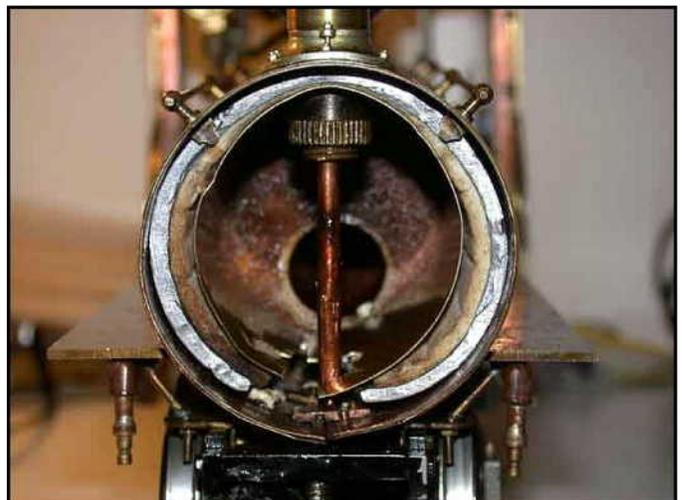
(22 Dec 2007) I got the sheet lead installed in the smokebox a week or so back. It makes all the difference in weight distribution, and the loco isn't front-heavy anymore.

I made the weight from 1/8" sheet lead rolled to fit inside the smokebox...



... and tucked it inside...

... then reinstalled the fiber mat insulation and brass spring that keeps it in place.



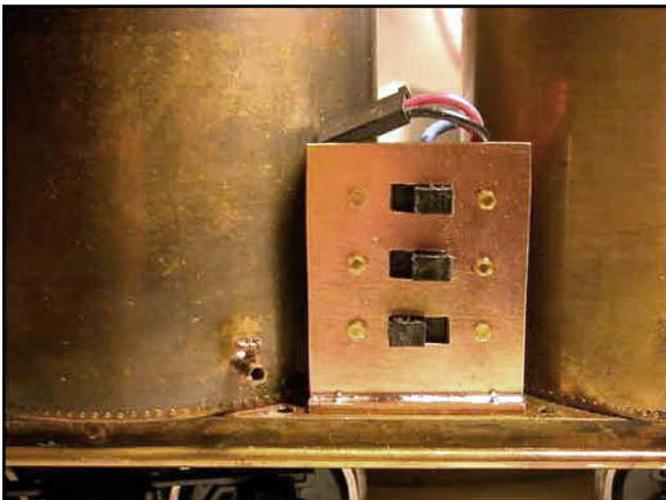
I may add more weight just aft of the rear driver inside the frame, but this cured all the balance issues. The prototype wasn't considered entirely successful, and is said to have had poor tractive effort compared to other conventional 4-4-0s in the stable. After making the model, I'm beginning to understand why. The prototype may have, to some extent, suffered from the same front-heavy problems as the model. Also, the boiler was a water-tube design, which seems to me to indicate less actual water in the boiler than would be the case with a conventional fire-tube boiler, and consequently less weight.

Which brings me to another thought... only one source I've seen mentions the slope of the boiler, and attributes this to "helping on grades." That never made sense to me, but when I thought of less water/weight in the boiler, it occurred to me that perhaps this is to insure that what water there is collected/stored in the rear to keep the weight where it's needed. Comments?

Here's the coupler pocket I mounted a couple of weeks back...

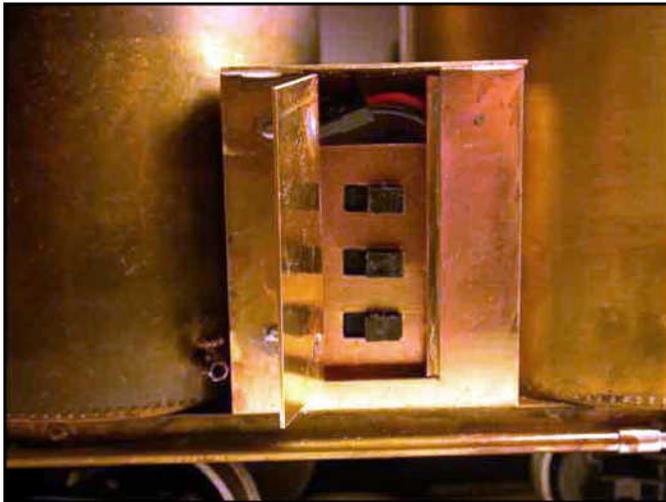


The prototype has a large toolbox on the tender between the vertical tanks on the fireman's side. I decided this would be a great place to hide the on/off switches. It turned out to be a much tighter squeeze than I'd anticipated. 🤔



Here's the switch plate... The top switch is Master On/Off for the R/C and everything else. When off, it also connects the battery to the charging jack, which tucks into the top. The middle switch will be for the headlight, and the bottom for the WLDS electronics/water pump. I had to saw off a little over half the switch knobs so they clear the toolbox.

Wiring turned out to be 10 pounds of stuff in a 9-pound sack. Not my prettiest wiring job, but it works. 😊



And here's the toolbox proper, which slides over the switch plate and bolts down.

And once again with door closed...



Here's the whole thing in overview... left front three quarter, door closed.

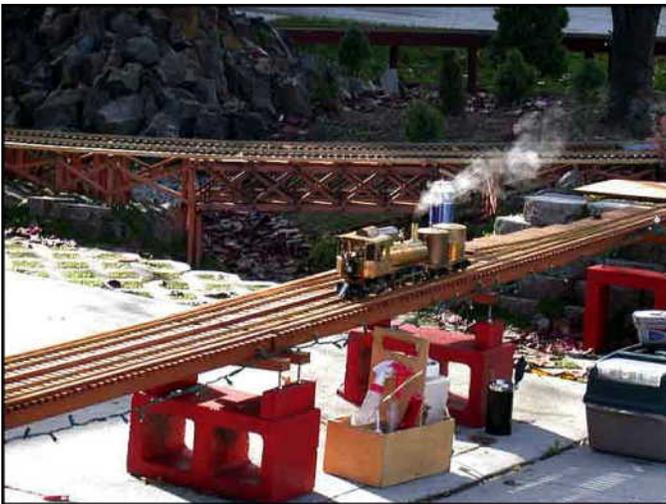


Left side-on view with door open.

And lastly, left-front three-quarter view with both locomotive and tender.



And a few photos from today's test run on Mark's layout.



Now I just need to figure out/install some sort of door latch. Merry Christmas everybody! 🤖

Comment flatracker:

Hey Dwight, That's one neat looking machine!! 🤖🤖🤖

I know you've worked your... ahem... backside off building it, but WOW what a unique loco! That's more or less one of a kind in the model world isn't it? I can't wait to see it all painted up and pulling a couple of cars. Super job! 🤖🤖

Comment SlateCreek:

In a standard boiler, generally you hear about sloping the boiler to keep the crown sheet covered. That's why the cog railroad engines are sloped in the extreme...

http://www.thecog.com/images/gallery/ascending_jacobs_ladder.jpg

In a water-tube boiler, there's no crown ... but there's even less water, and even more need to keep what's there in the hot part, and the tubes from being heated dry. That's why a lot of water-tube boilers were vertical, I think... to make sure the water ALWAYS was at the fire end of things, particularly in a "portable" boiler like an engine.

Generally, as I understand it, tractive effort and weight distribution was more a function of axle placement and spacing.

Comment Henner Meinhold:

Dwight, as we discussed at Mark's, I would recommend adding sprung couplers to the tender. Here are the parts:

Ozark Miniatures - Detail Parts

[Item #4017 - Link & pin coupler w/ sprung draft gear](#)

Comment coolhand:

😄 *Dwight Great work! Instead of weights in the rear, do you have room to put a heavier spring on the front truck?*

Comment Bob Sorenson:

Dwight: She's coming along nicely. Looks like the fabrication work is almost done. How close to finish?

Comment Jerry Barnes:

Dwight, it just keeps getting better all the time!

Matt - you make some good points. OTOH, how could sloping the boiler back three degrees "help the loco on grades" if not to redistribute some of the water's weight to the rear?

Gary - I already have heavy springs under the pilot. Before adding the weight in the smokebox, that was the only way to keep the rear drivers on the track, and they still lifted off with the slightest down-pressure on the cab.

Henner - I'm still mulling that one over. I'll more likely go with Hartford's coupler if I change it at all, as I already have one of those already.

Bob - I'm getting close. Still several things to make, but the to-do list keeps shrinking.

