MasterClass MLS-2

Build a 2-6-6T / 0-6-6T Mason Bogie
An Adventure in 1:20.3

By David Fletcher

Chapter 6 - The Mason Valve Gear

Background

Well this has been a while coming! The world seems to have changed since I began setting this class up in late 2001. However we are now clear to run the class through to completion, and oh boy are we close to finished already! To the end of chapter 5 you will have already completed all the major components of the model. In chapter 6 we now install the valve gear to the BBT chassis, and in chapter 7 we install the paperwork and detail the backhead. The model will be complete at that point, only leaving chapter 8 as a summing up and discussion about decals and decoration. Keep the faith, chaps; we're almost there. Never losing sight of the format of these MasterClasses, this chapter contains a "Background" section and "Construction" section.

Background: In this chapter, one of our best brings us the story of the Articulated loco. This is a really good summary of the development of the narrow gauge articulated locomotive in its many guises. We are especially proud to have Chris Walas present this to us, and thank him for the dedicated research and time he has put into Fairlie locomotives generally. Please enjoy this "Background" section. ***<<Fairlies.pdf>>***

Construction: In this chapter we finally place the BBT chassis under out models and install the rods, valve gear and bell rig assembly. This takes the model from the static to the animated, and what animation it is!

Access to Sub-Articles: This chapter also contains 3 sub-articles aimed to builders who have not ordered any BBT chassis and would like to participate in building a Mason Bogie. Also any one of these 3 chassis options might be useful to builders awaiting their BBT chassis, and would like a 'stop gap' temporary chassis to fit to their model so that they can have a running model sooner. You can then swap out the chassis for the BBT when it arrives. All 3 chassis methods require a motor/gearbox, drive wheels and wipers from Hartland Trains. It should also be noted that while the motors and parts are of high quality, on par with LGB, the power of the locomotive, derived from any one of these three chassis options will be NO MATCH for the power and performance of the BBT chassis. They will make for a nice running model, capable of pulling typical loads this sort of loco would handle in her day, but no more. Therefore should you be awaiting the BBT chassis and do take up one of these alternatives as a 'stop gap' then please take the time to swap back to the BBT chassis when it arrives, the advantages in performance will be worth it. Likewise do not cancel your order with BBT - it is worth the wait, and worth making the chassis swap at that time. Here are links to the 3 chassis options:

Build Your Own Chassis From Styrene - *By David Fletcher & Phil Jensen.*
<<MC2002-DIYchassis.pdf>>

Assembly Instructions for the Laser Cut Stainless Steel Chassis - *By David Fletcher.*
A highly detailed bar frame chassis for the power truck only.
<< MC2002-laserchassis.pdf>>

Build Your Own 6 Wheel Tender Truck - *By Jens Lasch.*
The building of this tender truck can serve with any of the chassis options above.
<<MC2002-tendertruck.pdf>>

The Mason Bogie Archive

Keep reviewing the Mason Bogie Archive.

http://www.ironhorse129.com/Prototype/MasonBogie/Mason_Bogie.htm

The site is constantly being updated as more photos of Masons come in. Keep searching your books, old photos and magazines, and send us any Mason Bogie photos you might find that don't appear to be in the current Archive. Also send us pictures if your images are clearer than the many we have in the current Archive. E-mail the images as a jpg scan; 300 bit-per-inch images preferred.

The Masterclass Forum

Please direct your discoveries, discussions and questions to our Masterclass and Articles forum at Mylargescale.com.

http://www.mylargescale.com/forum/forum.asp?FORUM_ID=46

Mason Bogie Parts

Per previous chapters, we'll unveil new parts as brought to us by other members.

Sadly we have to report to the closure of CSC Innovations. Chuck from CSC has moved onto other areas in his life and will not be producing any more train parts for us for the foreseeable future. We also sadly see the end of John Clark's Fall River Productions

Additionally Vance Bass of FH&PB Supply Co. has closed his doors too. This means the Mason Bogie cab, pilot and tender shell parts are no longer to be made. Vance informs us that there is no old stock remaining. We are especially thankful to Vance for his huge contribution to this class, and tome personally in proofreading the chapters. His product was about the best one could buy, so we hope that in time to come Vance will be back. While his products will be missed, we are still very fortunate to have his support and expertise available to us here.

Regardless of these sad closures, please always drop a note into the Masterclass forum if you're after specific Mason parts. Many members have come and gone in this class, and as such there may be parts available from other members.

New Parts!

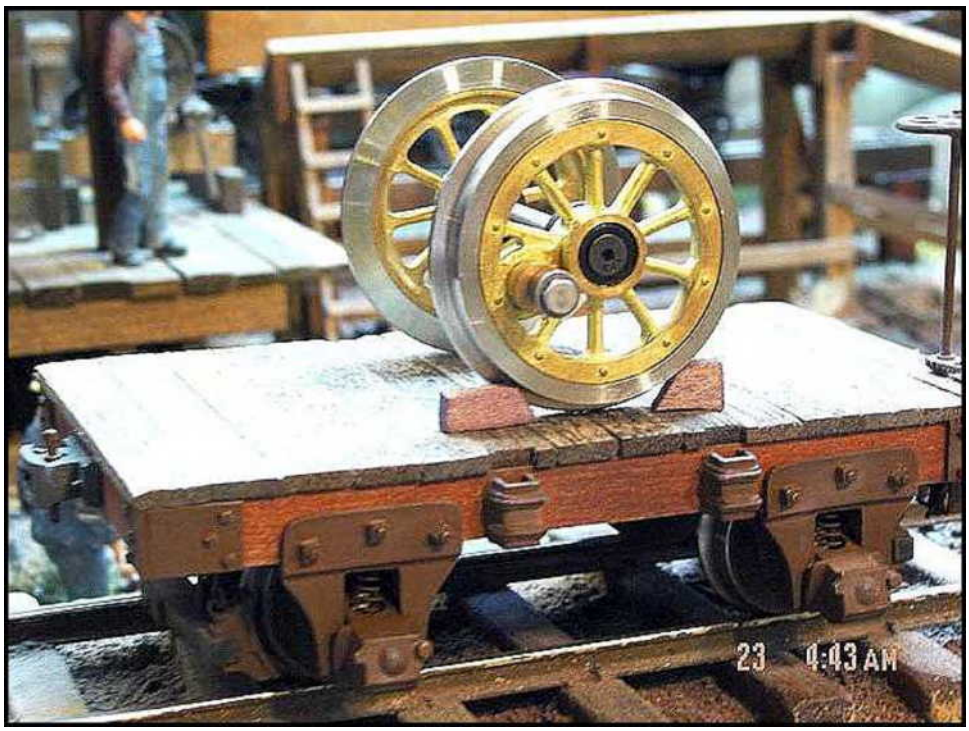
We have some new parts that have been made and advertised in the forums over the last couple of years.

The Bell-Rig

Jim Barron, who is building a most extraordinary Mason Bogie from this class, arranged to have his hand made brass Bell Rig and Star Stanchions made into castings available to all. These castings are amazing and certainly reduce the effort required in making a couple of the more difficult assemblies from Chapter 3! Jim has produced, advertised and sold most of these castings, however should significant interest be there, I'm sure more could be made. Please contact Jim via Rich Schiffman via the Masterclass forum. Here are his magnificent parts:

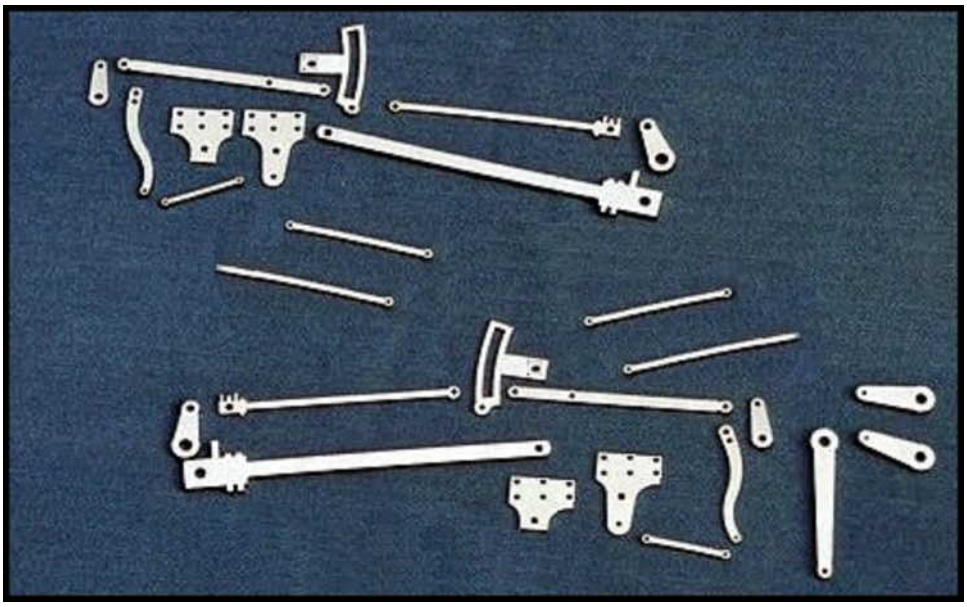
Mason Bogie Wheels

Rich Schiffman, with from Jim Barron and Allan Pollock have also been hard at work producing a real prototypical Mason wheel as a retrofit to the BBT chassis. Again, these wheels have been advertised in the Masterclass forum over the last year and are all sold. Should interest in more be high, a second run may be possible. The wheels have been provided to BBT for fitment to BBT chassis upon request. These wheels are works of art, and it just felt so good just holding them! Here is one of the wheel sets:



Mason Valve Gear Sets

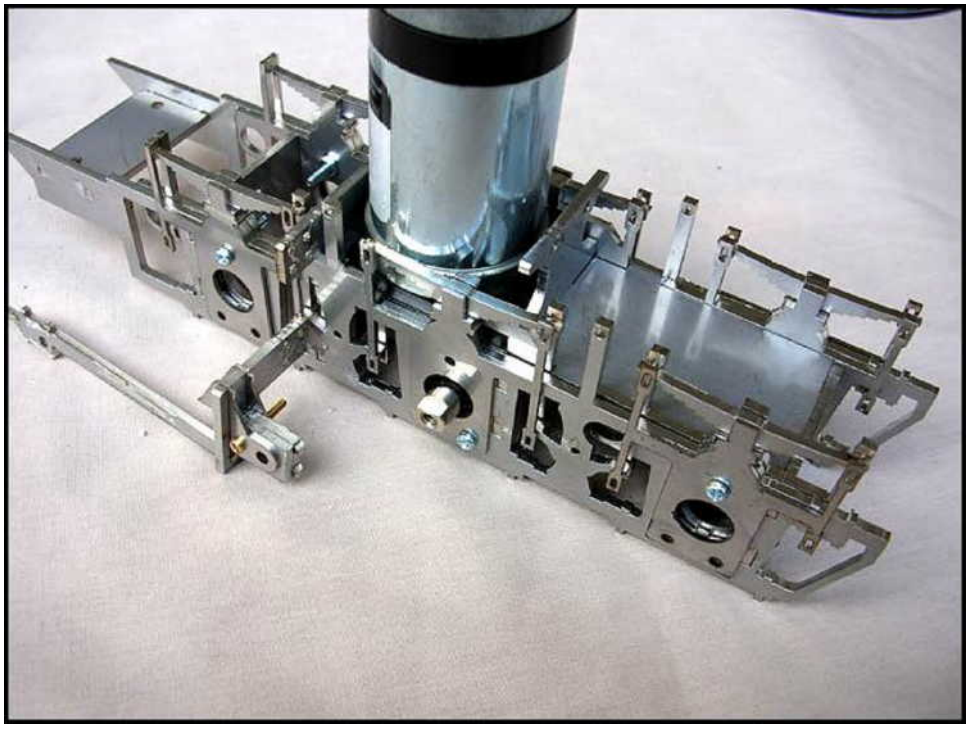
Finally, even I have gotten into this manufacturing thing in order to help reduce the difficulty of building a fully working Mason valve gear. As such, I produced the entire Mason valve set on CAD, and had the sets laser cut from 1.2mm thick grade 304 stainless steel. This was a real first for me, as I produce CAD work for parts all the time, but never arrange to manufacture these myself. The interest was high, so we cut 114 valve gear sets in January 2005, and all have been sold and distributed. If anyone wants a set, please note this in the MasterClass forum and we can produce more sets at anytime, so long as we have a minimum order of 20 sets in total. I can cut a single set upon demand, but the cost is very high. Here is the valve gear set:



This set is prominently used in this very chapter. The chapter is written on the basis that this set has been acquired. If you had planned to hand make the valve gear all along, and have not bought this valve set, fear not, the valve gear PDF's are included in this chapter which will enable you to hand make these exact same parts. There will be no "wimps way" valve gear assembly in this chapter as previously advertised because buying this laser cut valve gear *is* the "wimps way"!!