(31 Dec 2007)

The tender is essentially done!!!!



Cosmetically at least. 😊 still have to make the innards of the rear water tank.

I made the water hatch by bending annealed #22 gauge brass around a hardwood form.



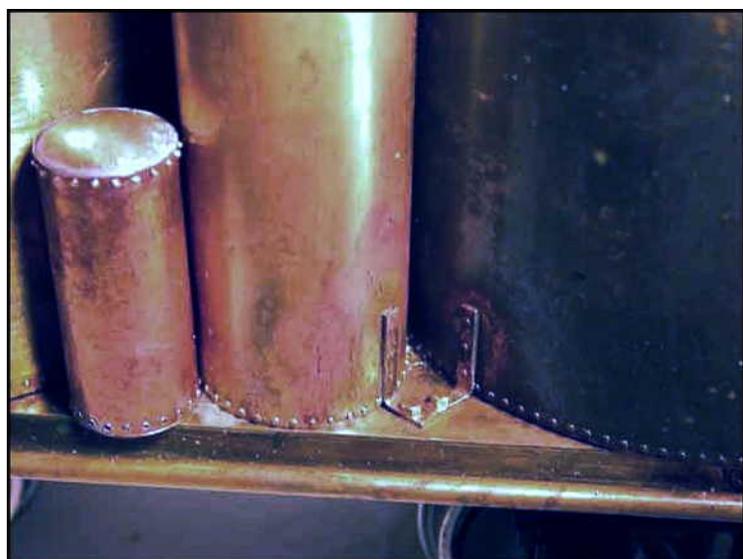


Took a couple of tries to get the flange lengths right. The domed top was milled out in a matching pattern, and the hatch sides silver soldered in place.

Next I made the hatch lid, which has working hinges. This will allow filling the real water tank inside that will feed the WLDS water pump.



Then I made the two air tanks that sit between the large tanks on the engineer's side.



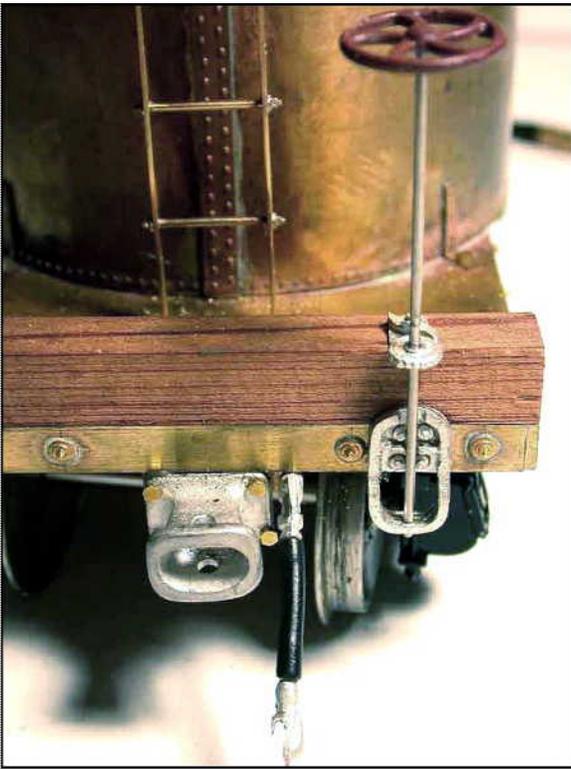
The plumbing, I believe fed air from the large air tank to pressurize the oil bunker.



I then made the ladder. I must confess, I'm particularly proud of how it turned out. The sides were cut on the CNC mill, and the ladder assembled in a makeshift jig - two machinist's squares clamped to a piece of 1/2" aluminum. After the ladder was assembled, the sides/rungs were drilled to accept the Precision Scale NBW castings, and the castings sweated into place. It took hours to make this. 😊



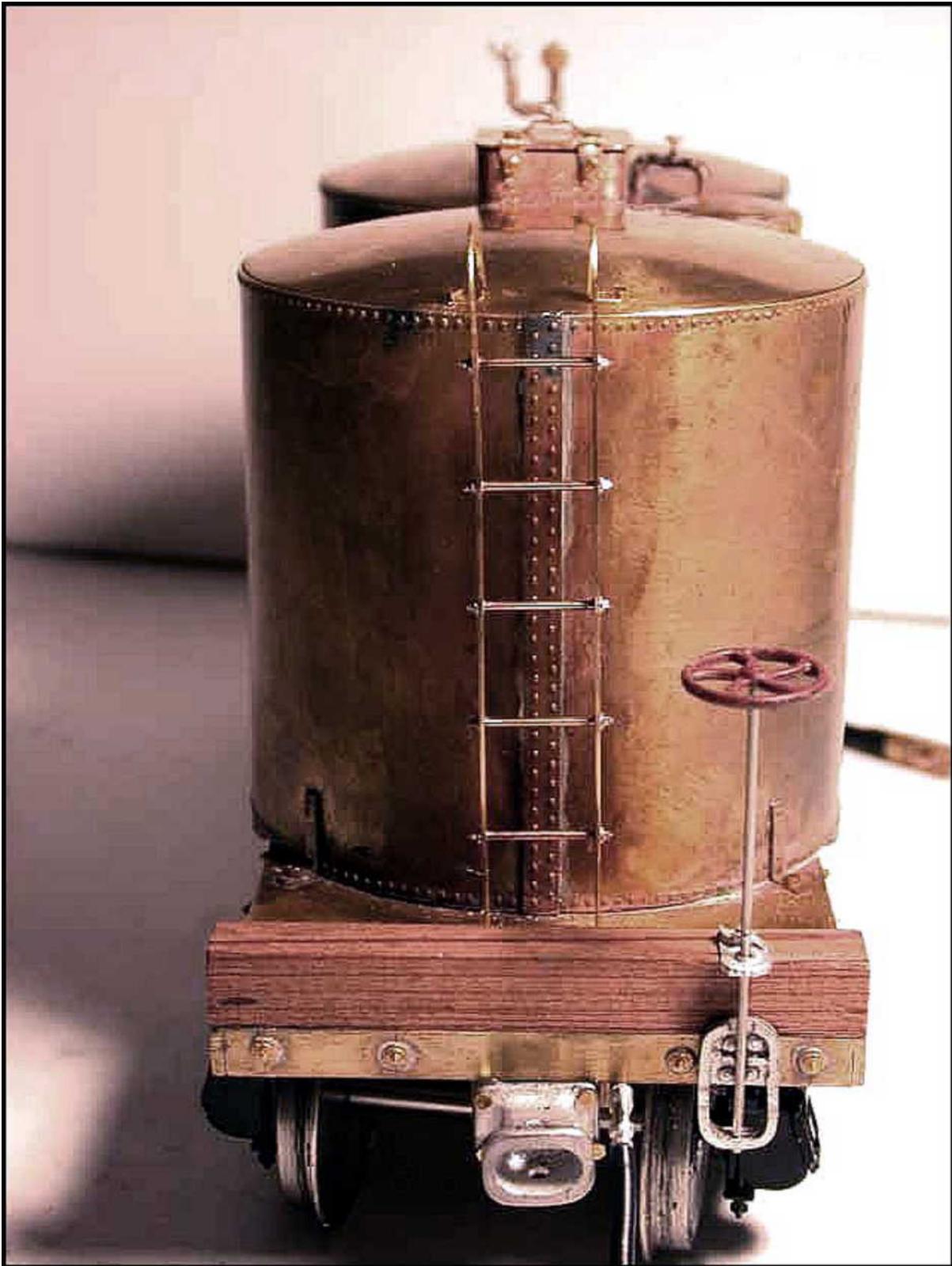
I chose to use NBWs because I figured welding wasn't common in 1901, and it probably would have been bolted together.



Finally, I mounted the brake staff and air hose. The brake staff is Accucraft that I got from Cliff, and the rest are Ozark parts.

Here are some shots of the overall cosmetically complete tender...





I may also add some plumbing to the top of the small tank, but I need to order some more plumbing castings.

Sure feels good to have this part essentially finished!!! 🤖

Comment Bob Starr:

Looks great Dwight! Jackie liked your ladder! It's good that you have a lot of patience.

Comment Eric M.:

Looks good Dwight. Your sheet metal work looks fantastic as usual. I have to agree with Henner on the coupler though. Instinct tells me that this tender would have had a coupler with draft gear. The flange mount pockets are actually less common and were used more in industrial and logging applications. My only other suggestion would be to swap out the Ozark brake hose parts for Hartford ones. The Hartford ones are much nicer, more accurate, and you can actually link the glad-hands together. 🛠️

Thanks guys.

Eric - I'm going to be calling on you and your paint shop soon. 😊

As to the coupler, I've given thought to it. Fletch and I discussed the tender "flat car" at some length when I started this project. We essentially came to the conclusion that it was either built from scratch out of steel, or used the deck of another tender. Eugene Tu was just up at the Sacramento Railroad Museum and was kind enough to take some photos of the Sonoma's rear coupler pocket for me. Locomotives as a rule did not have draft gear and sprung link and pin coupler pockets. While the pocket I used is probably not 100% accurate either, my feeling is that it's more accurate than a sprung pocket. 😊

If I change it at all, it will be to make a new pocket from scratch that is more in the vein of the Sonoma's.

Comment Henner Meinhold:

Dwight, the ladder looks awesome! I am curious how you made it. Did you clamp the brass down and moved the clamps while milling or did you solder the plates on a sacrificial piece of brass (That's what I usually do and where solder paste comes in handy...)?

About the sprung/un-sprung couplers: I just thumbed through my books. Unfortunately almost nobody took photos of the back of the tender. There is however one photo showing an old standard gauge tender of the V&T #21 (coincidence?) In "The Silver Short Line", page 159. This shows very clearly that the coupler was just bolted to the end beam. So I guess you are perfectly right with your choice...

Comment llyn Rice:

NPC #21 has really been quite a project and it has been fun to see your detailed posts showing the progress. I've been Americanizing my Roundhouse Lady Anne and your posts have been helpful in getting comfortable with working in brass and soldering joints.

I note that you've modeled a pipe from the air tank to the forward (oil storage?) tank. Did the prototype use air pressure to force the fuel oil forward to the burner?

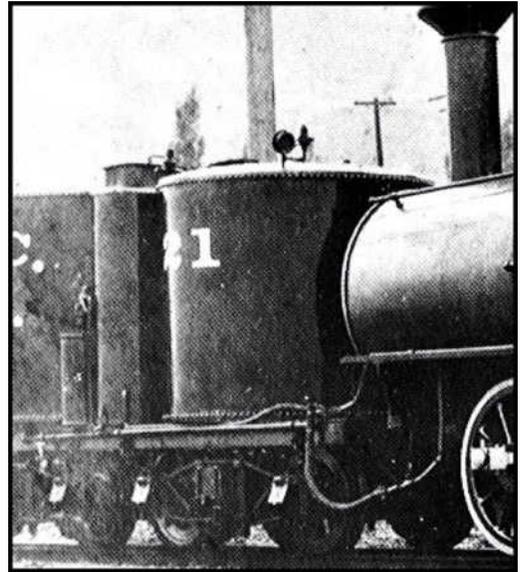
Originally posted by llynrice:

"I note that you've modeled a pipe from the air tank to the forward (oil storage?) tank. Did the prototype use air pressure to force the fuel oil forward to the burner?"

That's the general consensus Llyn. In the photo below (borrowed from Tom Farin's web site)...

You can see about the same plumbing, and can also vaguely see the oil hatch pressure dogs. As near as I can find out, this was the first oil burner, and as such was a prototype. Later locomotives apparently found that pressurizing the oil tank was unnecessary.

You can also see some sort of plumbing atop the small tank which I plan to add as soon as I get more castings. I'm also going to add the hose from the loco air pump to the large air tank.



Henner - re the ladder. The frames were cut from sheet metal on the CNC mill, and then drilled 0.046" for the 0.045" rungs. The rungs were tapped into place until flush with the outside of the frames. This assembly was then sandwiched between, and clamped to, two machinist's squares, which were in turn clamped to a slab of 1/4" aluminum. This was to keep things flat and square.

I used a technique to solder the rungs which I may have heard someplace (can't remember where). Kevin O'Connor advised me at the NSS to use a fine artist's paintbrush to apply flux, as the solder will only flow where the flux is. Each joint was fluxed in this way.

The Stay-Brite I have is 1/16" diameter, too coarse for fine application as a large blob starts melting onto the joint as soon as it nears the torch flame. I therefore cut small bits of it 1/32" to 1/16" long, and after fluxing and before heating, laid a piece on the rung with tweezers right at the joint and touching the frame. Bringing a small low-pressure flame to the joint heated the flux and solder at the same time and the solder wicked right in without a lot of excess.

I used the same technique on the air tanks. Wish I'd learned it a lot sooner. Most of my joints would have been a lot cleaner. 🙄

Comment Howard:

Dwight...as usual, your work is first-class. So, now that you've soldered the ladders in place and can't readily remove the tank lids... I'm assuming that your workable hatches have to be used to actually refill your fuel tank and water supply for the WLDS pump---Is that right?

I'm interested because I'm using approximately the same tank scheme on my Climax project's trailing car. I was going to leave the water tank lid removable for easy water fill up. My fuel tank's lid has to be removable because I'm just going to drop in a new ISO-butane canister for refueling. I really like the look that ladders add to the tanks, maybe I'll do it on the water tank only.

Comment Winn Erdman:

Dwight, Your loco is really looking great. Very nice job on the ladder. I love the pictures of it under steam. I know that felt good! I'll have to keep in mind your servo problem when I get to that point.

Howard - The oil bunker lid (forward tank) is still removable to access the butane tank Howard. The piping is soldered to its lid, but just sits in a hole on the air tank, so it comes off with the lid.

The ladder complicates removal of the rear tank. Right now it's bolted to both the lid and the deck, but it would be easy enough to solder the deck bolts to the ladder and use them merely as guide pins. The plan is to use the hatch to add/check water in the rear tank and I don't foresee having to remove the lid unless trouble develops inside with the battery or the WLDS and its pump. However, experience may prove me wrong. That's why I'm not in a real big hurry to paint it until after I've run it with everything installed and working. I may need to make some modifications, which may screw up the paint. 😊 Besides, it's easier to solder stuff unpainted.



Thanks Winn. Just make sure you adjust the servo end points and eliminate any buzzing BEFORE extended operations and you should be fine. 😊

(13 Feb 2008) Continuing the Builder's Log now in the archives [here](#).

Today is an appropriate day for an update since it was one year ago today that I bought my CNC milling machine and started this project.

I've been putting off installing the air pump for several reasons. One, I was looking for an appropriate casting in both style and size. Second, I was still agonizing over how the damn thing was connected. Third, I knew what a tedious PITA making up all the pipes would be.

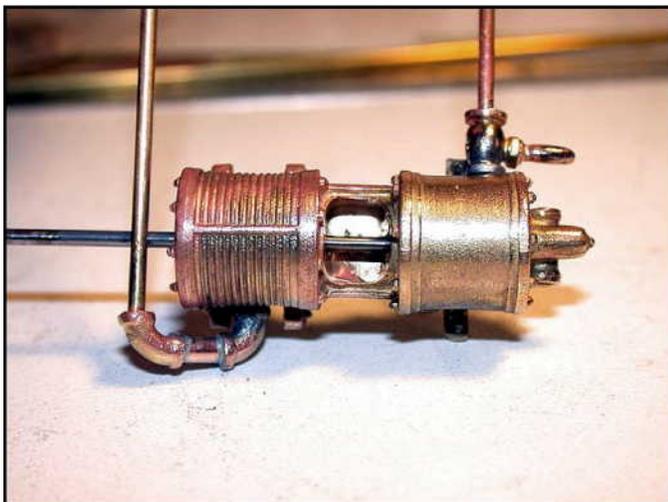
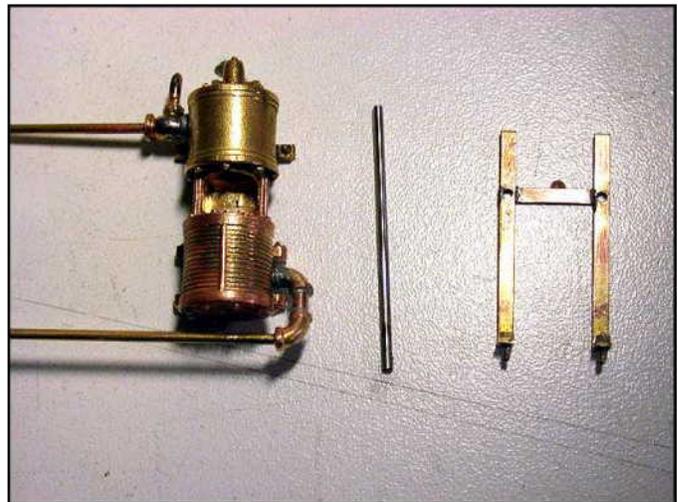
I picked up a few pumps from Trackside Details a little while back. The most promising was their TD-9X (which was actually the first pump I bought). I wasn't real thrilled with it due to the (imho) poor quality of the casting. After receiving the others (TD-190, 191, and 192), while the castings were better quality, the size and/or style was all wrong. I also got a Bachmann pump off their 4-4-0 from TOC (thanks Dave Goodson), but ultimately wasn't real happy with it either.