The Mason Bogie Class parts all laser cut

Stay tuned for updates about this at MLS. With the success of styrene laser cutting by Rick Raively in the CP Huntington Class, we're exploring the possibility of laser cutting all the major assemblies for the Mason Bogie from the class templates, including cab, pilot, smokebox front, headlight, tender shell, firebox, optional styrene chassis frame for use with Hartland wheels and drive, running boards and decks. The only parts left to be hand made would be the boiler; stack elements and detailed wrappers rivet heads and pipe work etc. We've also experimented with a stainless steel full bar frame all laser cut for use with Hartland drives, wheels and electrical contacts. See this chapter for details of the assembly. These frames will most likely be available in batches, so long as minimum orders are placed.



Art Wallace's Book

This has been a much anticipated book release:

Mason Steam Locomotives - By Arthur W Wallace.
Heimburger House Publishing Co.
7236 West Madison St.
Forrest Park, Illinois 60130 USA

The book represents a lifetime's research into William Mason and his works. About 50% of the book is dedicated to the Bogie locomotives as a developmental progress from his 4-4-0s of the 1860s. While you will probably not learn anything specifically new about the Masons of the South Park, you will learn loads about the context of the locomotive design, what was happening at the same time, and loads about small engineering details such as changes in steam pipe arrangements and valve gears. I believe this to be landmark book for anyone interested in steam technology or William Mason's work in general. It must also be reminded that most of the engineering info used to build and detail our models throughout this class comes from Art Wallace's drawings and information.

Try and get a read of this book sometime.

Introducing Bill Gould

Over the years of this class, we've been pretty much directed by information gained from the superb drawing set done by Art Wallace in the mid 1980s. The set of 7 reconstructed engineering drawings at 1:8 scale are the finest drawings of Mason Bogie details in existence and are a testament to Art's extraordinary lifetime research into William Mason and his Bogie locomotives. Everything anyone really knows about the Bogie has come from Art's research at some point. Sadly his drawing set was not published as part of his recent book on William Mason. The book is excellent, and I highly recommend the purchase, but-

detailed drawings of the Bogie are not included in that book. In fact the1:8 drawing set is getting very hard to find, no more copies are being made as the drawing set original is frankly worn out. The prevalence of inaccurate bogie drawings out there far out weight the limited number of these highly detailed drawings from Art. This is sad because in time, the inaccuracies become the standard, and the level of detail we've learned from Art, and applied to our models here in the Masterclass slowly become invalid. There is hope!

Bill Gould is a professional model maker and patternmaker (for almost all model railroad manufacturers, and owned The Gould Company line of plastic kits) and a 3D modelling artist who in recent times has produced a fine Class 60/C-16 2-8-0 and Class 40 2-6-0 full-colour lithos as well as drawing sets in 1:24 and 1:20.3 scales. As I write this he is doing the finishing touches to an outstanding Bogie drawing in 3D, which includes a large number of detailed drawings. The colour scheme worked up for his bogie is based on the Chocolate brown scheme noted by an eyewitness at the time on the DS&PRR. Jim Wilke has aided Bill in getting the scheme correct to the period and is one possible example of what the real Mason Bogie looked like.

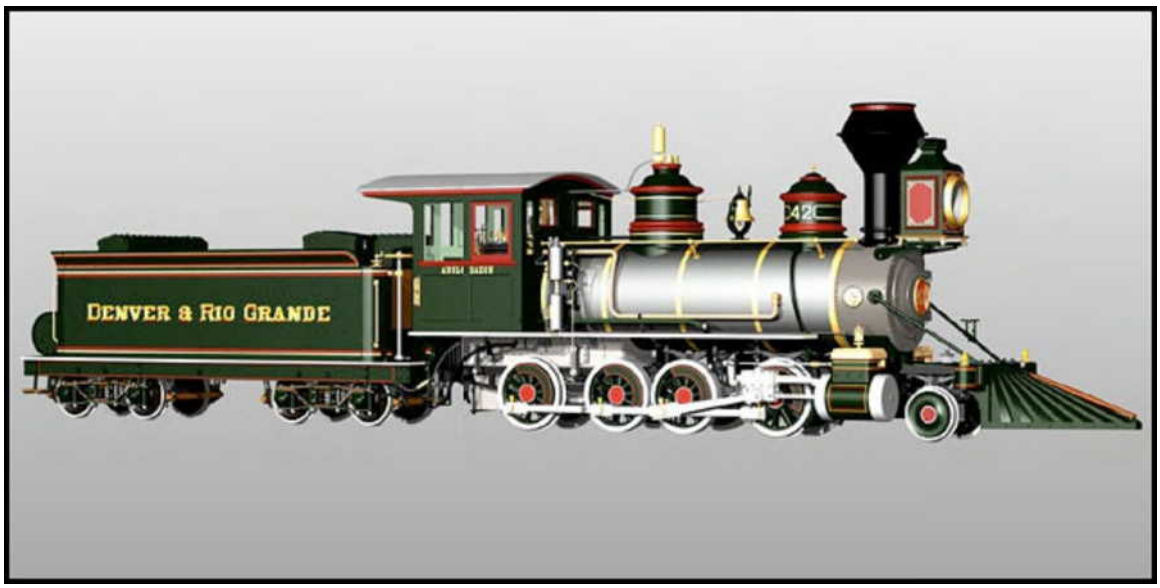
The Coloured drawing set will be available from Gould Studios, along with continued advice from Jim Wilke to aid you in your Bogie Colour schemes, including options for base colour and wheel colour choices.

We can discuss the Mason drawing set further when it comes out, but the C-16 drawing set he has on the market is easily the finest C-16 drawing I've ever seen. It is highly accurate, being based on copies of over 40 original builder's drawings, and has sorted many of the lil tricks and inaccuracies that have shown up in past C-16 drawings. These are the best 1880 era drawings of the C-16 inexistence and we'll be using these in the C-16 Masterclass in future.

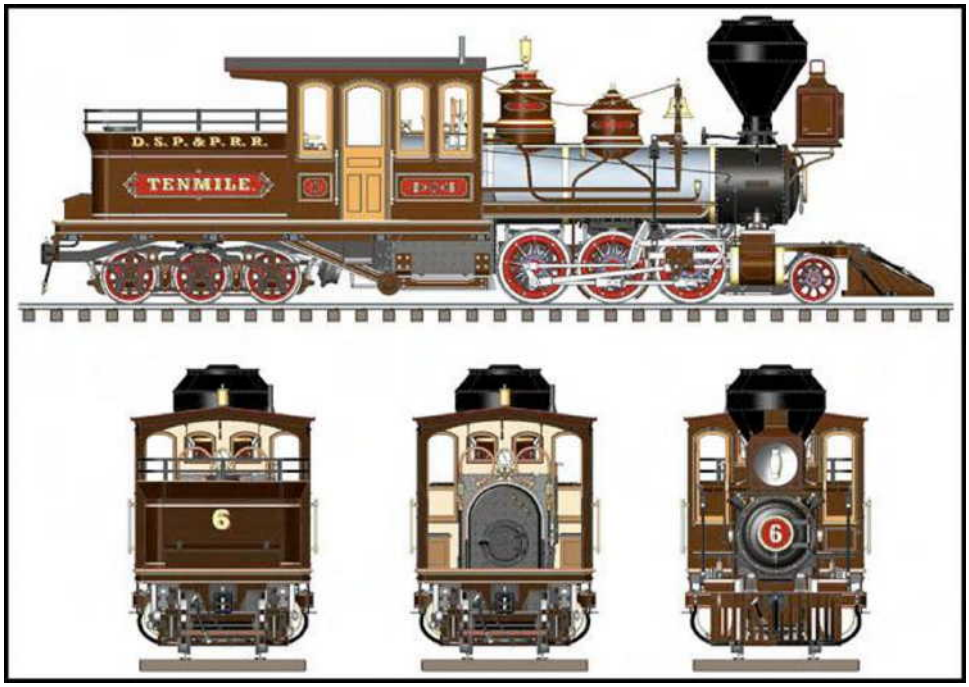
Take a look at Bill Gould's website:

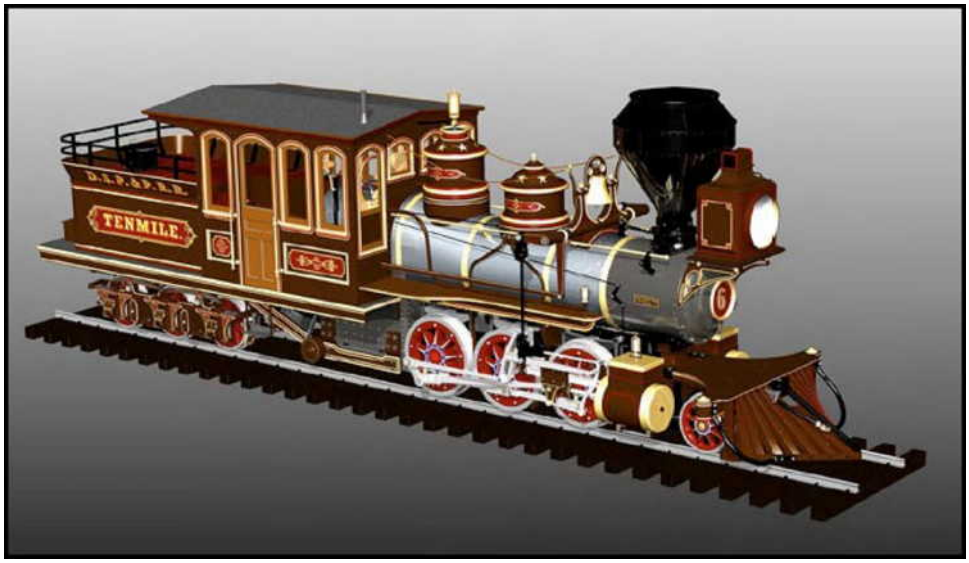
http://www.gouldstudios.com/

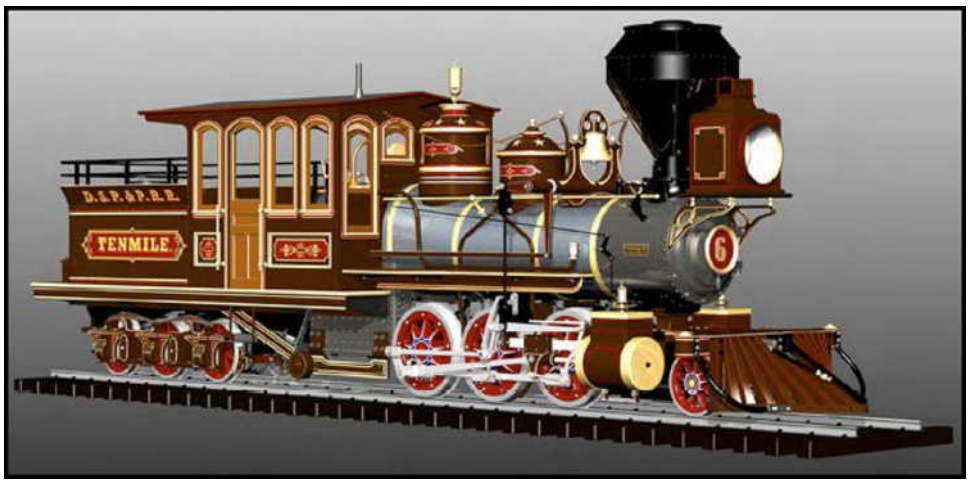
Here is Bill's SolidWorks 3D Class 60, with correct colour scheme for 1880, D&RG engine #42.