On a whim, I ordered another TD-9X. This one was far better in quality - the first one must have been a fluke. With the pump settled upon, it was time to modify it.

Here's the original casting...



While the second one was a lot smoother and cleaner, the center section between the cylinder and compressor was still filled with... well, I'm not sure what to call it. The first step was to mill out the center section. I also drilled a hole up through the bottom for a simulated connecting rod made from 1/16" piano wire, which I shined up. While I was at it, I cut the governor off the TD-190 air pump, drilled it for 0.06 brass wire, and silver soldered it to the 9X, and started fabbing the air line. I then made an H-bracket to mount it.



As I said, I've agonized over how this thing was hooked up for many months now. I've gathered opinions from many people, including David Fletcher. The problem is the lack of clear photos; so much is left to educated guesswork. The steam input line and the exhaust were the problem. In the following photo, which I'll call Figure 1...

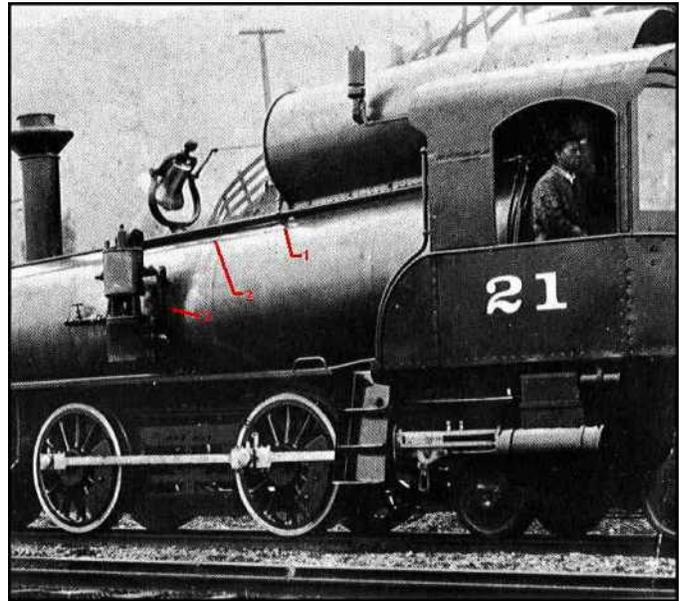


Figure 1

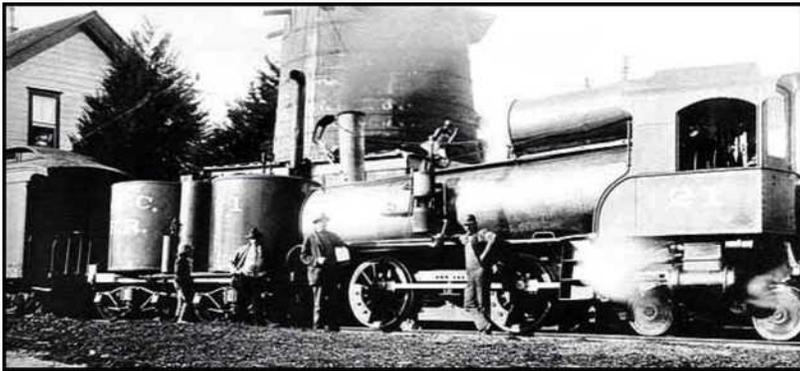


Figure 2

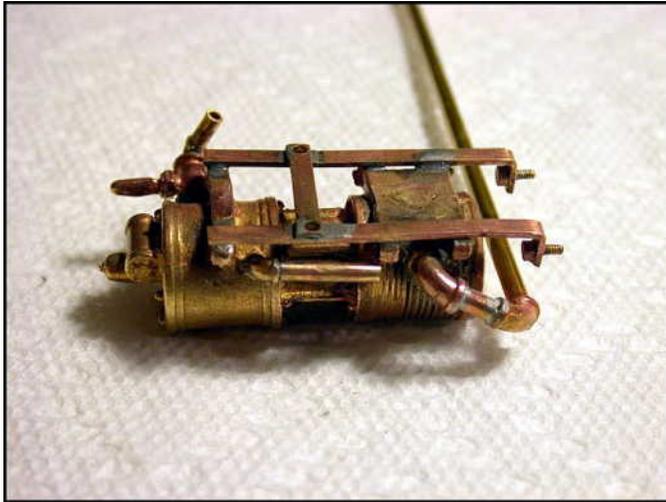
It would make sense to assume that the exhaust would be the pipe running into the smokebox. After long study, I came to the conclusion that such was not the case. The pipe coming from the smokebox goes through a globe valve, then some sort of large hex-shaped union, and then appears to go into an elbow and head north. This shows even more clearly in this photo, which I'll call Figure 2...

The exhaust seems to head down behind the airline, but deep shadows make it unclear where it actually ends (see (3) in Figure 1). This last photo finally convinced me with reference to the exhaust line...

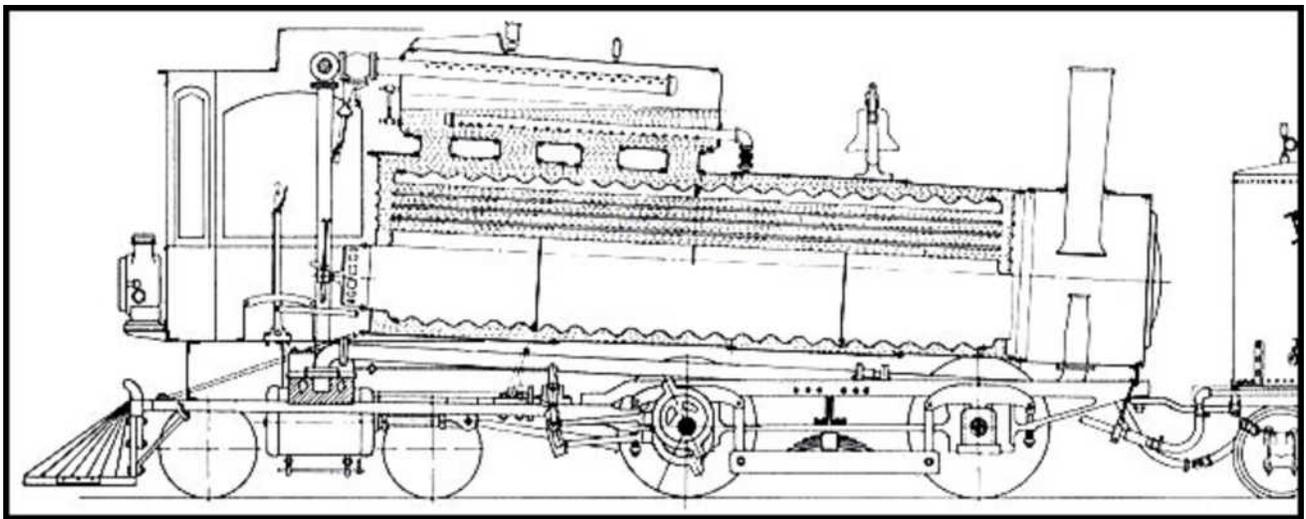
The cloud of steam right near the center of the air pump leads me to believe it ends here. Consequently, that's where I chose to end mine, as shown here in Figure 3...



Figure 3



On to the steam supply line where similar problems are faced due to a lack of good photos and information. Figures 1 and 2 were my only real sources of info here. Referring to Figure 1, the shadow under the handrail (2) made it appear to me that the steam line ran above it, probably to the cab. However, even more careful scrutiny exposed the little bit of light just to the right of the handrail stanchion (1). Could it come from the globe valve on the rear of the weird steam collection cylinder atop the boiler? I can also see what might be part of an elbow on the bottom of the globe valve.