Here is an example of the SolidWorks 3D computer Bogie model Bill is working on:







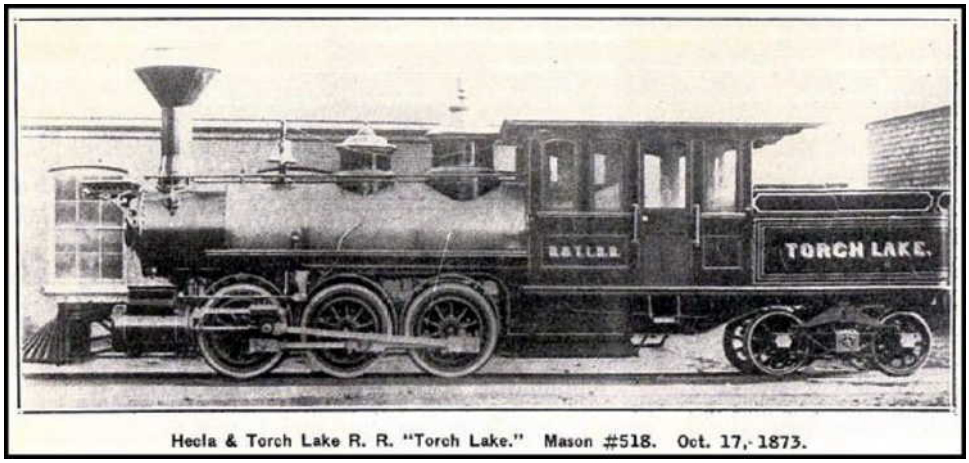
The Ghosts of Mason Bogies Past, Present & Future

The last of the Mason-Fairlie Single Bogie Locomotives:
This is a quick review of the last two surviving original Single Fairlie type Bogie locomotives in the world. The last Mason Bogie is the famous "Torch Lake" 0-6-4T from the copper mines area of upper Michigan. This locomotive is today the pride of the Henry Ford Collection at Greenfield Village, Michigan, and is fully operational after undergoing a recent major overhaul. The Narrow Gauge Convention of 2005 was held at the Museum, and some of our Mason class members enjoyed seeing this locomotive in action.

The other survivor is the last of the British built "Single Fairlies", now preserved in a lonely corner of New Zealand's south Island. I was fortunate to crawl over this 0-6-4T in April 2003.

Hecla & Torch Lake #3 "Torch Lake" - The Last Mason Bogie in the World:
Arguably one of the more functional Mason Bogies, and among the earliest of Mason's Bogie locomotives to be built, 0-6-4T "Torch Lake" was built in 1873, Mason's 518th locomotive.

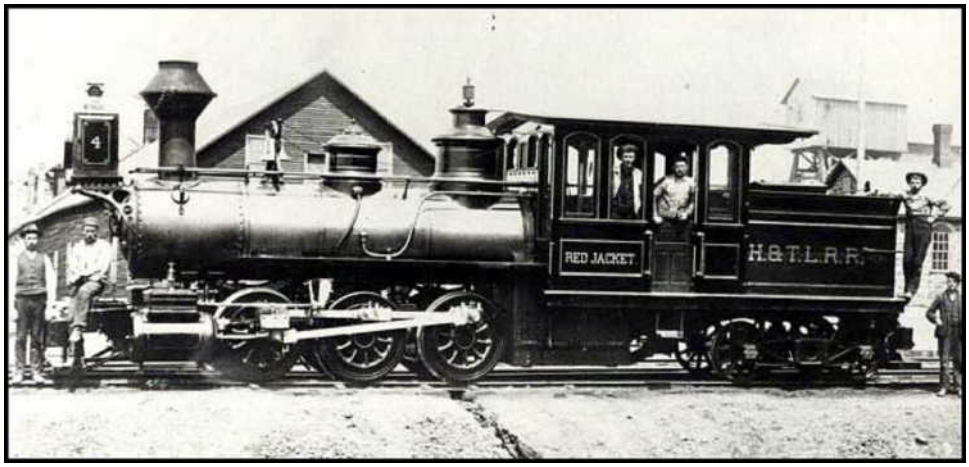
This was Torch Lake as delivered in 1873:



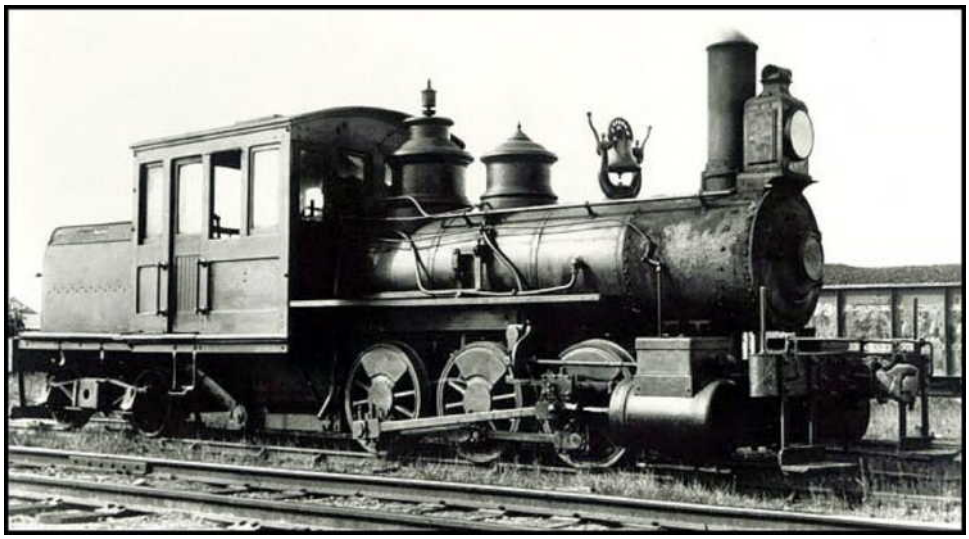
Hecla & Torch Lake R. R. "Torch Lake." Mason #518. Oct. 17, 1873.

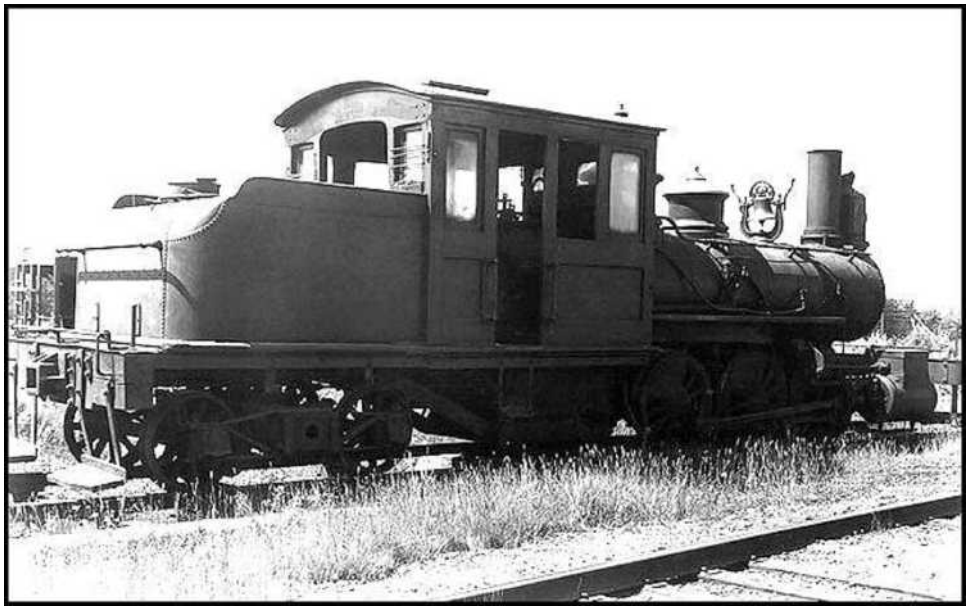
The Hecla & Torch Lake RR was built to the unusual gauge of 4' 1", said to be the result of an error made by the original manufacturers of Locomotive #1, an upright boilered locomotive named" Fluke". In all, the line would own six Mason Bogies of the 0-6-4T configuration, built between1873 and 1887. By the mid 1830s, the road was still operating 5 Mason Bogies and several camelback locomotives.

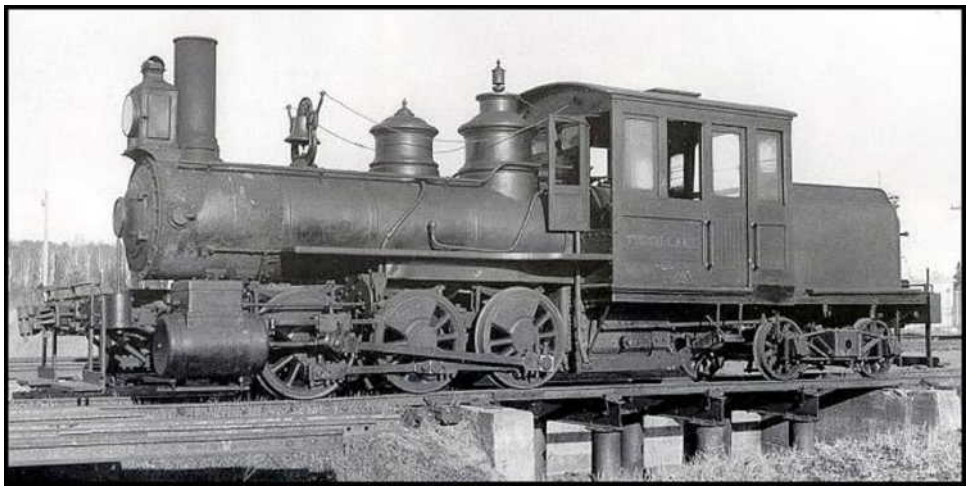
Here is sister loco "Red Jacket" as photographed in "as built" condition.



Next, a selection of photos of Torch Lake in her last days in service. Visually, she may look far removed from her 1873 style, but she is in fact surprisingly original. The changes are mostly cosmetic, upgrades and so on. Also, changes occurred as a result of major damage in a roundhouse fire around the turn of the 20th century.