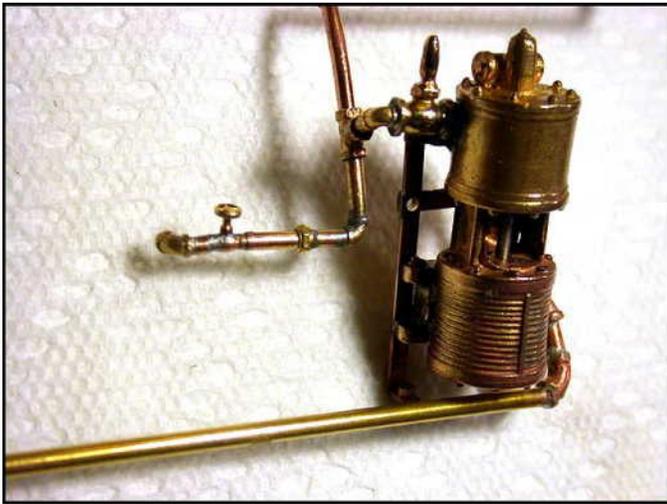
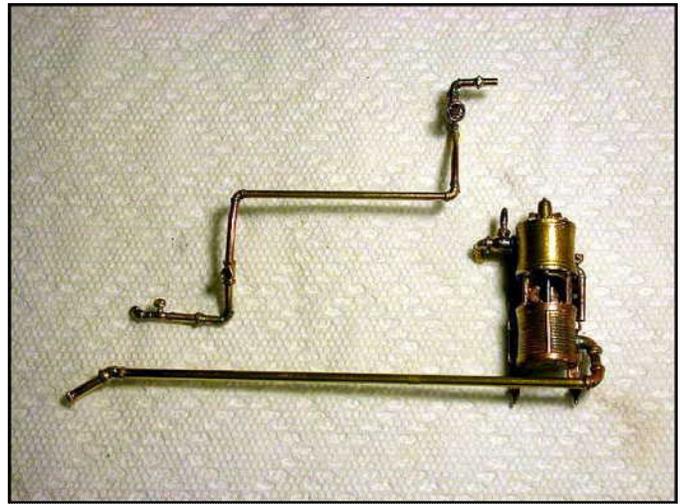


I had as a reference this drawing from "*Those Amazing Cab Forwards*"

This drawing originally convinced me that the globe valve ran back down into the boiler, though I had no idea why or what purpose it would serve. Ultimately, I decided this drawing is probably wrong (like so much info about this loco). If you look closely at the thing inside the cylinder the globe valve is connected to, it looks just like the steam collector connected to the throttle. I concluded that the water probably didn't get up that high, and that both were most likely steam collectors, which left the lower one free to supply the air pump. While it meant I'd have to change what I'd already done, I decided to connect the air pump steam supply line to this globe valve.

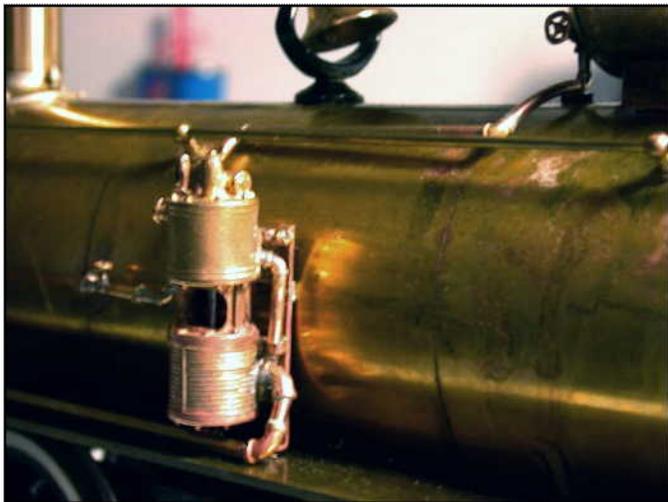
Figures 1 and 2 ultimately led me to conclude that the steam supply line comes off the cylinder globe valve, runs aft horizontally above the handrail, then down on the left side of the pump, through a tee, then aft through a second globe valve and into the smoke box. I'm not sure why it's connected to the smokebox, but after months of staring at these photos, it's the only thing that seems to fit what I see.

Here are the completed pump and steam supply line...



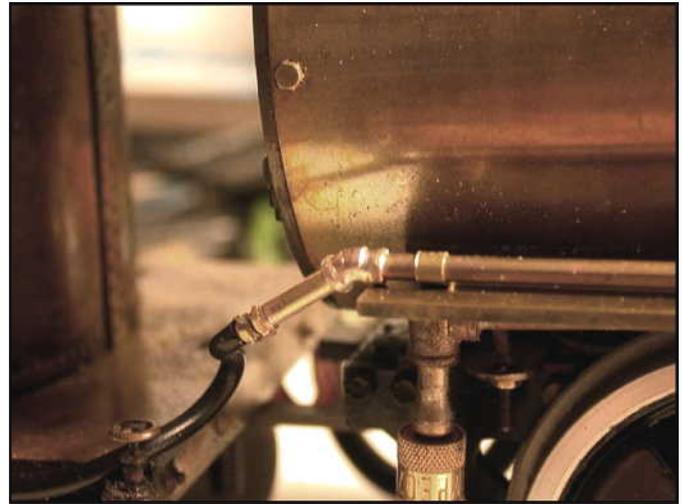
... and the two fit together...

... and here they are mounted to the boiler...



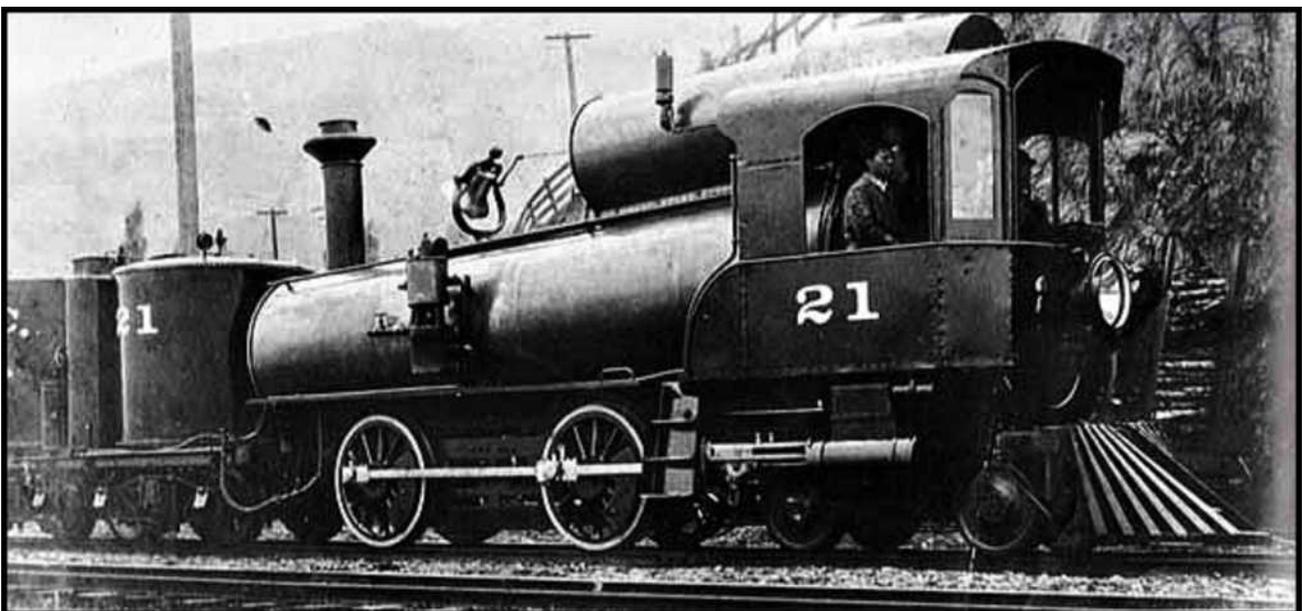
Second view from another angle.

The airline runs back to the end of the running board, through a connector, and into a hose...



...which in turn runs through another connector and into the large air tank on the tender...

Finally, on the 1-year anniversary of this project, I thought it would be fun to take a couple comparison photos from the same camera angle as my primary prototype photo. 🚂



The prototype...

The Model...



Still more things to do before she's ready for paint, but she's getting real close!!! 

Comment Bob Starr:

Dwight! That is some real fine work you have done there! Bet you feel like you have learned a lot in this year. My hat is off to ya. Btw, are you going to make the change to the stack?

Thanks Bob. Yes, I've certainly learned a lot this year. Hehehe

The stack is one of those things still left to do. I'm not going to change what's already there, but I am going to turn an insert for the top. All of the later photos show it already removed, but I kinda like the look of it. 😊 Figure 2 must be an intermediate transition period. The spark arrestor is already gone and the whistle has been moved, but the headlight hasn't yet been raised up and there's no sand dome.

Comment Alan in Adirondacks:

Dwight, Beautiful work on the air pump. And a fantastic job on the photography for a side-by-side comparison with the prototype!

Comment Charles:

*Dwight, I found this resource for me to better understand the design and operations of your locomotive very informative (given I do not have the book, *Amazing Cab Forwards*):*

[**Ironhorse 1:29 - NPC RR No. 21 Backhead Detail**](#)

Thanks Alan. 😊

Charles - thanks for the link. That's Tom Farin's #21 page. He put that together from discussions on MLS when Bob Baxter and Chris Walas were building their sparkie versions a few years back. It's been useful to me throughout this project. Doesn't say anything about the air pump or its plumbing though. 😊

Part of the fun (to me) of this whole thing has been the research. Same with my yet-to-be-started On30 layout based upon the SPC. I enjoy learning about local history and how my area used to look. It's fun to come across a street name like "Lick Mill Rd." and know where it came from. 😊

Comment Jerry Barnes:

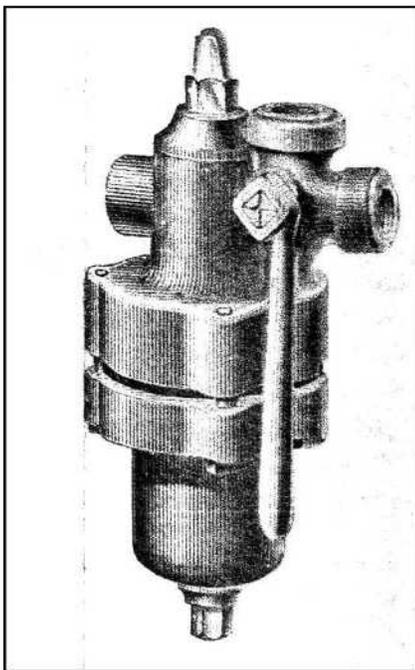
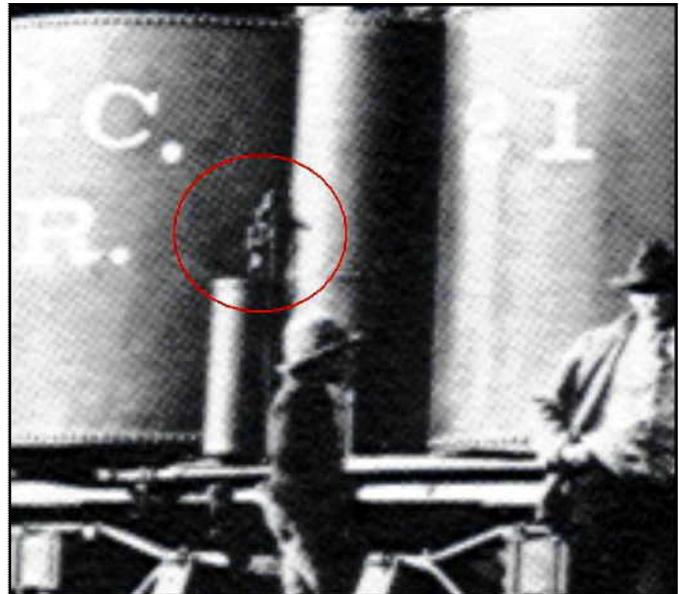
It just keeps getting better all the time-as the Beatles said!

(19 Feb 2008)

There's a device sitting atop the small air tank that for months I couldn't figure out what it was or what it looked like. It was large enough and prominent enough that I wanted to reasonably represent it.

I finally sent out an email to a bunch of people I know and posted the same question and photos in the Public Forum (figuring I'd get the most views and responses there).

See [this topic](#).



Only two people responded (including the emails) - Matthew and David Fletcher. Both agreed it was a triple valve for the brake system on the tender. David was also kind enough to email me this image of an 1883 triple valve...

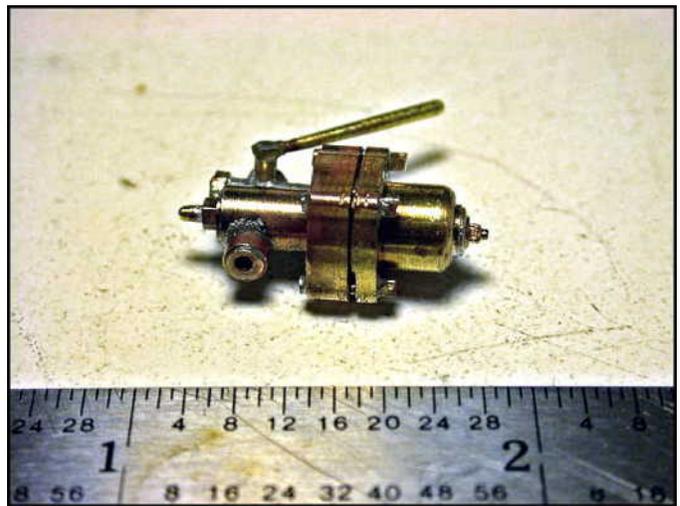
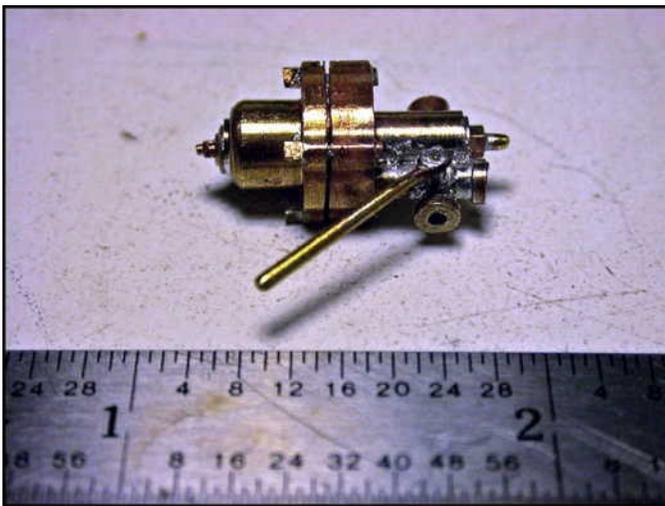
Armed with this info, and not being able to find a commercial casting that would work, I set about to make one.

Taking proportions from the prototype photo, I determined that the overall height should be 0.656". Measuring the above image of the triple valve, I generated an AutoCAD drawing from which I could take measurements. The first step to making one was to rough out the shape from a piece of 0.375" brass hexagonal stock. I turned the upper and lower cylinders manually, then clamped the part vertically in a machinist's vice on the milling table and wrote a little g-code program to mill the body profile and center-drill the hole locations.



After milling and drilling, I then had to use the lathe again to remove the scars left by the vice 🤔 (I did that after taking these photos 'cause I didn't notice them until I looked at the pictures).

I then started making and adding parts using various sizes of tube, rod, and wire. Here's the finished triple valve...



Now to mount it and run the plumbing (I need more elbows again - sigh).

Comment Henner Meinhold:

Dwight, your builder's log has two big disadvantages: 😊

- 1. It makes everybody jealous of your excellent NPC #21*
- 2. Same holds for your CNC equipment!*

By the way, I Googled over the weekend and tried to find any patents by William (Bill) Thomas (designer of #21). Amazingly, none showed up... One more thing: Are you sure, the lower "steam collector" is really for steam. If you look at the backhead (or what would be a backhead on a conventional loco), you see a water gauge right at this spot. I think this is real, because the photos of the unfinished boiler don't show any fittings/holes for such a device at a different location.

Thanks Henner. However, with the exception of the main body profile, everything here was done by hand.

One more thing: Are you sure, the lower "steam collector" is really for steam. If you look at the backhead (or what would be a backhead on a conventional loco), you see a water gauge right at this spot. I think this is real, because the photos of the unfinished boiler don't show any fittings/holes for such a device at a different location.

I'm not 100% sure about anything on this locomotive. Where did you see the sight glass? In a photo?

Comment Rod Blakeman:

More beautiful work Dwight, you are showing us all the way these models should be made.

Comment Henner Meinhold:

Dwight, the sight glass is visible in the drawing, spanning exactly the water level. On the photos of the boiler you can't see any fittings for either such a sight glass or try cocks. It would be mounted on the plate bolted to the upper drum (which is still missing on the photos). I still think the drawing is quite authentic; it may even be from the (not yet found) patent drawings.