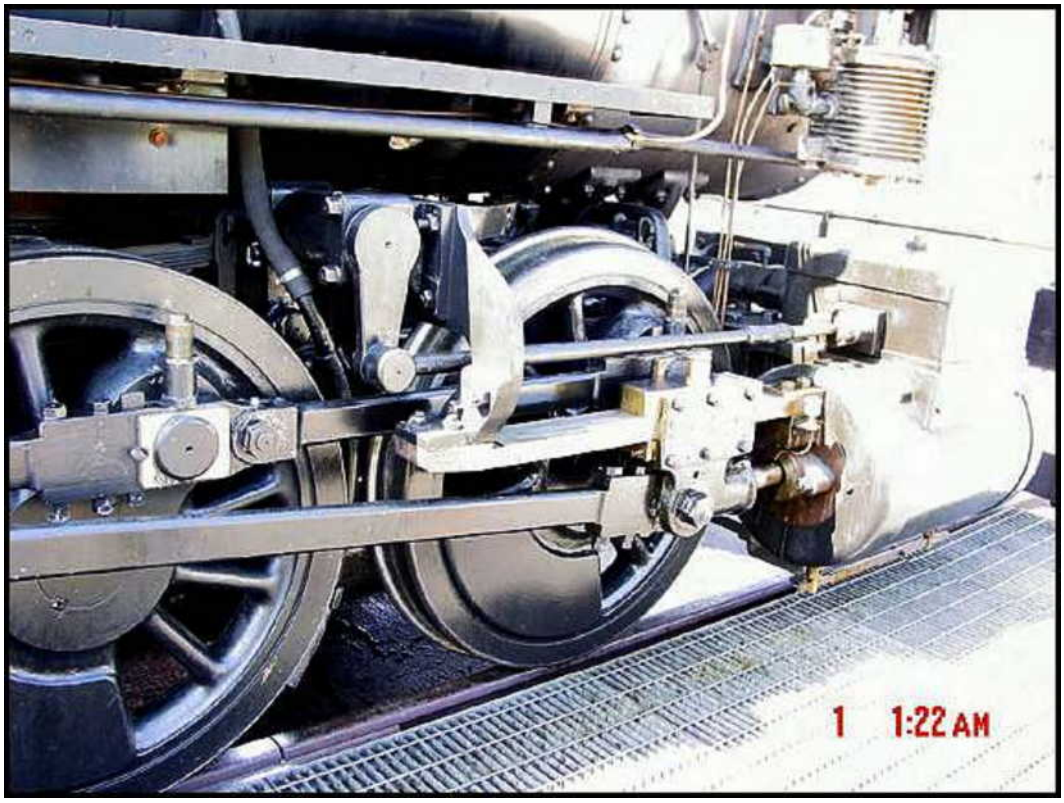




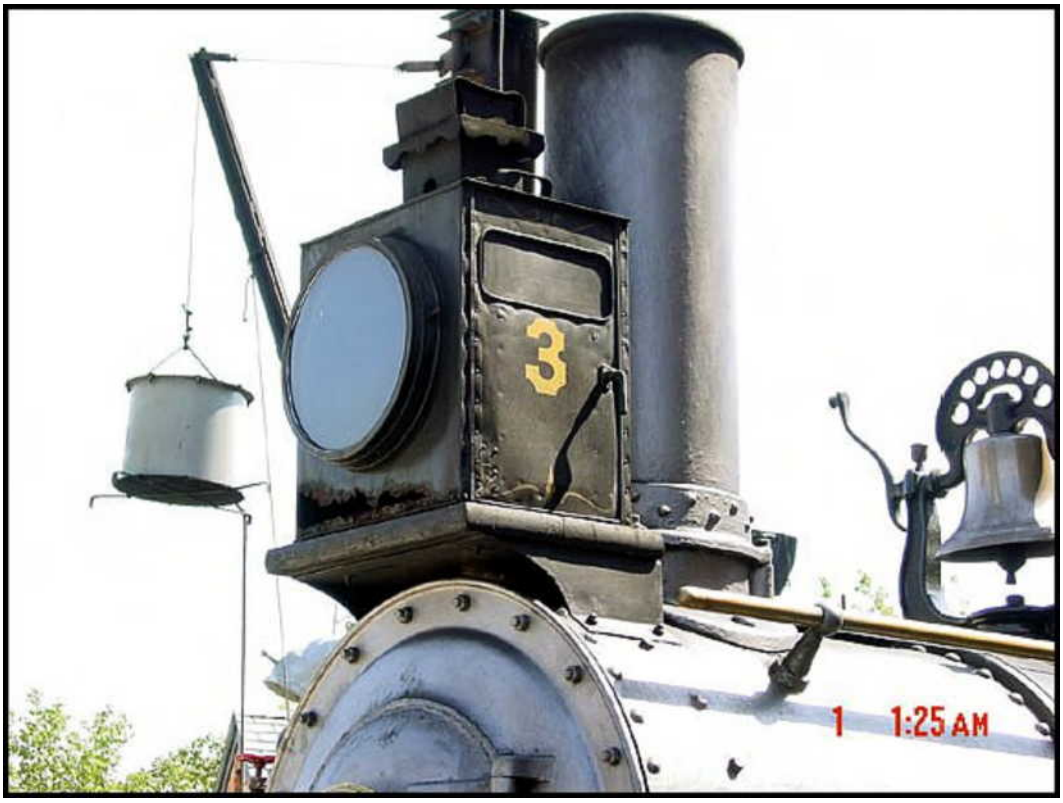
All the Hecla Masons, except "Torch Lake" were scrapped during the WWII metal drives. For 40years "Torch Lake" would remain mothballed as the line progressed into dieselisation. Offered to the Smithsonian Institute Museum, she was turned down and would remain neglected until moved to the safety of the Henry Ford Museum in 1969. The copper mines also closed in 1969 and with it, the story of the Masons of upper Michigan faded into history.

Here is Torch Lake at the end of her time in upper Michigan, being moved to Greenfield in 1969.

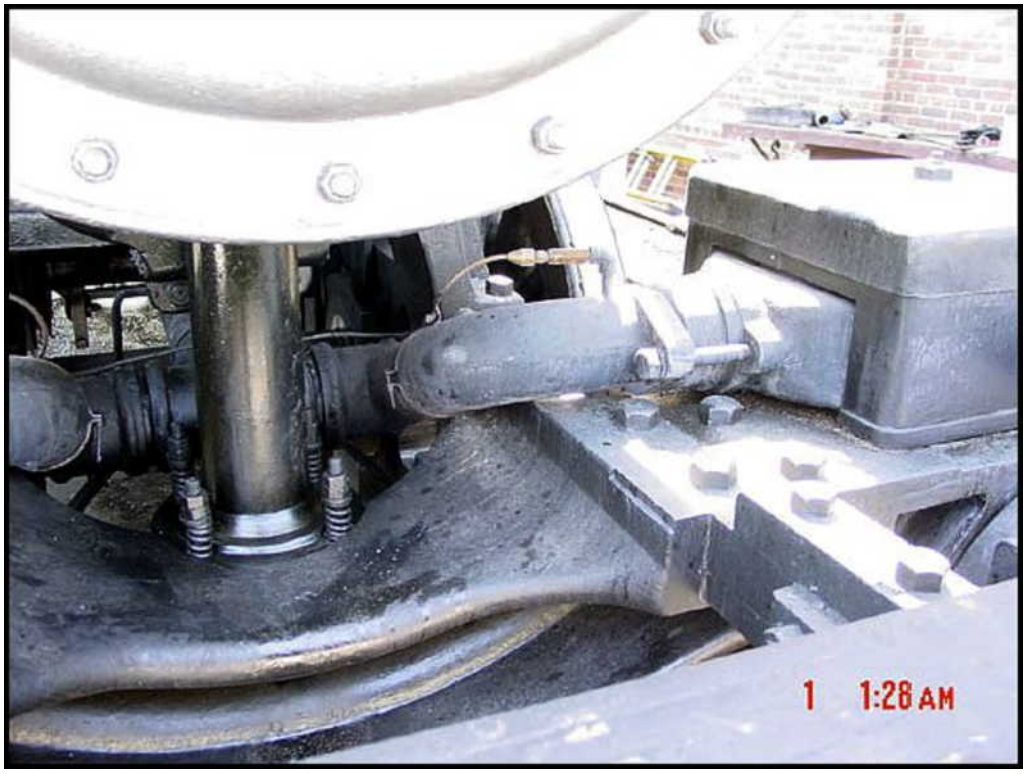
The following photos were taken in 2005, during the Narrow Gauge Convention. Thanks to Rich Schiffman for these wonderful images.



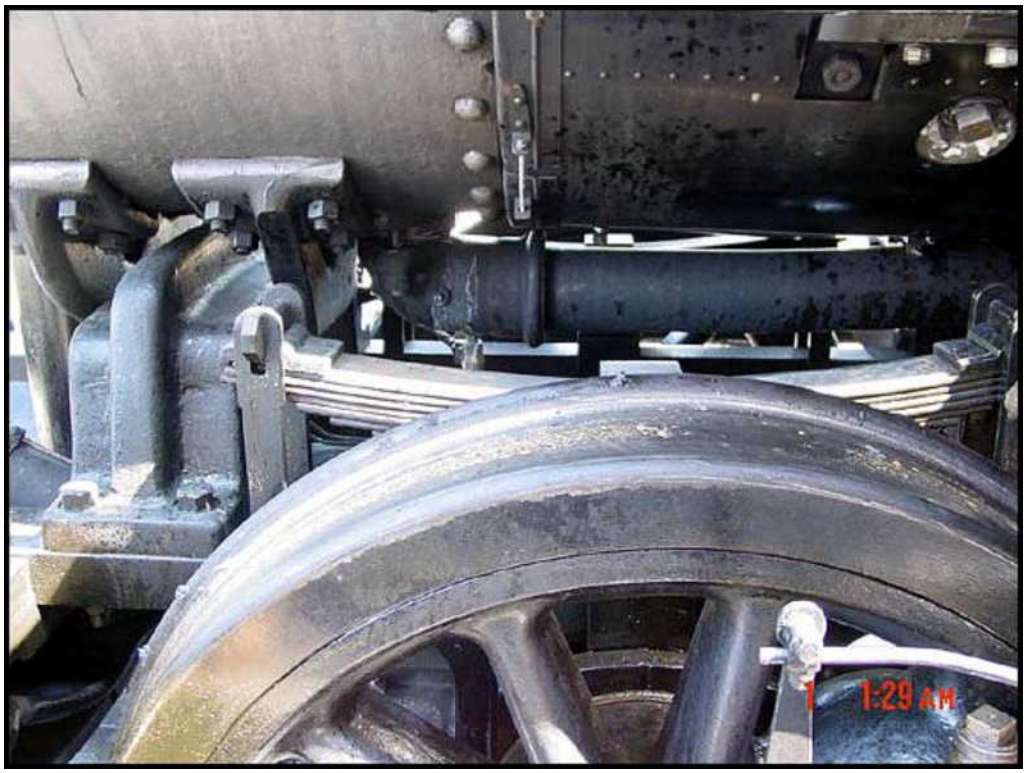
Ah, that beautiful Mason bell rig! An earlier styling than that used on the DSP&PRR.



The Smokebox door, Original Mason style down to the plate!

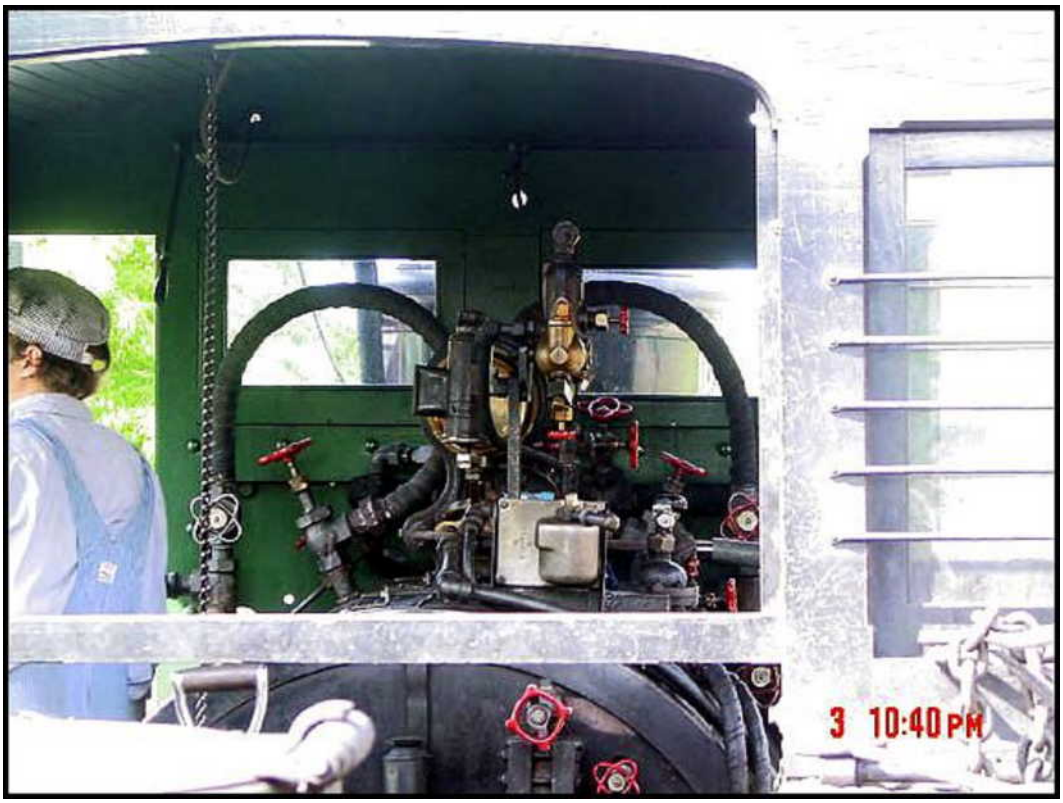


A view under the smokebox. The steam supply pipe can be seen coming from the middle chassis area, then splitting into a "Y" branch to the cylinders. The shiny vertical pipe is the steam exhaust pipe, which enters the smokebox via a crafted slip joint.

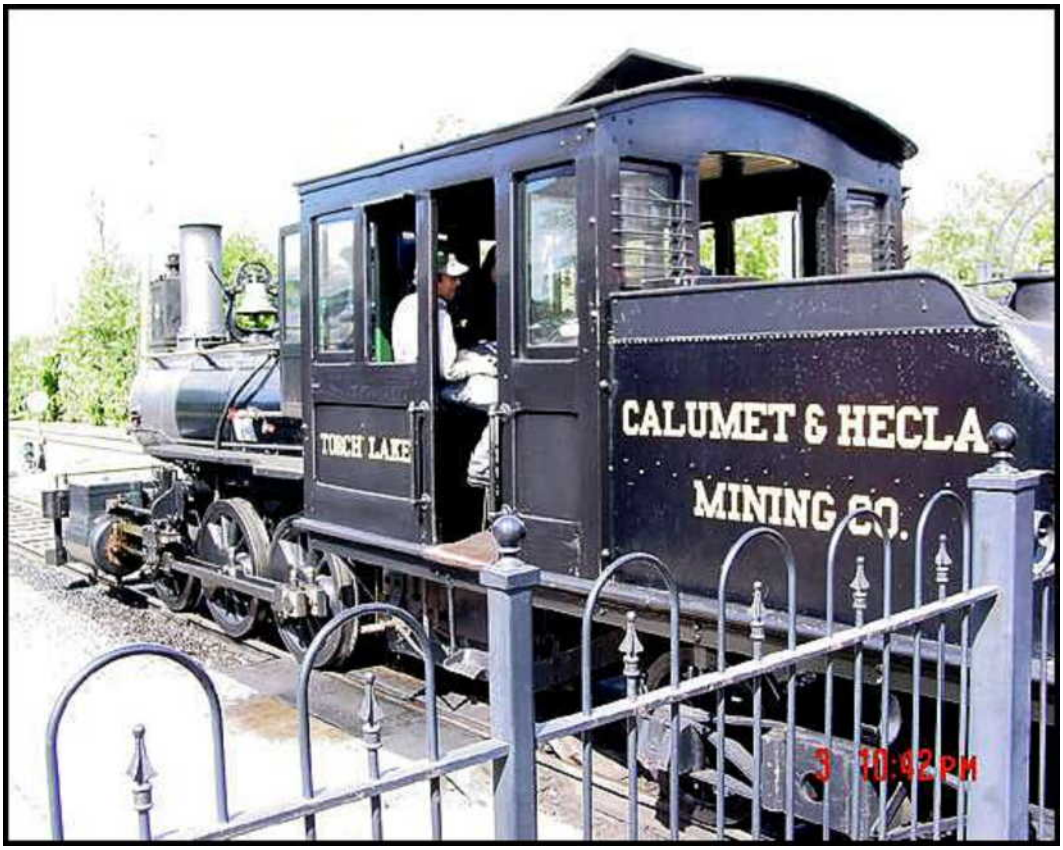


Above the lead driver in this view you can see the steam supply pipe running out of the bottom of the smokebox and heading to the rear where it will enter the chassis through the centre of the truck bearing plate.

A real treasure! This is the disused bearing plate normally mounted to the underside of the boiler directly above the middle drive wheel. Note the vertical edges to the giant casting, which bolt into the sides of the structural support frame running along the boiler sides. The above casting is shown upside down, and would be bolted under the boiler.



A view over the tender to the backhead. We'll use more of Rich's backhead details in chapter 7.While there are modern fittings in there, a great deal is also original and very close to the DSP versions.


TORCH LAKE
CALUMET & HECLA
MINING CO.


MASON MACHINE WORKS
3
TAUNTON MASS
3 10:57 PM

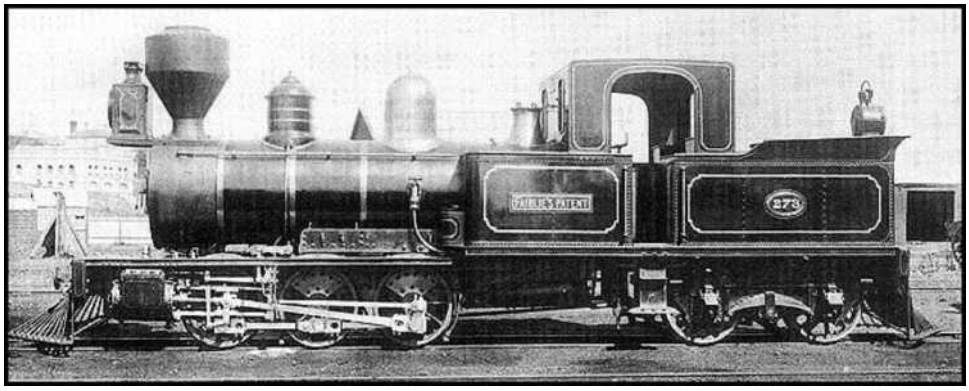

3
3
3 11:01 PM

New Zealand Railways R-28 - The Last Single Fairlie in the World

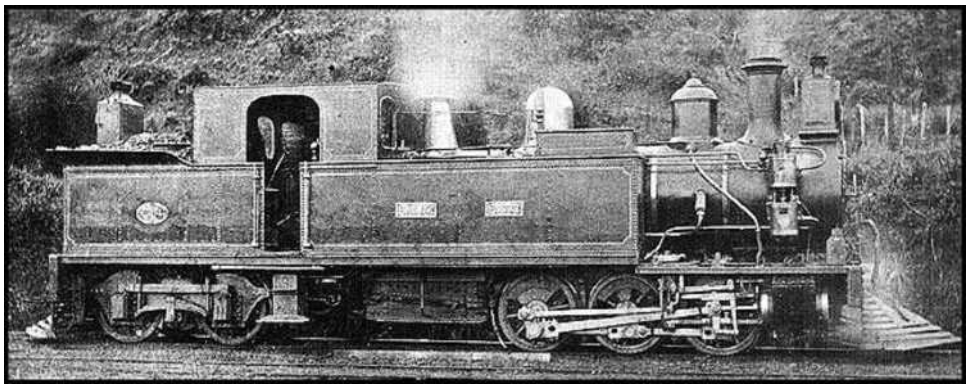
We leave Michigan behind and head to New Zealand to see the last surviving British-built version of the 0-6-4T. This is R-28, the very last surviving Single Fairlie anywhere, and is about as significant historically as the "Torch Lake" above. They are very much twins in many respects, derived using different engineering, different builders, but for the same purpose. Both built as 0-6-4T flexible truck locomotives, and both sharing similar structural and engineering concepts. The NZ R-28 0-6-4T was built by Avonside, Bristol in 1878. Take a note about that. This is the exact same year that Mason began building the DSP&P fleet. From the outset, you can see that Mason's steam supply and exhaust fittings seen above were simpler but more effective than the steam lines seen in R-28. Having said that, the Single Fairlies of New Zealand were locomotives kept in high regard, and were said to be especially successful. The Single Fairlies such as R-28 were regarded much better locomotives than New Zealand's Double Fairlies.

Said to have cost only 2/3rds the price of the Double Fairlie locomotives built for New Zealand, the Single Fairlie was just as flexible, but easier to run and maintain. They were said to cost only a little more than conventional locomotives, and were more adaptable to lightly constructed railways and held the track far better than other British designs. (William Hudson of the Rogers Works in New Jersey would soon prove that rigid framed locomotives could be just as adaptable via the use of balanced suspension.) As for the R-28, she is the sole survivor of the 18 Fairlies built of this type, out of a total of 28 Fairlie locos built by Avonside for NZ. The R class Single Fairlies were the most successful of the various Fairlies used in New Zealand.

Here is an R class (R-273) in "as built" condition.



The R class 0-6-4T's were the smaller of two classes of Single Fairlie used in NZ. Here is a view of the larger "S" class Fairlie, also built at Avonside. This one is S-214.



As for R-28, after working on the west coast of NZ's south island until the 1930s, she was sold to the Timaru Harbour Board in 1944, and later worked for a Colliery in Reefton nearby. In 1948 she was retired and handed to the town of Reefton for display. Here she remains in a lonely wet place on the south island's west coast, a rare and significant British locomotive.

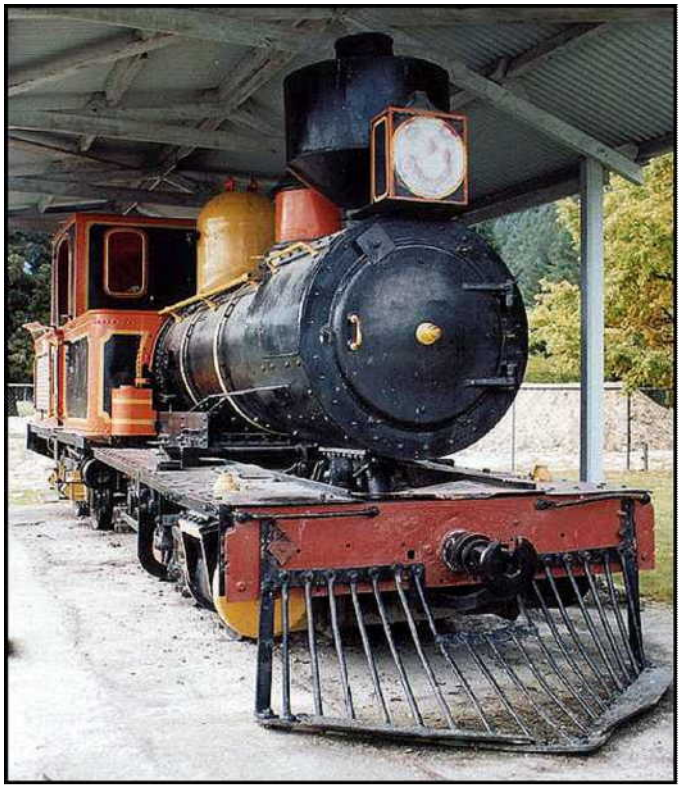
Now some views of old R-28 as seen today. While not nearly as well kept as "Torch Lake", she is still remarkably original and missing very few parts. I'm sure her day will come when she'll leave this lonely old park and steam once more.