Comment Eric M.:

That triple valve is a beautiful little part Dwight. Can you make me one? I want to wear it as a piece of jewelry. 😊

Thanks Rod. 😊

Henner - I have my doubts about drawings - first because I've seen a couple of them that were obviously wrong, and second because I doubt there were very many drawings made at the time she was built, and I doubt those survived. If you're referring to the drawing I posted earlier from **Those Amazing Cab Forwards**, it was first published in 1983 - 81 years after #21 was built. While I don't have the book and so haven't read it, I seriously doubt the author was an expert in obscure marine boilers. The fact that the lower collector(?) connected to the globe valve out the back is, for all intents and purposes, identical to the upper collector(?) connected to the throttle valve, and yet is under water, indicates to me that the author was guessing at best. The additional fact that the globe valve isn't shown connected to anything reinforces my suspicion that this drawing is wrong, as does my own study of the actual photos.

At any rate, when you come right down to it, without actual builder's drawings and with only a few grainy photos to go on, we're all guessing here, no matter how educated the guess may be.

🤔 That being the case, if I can't see it and recognize it in an actual photo of the prototype, it's up for interpretation. 😊

Eric - thanks, but no thanks. 😊

Comment Winn Erdman:

Dwight, Your #21 is certainly looking FINE!!! Those little tiny pieces sure time consuming, I admire the amount of work you put in to them. I'm glad the Mason Bogie research and drawings were done for me or I would have never even gotten started. Looking forward to the finished loco.

Thanks Winn. I enjoy the detailing on my models - always have (Tom Bowdler says I'm "anal" - Hehehe).

I'm glad the Mason Bogie research and drawings were done for me or I would have never even gotten started.

And I'm equally glad I didn't have to make my own cylinders and valve gear or *I* never would have gotten started!

Comment Winn Erdman:

Hope to have an update in a day or two. I'm finishing up the cab except for decals and windows. Trying to get all the parts for the RC servo links figured out. I'm getting down to the detailing, which goes very slowly for me.

Comment Tom Bowdler:

But Dwight, I meant ANAL only in the nicest way. Your work is superb!

I know that Tom. Thanks. 😊 Just having a little fun at your expense. 😊

(20 Feb 2008) I got the triple valve installed tonight. There's one more pipe connection out the top, but unfortunately I'm out of elbows again. 🤔

Here are the requisite pictures... 🤔



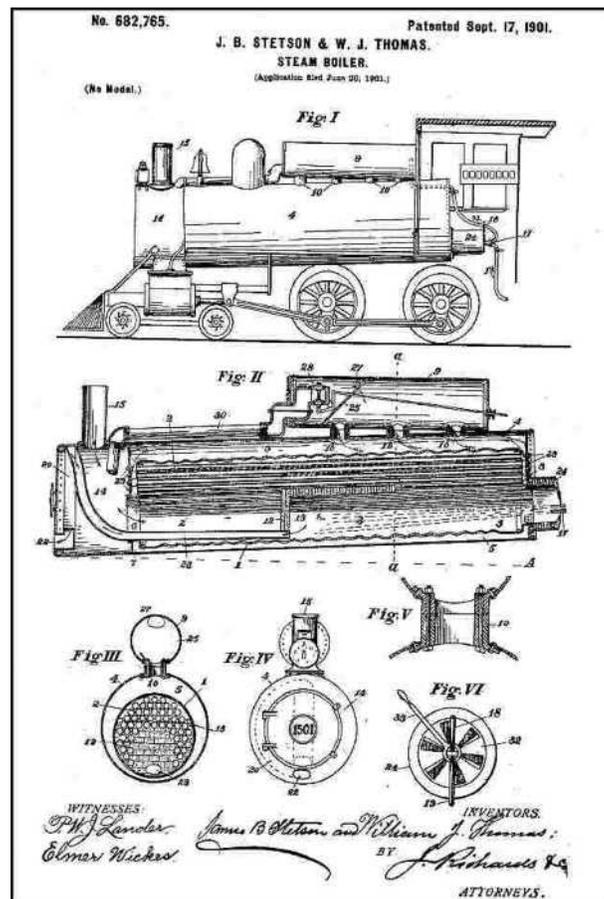
... and one from the same relative perspective as the prototype photo...

Comment George (MLS- GrizzlyFlatsFan):

Dwight, truly spectacular work. Your research and modeling ability is amazing! This is one beautiful locomotive.

(21 Feb 2008) Thanks Dan. 🤖 I've had a lot of help in the research department!!

Speaking of which, a few days ago, I logged into MLS and found I had a message from our own Steve Conkle (SteveC) telling me I had "a surprise" and directing me to a link in his web space where I could pick it up. Imagine my surprise when I found that Steve had rooted out a PDF of one of the original patents on #21!!! The next day, a second message directed me to a *second* patent... this one containing the major details of the boiler construction, *including a drawing!!!* Here's the drawing...



The text explains most of the major construction features of the boiler and how they work. David Fletcher was amazingly accurate when he came up with his [backhead drawing](#) a few years back when Bob Baxter and Chris Walas were working on their sparkie models. Kudos to David!!

There are a few differences between the patent drawing and the prototype. For one thing, the patent drawing is a rendering of a more general cab-behind locomotive while #21 was a cab forward. As a result, the steam pipe out of the "steam drum" (as it's called in the patent - I've been calling it a "steam collection cylinder") exits into the cab on #21, not down towards the stack and under the bell as is shown in the drawing.

The most glaring difference I noticed is that the patent calls for mounting the steam drum level on the inclined boiler, while the photos of #21 clearly show the steam drum inclined and parallel with the boiler centerline.

The patent *does* answer a question many have had when looking at this... why was the boiler inclined? Apparently, it was for water circulation purposes inside the boiler and aided in the creation of convection currents through the water-filled flues (it was a water-tube boiler).

I have heard from practically every source that #21 used a marine boiler. However, after seeing this patent, I'm beginning to wonder whether or not it was built from scratch - probably not by the NPC shops, but by a boiler manufacturer according to NPC design specifications. Any opinions on that?

Those interested can download the patent [here](#). I'm *very grateful* to Steve for taking the time to root this out for me!!

It's rewarding to find that most of my guesses have been correct. 🤪

Comment Howard Maculsay:

#21 is sure looking good... your work is inspiring. Your triple valve is really nicely done.

Comment Chris Scott:

Dwight: Since you're into unusual (aka strange) locos, I thought you might make this your next project...

Comment Kent Killam:

Chris, that is exactly what I need! The floor platform is low enough that you can make a drop down ramp in the back, instead of like a swinging door. Then I'd have my own wheelchair accessible steam engine. Come on Dennis, after you finish the #21, wanna build it for me? 🙏🙏

Chris - remember the photo I took of you at the NSS? Can I use it on the inner-front wall of the carriage to represent the missing part of the horse? 🤪

Comment Bob Sorenson:

Dwight: Very nice work. The detail work really goes a long way. Again, I am convinced that saws and files are so last century. I need to get one of those CNC mills. Looking forward to the next

(28 Feb 2008)

Thanks to Mike Oates for sending me the package of TD-53's. I have completed the triple valve.



I also ordered a Grex Genesis XT airbrush, which can produce a paint pattern up to 1.5 inches. I considered their X1000 spray gun, but after talking to the distributor (himself a large scale railroader), his opinion was that the XT airbrush would be a better tool for this application.

At work, we use a water-based two-part satin black epoxy paint. Spec's wise, I think it would be perfect for this application. It's extremely durable, won't scratch or wear off easily, and heat actually hardens it. I'm going to experiment on some scrap parts and see if I can lay down a couple of thin enough coat of the stuff using the XT so as not to obscure detail. If it works, I've found my paint. 😊

Comment Steve Shyvers:

Fantastic bit of research by SteveC!

Dwight, Do you think that the various references to "marine boiler" maybe should really say "marine-type boiler"? At the time #21 was designed the San Francisco Bay waters were extremely important for transportation and commerce. Steam dominated for larger vessels. Gasoline engines were new technology and typically used only in smaller craft. There must have been many facilities around the Bay that could produce a marine-type boiler to custom specifications.

Originally posted by Steve Shyvers:

Do you think that the various references to "marine boiler" maybe should really say "marine-type boiler"?

Good question Steve. 😊 From the references in various books, I'd always assumed that a stock marine boiler was used. Looking at the patent, however, I now suspect the boiler was designed by the NPC. They wouldn't have been able to get a patent on it otherwise.