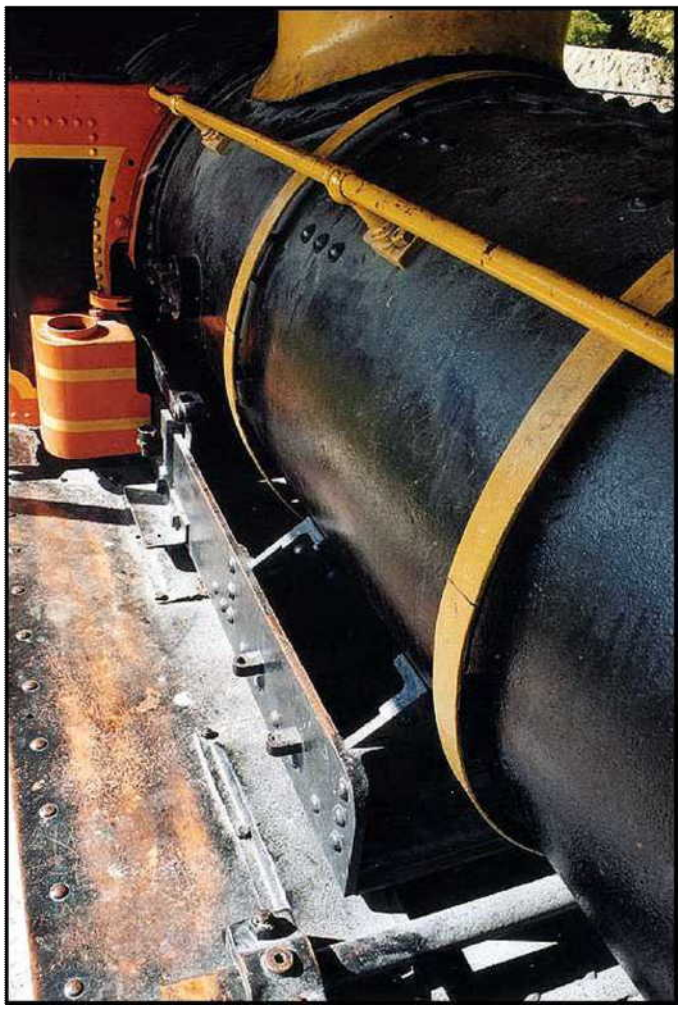
This is the site for the world's last Single Fairlie. You have to know it's in this place to find it.

Note the support structure running along the boiler side. You'll see the exact same type of framing the Mason, except on the Mason the running boards rest atop the framing, whereas on this Avonside loco, the running boards are attached to the power truck, below the boiler frames.

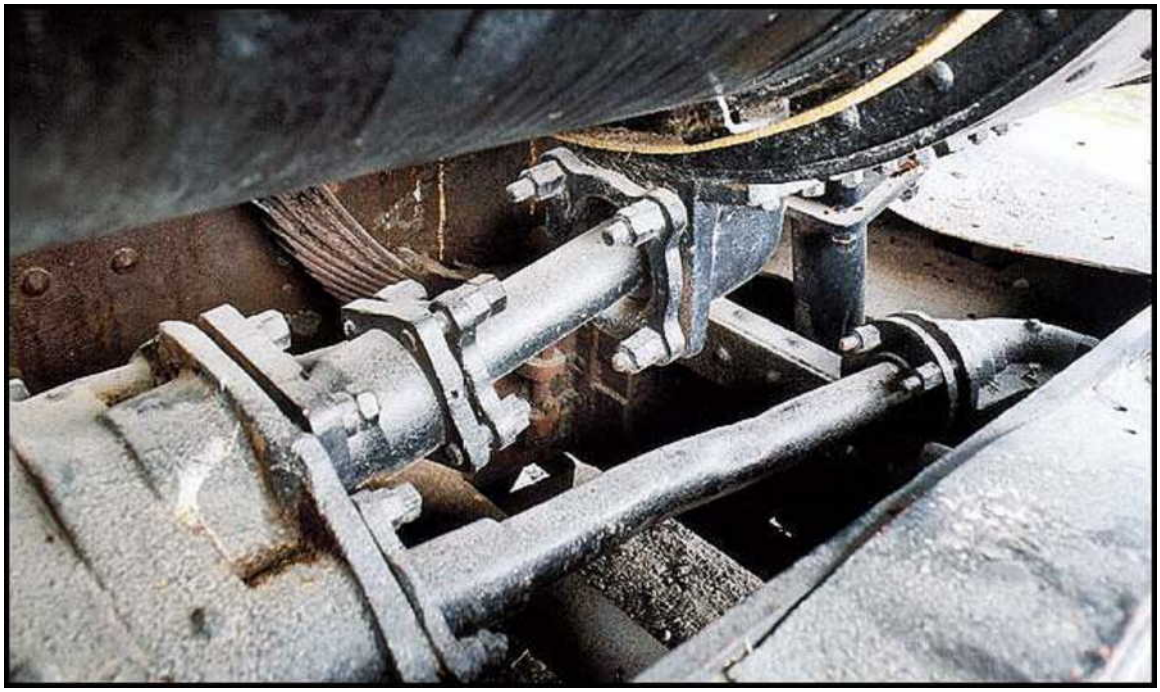
A view of the dilapidated backhead.

Note how the tender enters the cab in the same way as done by William Mason.



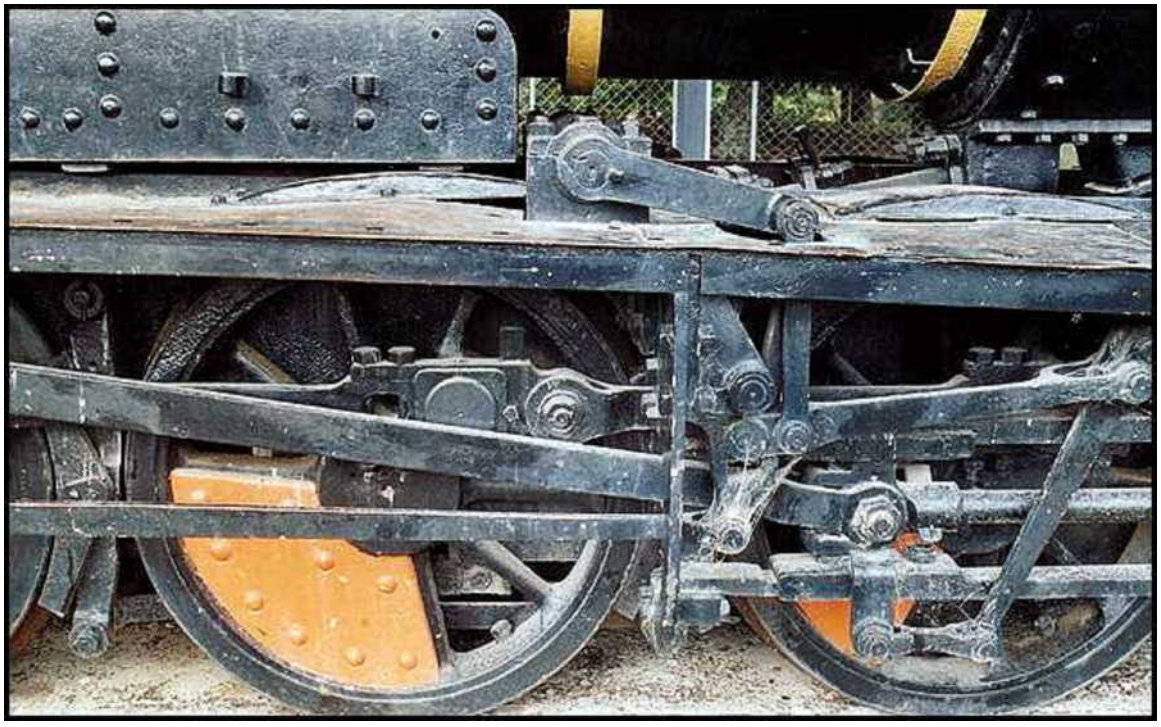


A close up of the boiler framing to which the pivot is mounted. Compare this to the rusty bearing plate of Torch Lake, as seen in Rich's photo above.

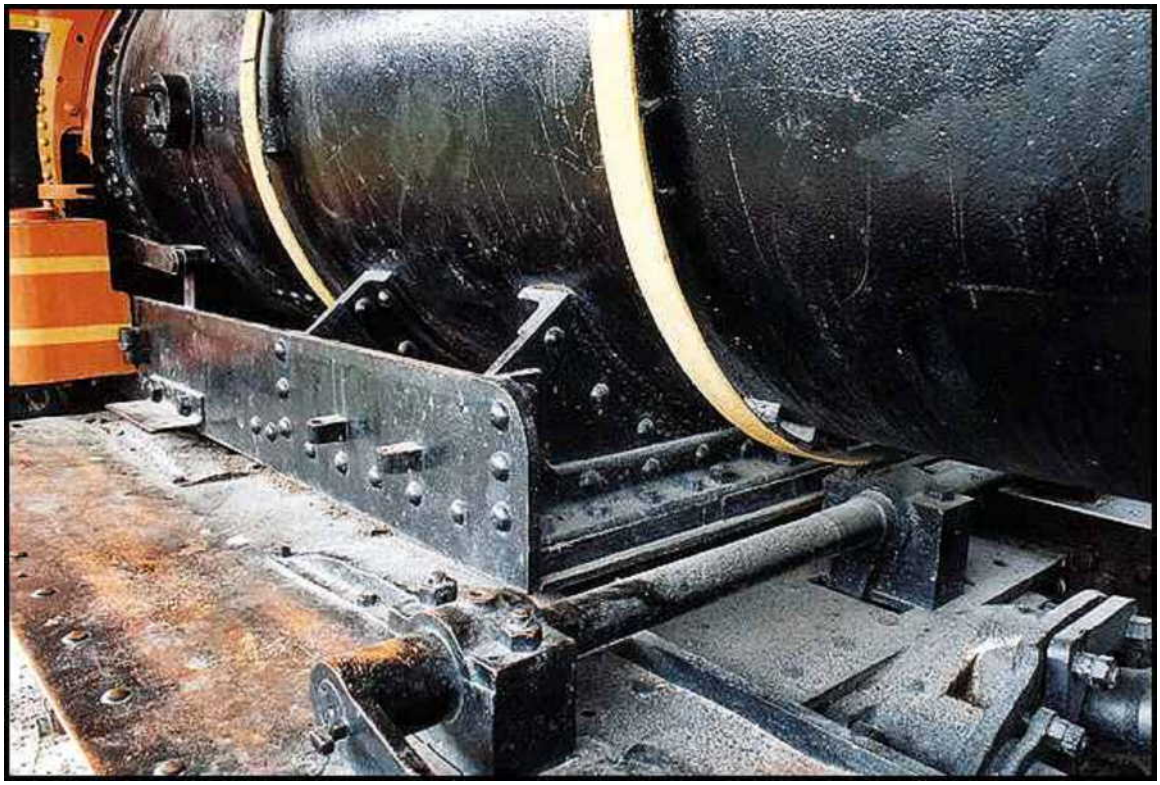


The complex Fairlie steam supply pipes. Steam comes from out of the bottom of the smokebox, runs to the rear via two ball/socket joints before entering this manifold to the left-hand side of this picture. Two pipes then exit this manifold and head forward to the cylinders. The manifold being well forward of the pivot means the supply steam line pivots via the ball and socket joints.

A view directly between the cylinders showing the steam exhaust lines from the two cylinders, converging into the vertical pipe to the smokebox above. Note how the vertical pipe exits the chassis deck via an elongated hole. Where Torch Lake uses a slot in the smokebox, this Fairlie's exhaust pipe also pivots via ball and socket joints.



Walschaert's valve gear is used on this 1878 locomotive, much like a Mason of that year. Note how the lifting rods remain with the chassis, and are moved via a forward reverse rod that runs along the chassis centre line just above the axles.



In this view you can see how the forward/reverse lever connects to the lifting rods at chassis centre, just forward of the chassis pivot.

To the very rear of the power truck is this sprung sliding plate arrangement. This forces the rear end of the chassis "down" onto the rails.

A view of the front end of the firebox. Note the forward dampers, like we made on our Mason models.

Not a large loco is our R-28. That's me sitting on a great piece of British engineering!

Right, now it's time to move onto the background section and learn more about the Fairlies. I'll handover to Chris Walas now.

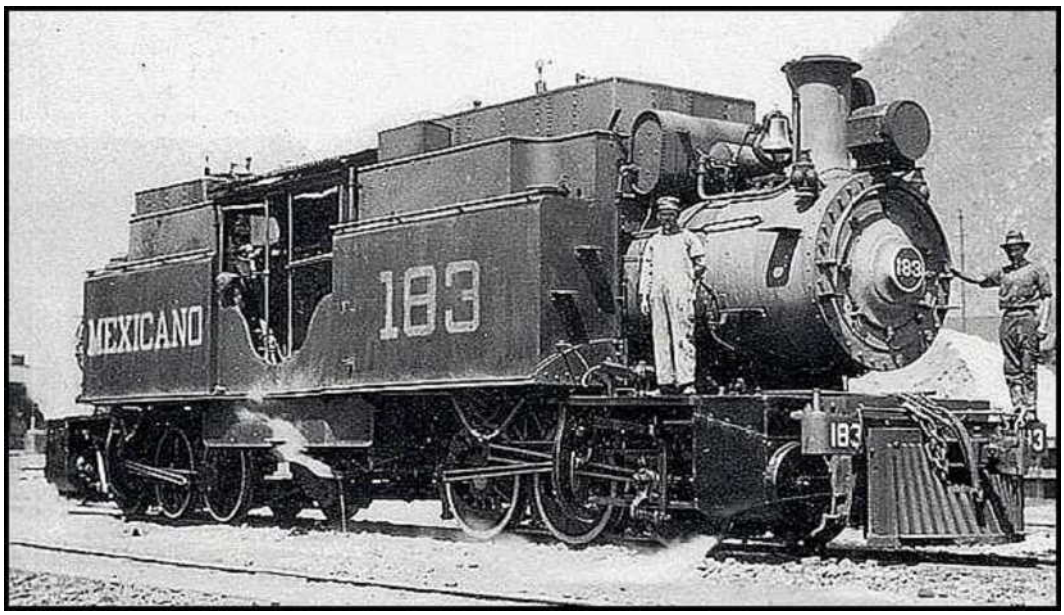


Photo courtesy Trackside Publications

Chapter 6 - Background

FAIRLIE INTERESTING FACTS

By Chris Walas

AUTHOR'S NOTE:

In the three years since this article was originally written, much of this information has come out in the forums and a number of fantastic articulated models have been built. But I do hope that this piece may still hold some new nuggets of information and interest for articulated fans. I think I've done my homework on this one, and I hope I've got it all right, but there's always the chance that I've missed something. So please, if you've got additional information or corrections (with some reliable support), let me know! In researching this article I was amazed at how much misinformation is out there!
-Chris

Fletch has already educated us quite a bit about William Mason, Robert Francis Fairlie, and particularly about the single Mason-Fairlies or, as we Americans call them, the Mason Bogies. But the Mason Bogies were only one small facet of the much larger story of the articulated steam locomotive. While the Mason Bogies were arguably the most beautifully designed and finely finished, they weren't the very first or the very last of the articulated designs, nor were they the best.

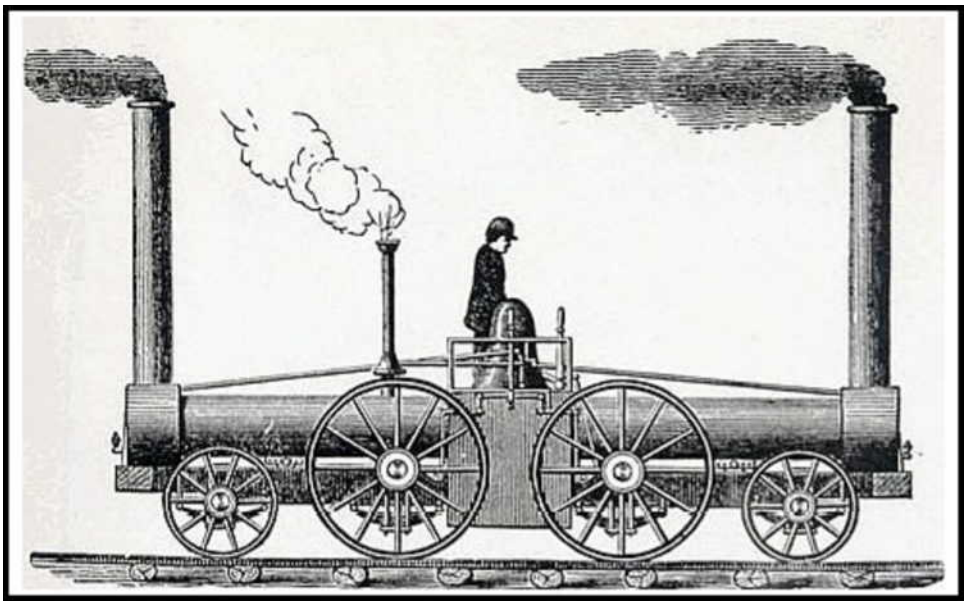
What I'd like to do in this chapter's background article is to provide a quick introduction into the five principal steam articulated designs: Fairlies, Meyers, Mallets, Kitson-Meyers, and the Garratt's. There are further developments and variations of several of these types as well as many "experiments" in articulation, but these five are history's best survivors.

After that, we can settle in for a closer look at the engine that really started it all (and my personal favorite)…the Fairlie. (Note: while Shays, Climaxes, Heislers, and other geared locomotives are technically "articulated", I'm putting them in a class by themselves and leaving the topic for someone else to do in another Master Class!)

David Fletcher has done a marvelous job in Chapter One of introducing us to "Fairlie's Dream" of the perfect locomotive, one with all the weight distributed on all the drivers; a locomotive capable of handling winding, mountainous curves and grades. It was specifically the winding nature of narrow gauge "surface" railroads that drove the development of "flexible" engines capable of bending with the turns. But while the designs were more often sponsored by the needs of the narrow gauge railroads, their application to, and acceptance by, the larger gauges was usually immediate.

THE BEGINNINGS OF ARTICULATED LOCOMOTIVES

The very first articulated engine in the history books that we know was actually built was designed by Horatio Allen in 1831. He was working for the South Carolina and Canal Railroad Company and felt strongly that as the demands of railroading grew, larger and heavier locomotives would be necessary, so he designed the world's first eight-wheeled locomotive, the "South Carolina".



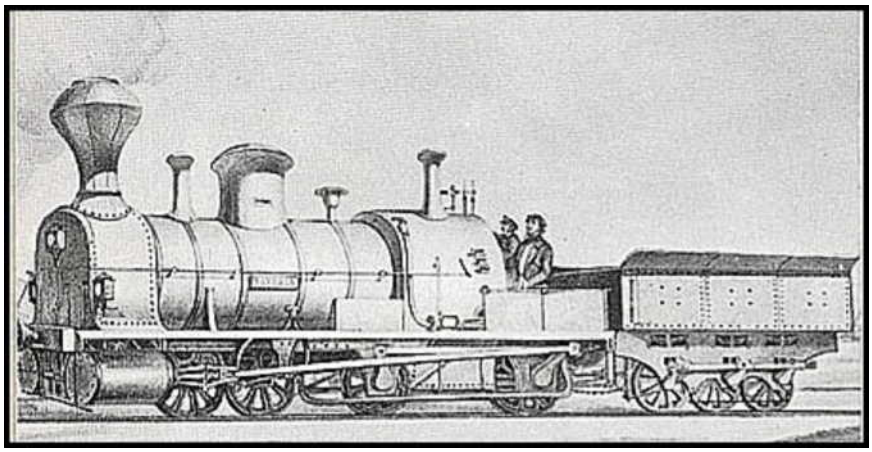
1831's South Carolina.

But he was way, way ahead of his time in his thinking. The South Carolina was not merely the first eight-wheeler in history, it was a double-boilered design with a firebox in the center and a smokebox at either end. It was, in a conceptual sense, the very first Fairlie engine. But it was even more unique than that because each of the boilers was made up of twin barrels side-by-side, like a shotgun, and instead of two cylinders per four-wheeled bogie, the South Carolina had only a single cylinder per bogie connected to the inner drive wheels at the center of the drive axle. This center-driven axle was meant to alleviate the side to side rocking of the usual twin cylinder arrangement, the double bogies allowed tighter curves, and the double boilers supplied maximum power to the individually cranked axles, which in turn reduced slipping. Oh, and it didn't have to be turned around. All in all, a most amazing design for its time. Unfortunately, it was a design many, many years ahead of the technology of the day. With leaky leather pipefittings and complexities well beyond most mechanics of the day, the South Carolina and her two sister engines spent the vast majority of their short life in the repair shop.

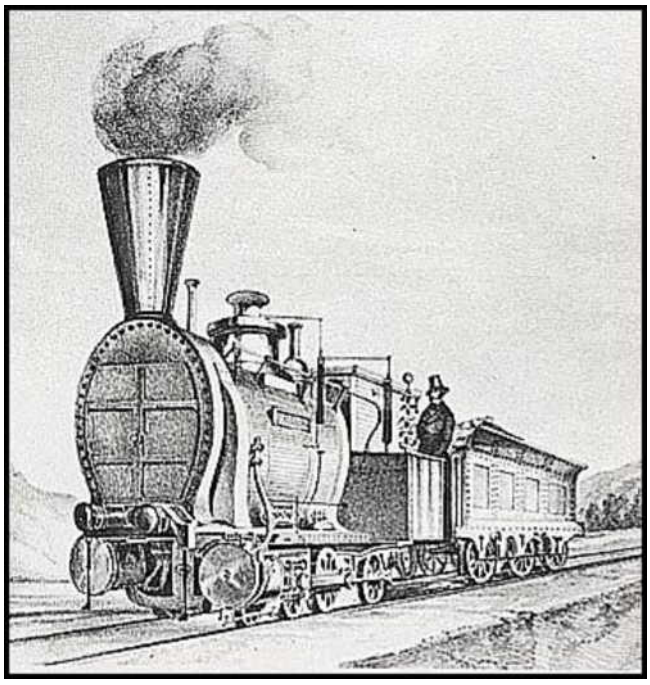
THE SEMMERING TRIALS

The real instigator of the articulated school of design had to be the Semmering Trials. These trials were held in an attempt to decide upon a locomotive type to be used on the Semmering grade (2 1/2%) in the Austro-Italian Alps. The trial conditions were simple; the locomotive, at a maximum axle load of seven tons (metric), had to pull a train of 140 tons upgrade at 8 mph. Locomotive designers from all over Europe were there to see what was hoped to be the birth of the "mountain engine". Anticipation was very high. There were only four entries;

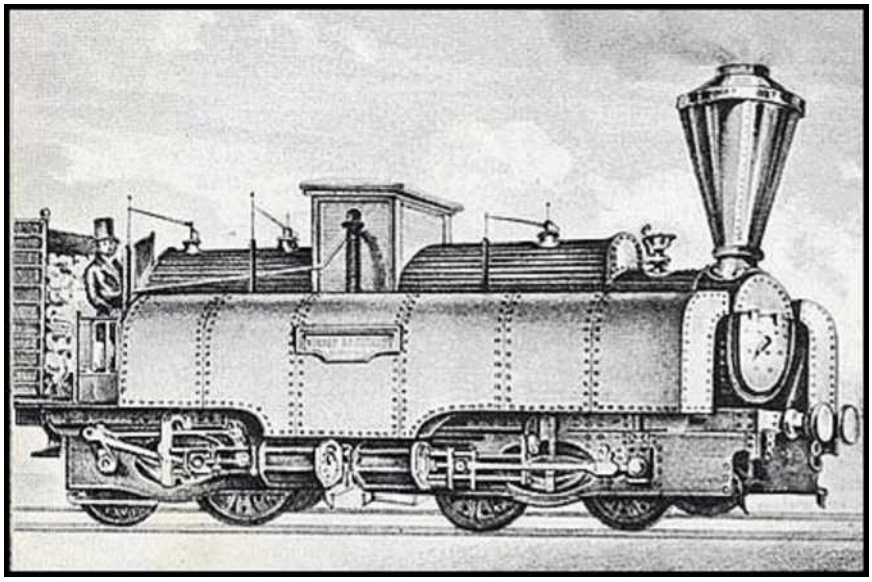
The *"BAVARIA"* was a 0-8-0 that had the first two axles mounted on a separate bogie and coupled to the rigid drive wheels by a chain. Other axles were also linked, including the tender's, so the Bavaria wound up with fourteen powered wheels!