Were there even gasoline engines in 1901? I don't know enough about marine boilers used in that era to even know if they were typically water tube types.

Bottom line, most of the stuff previously printed seems to have been based upon guesswork (some of it educated), and it seems much (if not most) of it was wrong. The patent drawings prove that. 😊 We probably know more about this loco now than most of the people writing the books. Hehehe

Comment John (MLS-Totalwrecker):

Dream on Dwight... nit pickers never build... where's the fun in that? Beautiful work. I am in awe.

Back in the day an engineer was often given one loco to run, they took pride in 'em and kept them clean and polished on their own dime. Out of the shops might not be polished enough!

Thanks also for expanding our knowledge; I wasn't aware of an American cab-forward, before I saw yours.

At first I thought it was a whimsy pulling stills!... An original ethanol; corn licker fired... classic! Great build.

Comment Bob Sorenson:

Dwight: Really nice work, no doubt about it. Can't wait to see the engine next. Don't worry about weathering it. Just run it a lot and the weathering will take care of itself.

Comment Stan Cedarleaf:

Beautifully done, Dwight. Ya really done proud with the paint job. The tender looks great.

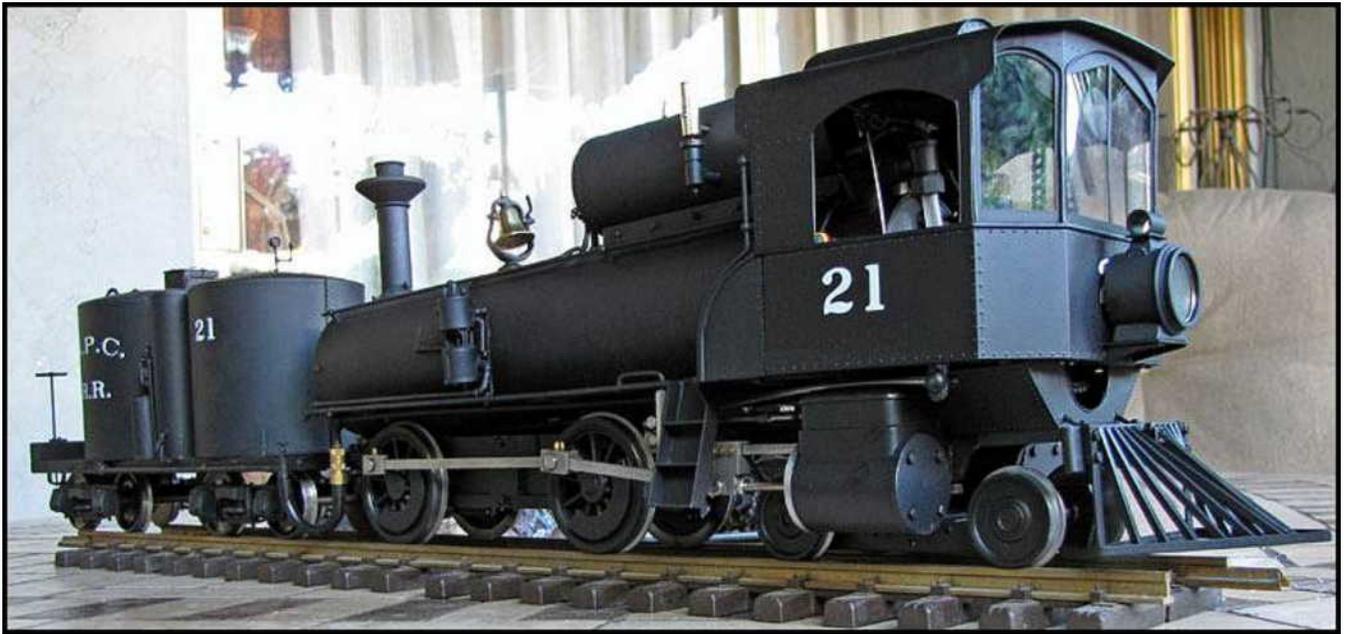
Comment aceinspp:

Holey Batman he actually is painting this loco. It will never be the same and most folks will think you just built a new loco. 😊 Great job maybe I'll get to see it again one day.

(22 Jul 2009) I had to bust butt to get her reassembled in time for the NSS. I finished reassembly last night around 8:30 or 9:00.

There are still a few details to add, and a couple of issues still to resolve, but this essentially finishes her!







Comment Mike Reilley:

It's been a long haul...and the proof is in this pudding. It's gorgeous. Great job...and the front windows really change it's character.

Comment Howard Maculsay:

Oh WOW!! She's beuuuuutiful !! You're modeling skills are A#1. You've got to be so proud of how she turned out. Congrats...and have fun at NSS.

Comment Noel Crawford:

Dwight: She is absolutely GEORGUS! What a beautiful LADY. Please take plenty of pictures of her running at NSS and a video or two for us guys on the Right Hand Coast.

Comment Larry Newman:

Hey Dwight, when I painted the Ruby - Mason Bogie you said; "She look GREAT Larry!!!" I've been waiting since June of 2008 to return it to you! She looks GREAT Dwight!!!

Comment Chris Scott:

Very COOL!

Comment Gary Armitstead:

Looks fantastic Dwight! Absolutely gorgeous!

Comment Eric M.:

Awesome Dwight-- painted is way better than raw brass.

Comment Henner Meinhold:

Dwight, I have to agree with Eric. It looks much better with paint. I think the reason is that everything blends together and it looks like one big chunk of machinery.

Comment John Corradini:

She looks fantastic. Good job. Wish I could be in Sacramento this weekend to see her in person.

Comment Chris Pearson:

Great finish, Dwight. "Black - it's the new black."

Comment Bob Baxter:

Magnificent! I am constantly in awe of you and your amazing creation. It is absolutely fabulous!

Comment Reed:

Great job; I liked it when it was all brass, but I really like it a lot more in black.

Comment Richard Smith:

Dwight, I've been fascinated with that engine ever since I first saw a photo of it in a book many years ago. You've done a marvelous job of recreating it in miniature and I sure like the paint job!

Comment Mark Scrivener:

Dwight, When I saw just the tender painted a few weeks back I knew she was going to be stunning in all black. And stunning she is. Can't wait to see her in person this weekend!

Comment Carl Weaver:

Dwight, Really nice. I've always been a fan of patina on brass, but this has changed my mind. The texture of the black you chose results in excellence. Good job and a very fun project to have watched.

Comment Jim Francis:

Dwight, A true labor of love that turned out to be just awesome! It looks magnificent in black!

Comment Terl:

Great job. Well done on the details. Is there perhaps a video available of it running?

Comment Bruce Chandler:

Dwight, It really turned out VERY nice! What type of paint did you end up using? What did you use for the window glazing and how is it held in place?

Man, that is inspiring! I'd sure like to see it on a longer piece of track. 😊

Comment Rick Marty:

Very well done my friend. You can be proud of that job for many years to come as she steams along. What's next "Tyrone"?

Comment Larry Green:

Congratulations on a great looking engine.

Comment Mike O:

Dwight, that is just so cool. Congratulations on a great job!

Comment John (Shaylover):

I was wondering if you were ever going to paint #21, in fact I was almost going to start a collection to help pay for the paint etc. 😊 Well done Dwight, she's a credit to you. A beautiful loco.

Comment Bob Sorenson:

Good show Dwight. Here's a virtual pat on the back for a job well done. You need to get your MLS signature photo updated there bro.

Comment Nick Kelsey:

Great job Dwight. congratulations.

Comment Richard Weatherby:

Very NICE!! If I send my video from last year at Duncan's can you Photoshop it to match?

Comment Duncan Thomson:

Nice. Berry nice. Wanna see some dingle balls on the front windows, though...

Comment Winn Erdman:

Hey Dwight, That is plumb wonderful!!! You have done a superb job on that loco. All the little scratch built details make it a masterpiece. It took quite a while and I completely understand why having been there myself, but the final result is certainly worth the effort. CONGRATULATIONS!!!! I hope to see it in person, maybe at Diamond Head?

Comment Alan in Adirondacks:

Dwight, Fantastic! Wish I could be there to see it in person. (But as a consolation prize I did get in the cab of #4449 with Doyle this afternoon) Will you be in town in early August so I might still see it in person?

Comment zubi:

Looks good Dwight! But you forgot to change the signature;-)))

Best, Zubi

P.S. does it have an axle pump? Or is it a gas pipe connected with the tanks?