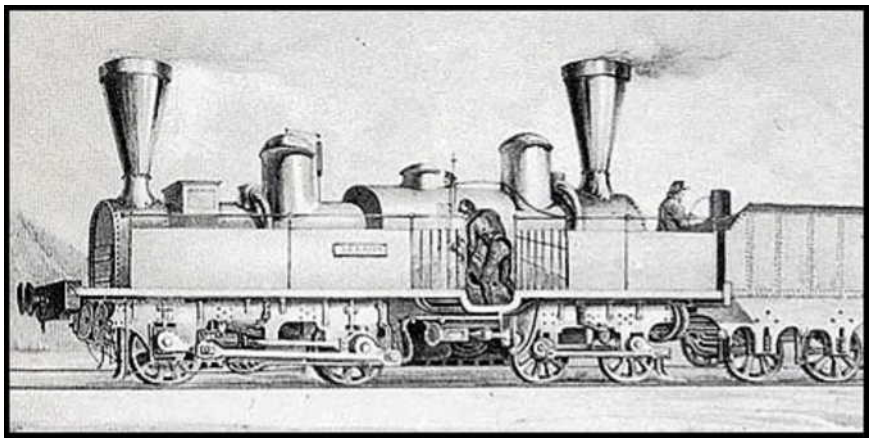
The BAVARIA.



The *"VINDOBONA"* (above) was a more or less standard rod-driven 0-8-0.



The *"WEINER NEUSTADT"* (above), a semi-articulated engine with four cylinders driving two sets of four drive wheels.



And last but not least, the *"SERAING"* (above), an articulated 0-4-4-0T.

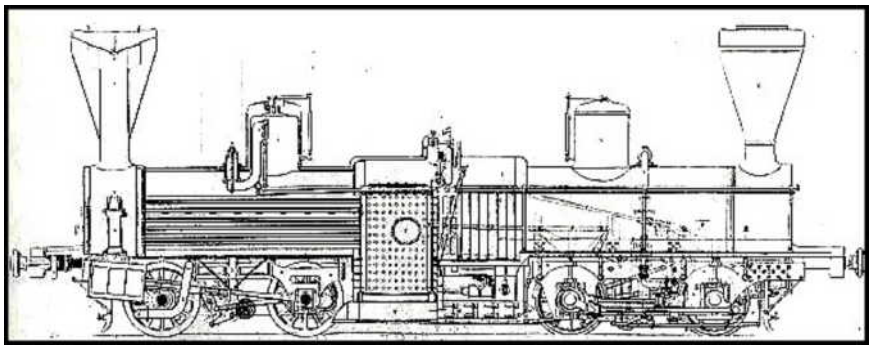
This picture is an artist's disproportionate depiction. The *"Seraing"* was in fact symmetrical, front to back. See plan below.

The trials were held in 1851 and must have been something to see indeed. Here were four very different locomotives and three very new and daring designs, all attempting what many thought was impossible. Sadly, they were absolutely right. None of the entrants managed to fulfill all of the final conditions. The declared winner of the trials was the *"Bavaria"*, which managed 123 tons at 11 1/2 mph. However, she just about self-destructed doing it and had to be immediately scrapped!

None of the designs were ever adopted by the railroad and entirely new engines were designed.

Now the interesting part comes in. The engine that turned in the positively worst performance was the *"Wiener Neustadt"*, but it got its revenge by fostering one of the most successful articulated designs (especially in the US), the Mallet!

The *"Seraing"* was in fact the very direct, even immediate, ancestor of the Fairlie type engine, having double boilers, side tanks, central firebox and two separate powered bogies.



But it would be a full fourteen years until Robert Francis Fairlie would introduce his design that would bring articulation into the spotlight for the entire world. We'll spend some time on his uniquely fascinating engines later, but for now let's move onto the Fairlie's first real competitor: the Meyer Articulated.

THE MEYER ARTICULATED

Four years before Robert Francis Fairlie took out patents for his articulated engine designs, another articulated design patent was taken out in France by a father and son pair of designers, Jean Jacques and Adolphe Meyer. The year was 1861, but it would be seven years before the first Meyer articulated would ride the rails, three years after Robert Fairlie had succeeded in attracting the attention of the world to his design.

The Meyer design utilized a single boiler, two articulated bogies, side tanks for water and normally a fuel bunker at the rear of the cab.

Although the Meyers had drawn up various designs for different engines over the years, the first engine to be built was *"L'Avenir"* (the Future) in1868.

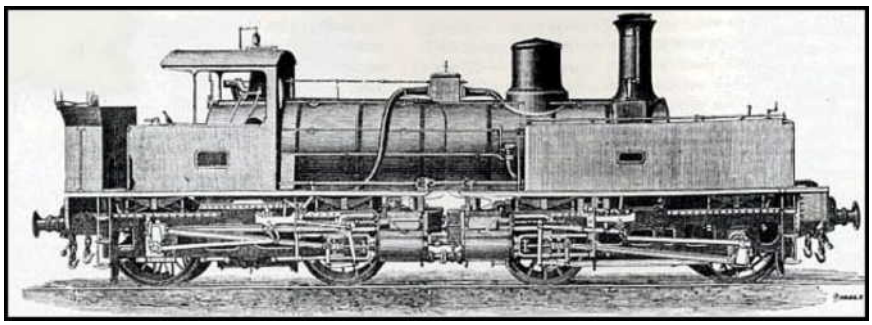
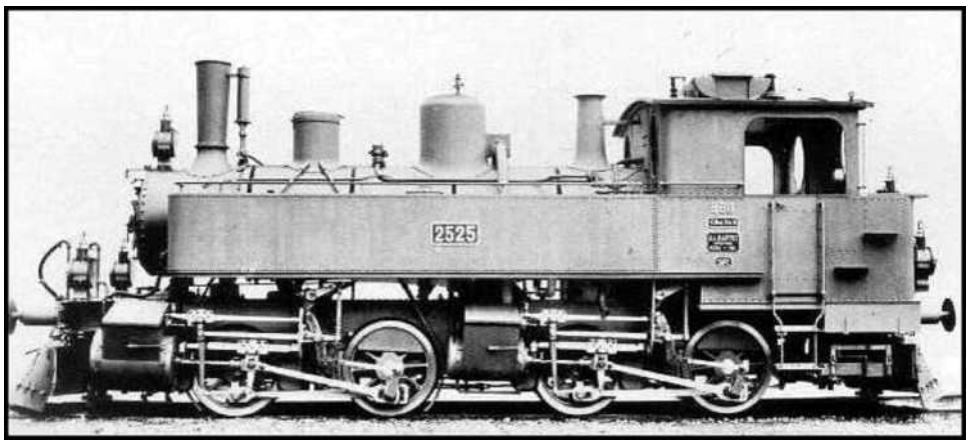


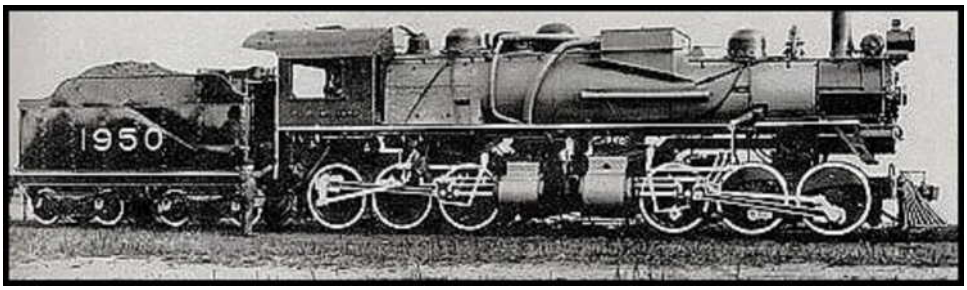
Photo courtesy Trackside publications

This engine proved very impressive for several reasons, the most impressive reason was that in the first 34,000 miles of operation L'Avenir required no repairs to its articulation or bogies whatsoever! This was particularly impressive when compared to the very disappointing weaknesses of the early Fairlie's articulation and very heavy maintenance requirements of the time. The Meyer was the only serious competition for the Fairlie during these early years of articulation and debate raged continually and heatedly over the relative merits of each design, but even the British bias toward Fairlies had to give room for the impressive performance of the Meyer.



A typical standard gauge Meyer engine from the Bavarian State Railway.

The Meyer design was to become relatively successful in Europe and particularly in Germany and was the standard engine on the narrow gauge (750mm) of the Royal Saxon State Railway for many years. Maybe some of our European friends can add additional info here, but I think all of the Saxon Railway Meyers were all 0-4+4-0Ts as well as all being compounds.



The Canadian Pacific built six of these 0-6+6-0 Meyers in 1909-1911, but the weaknesses of the Meyer design caused them to be rebuilt into conventional engines a few years later.

The Meyer proved a capable and versatile engine, but suffered from one serious weakness. In fitting the bogies together under the frame, space for the firebox was lost, and this shallow firebox simply couldn't fire up enough steam on long runs. It did well enough in more urban start-stop running, but this weakness allowed the design to be easily superceded by others.

THE MALLET

Something amazing happened to American Railroading at the St. Louis Exposition of 1904. A 240-ton, 80-foot long giant locomotive captured the eyes and hearts of American Locomotive designers and awed a stunned public. It was a thing never before seen on this continent and its twelve driving wheels were a sight to behold. It was a locomotive that would define the biggest, longest, and heaviest American steam locomotives ever to be built. This was the Baltimore and Ohio's number 2400, later to be lovingly known as *"Old Maud"*, and she was the first of a long line of stunning engines that many consider the ultimate in steam design. And whom does America owe a tip of the hat to for this? None other than Robert Francis Fairlie! It was while riding on a Fairlie double boiler engine in Mexico that Leonor F. Loree, president of the B&O, realized the value of a double bogied engine. But instead of a Fairlie, he chose to follow the design of Anatole Mallet when he asked his manager to come up with an articulated design. More's the pity! Imagine if he'd stuck with the Fairlie design; what would a Fairlie Big Boy look like?

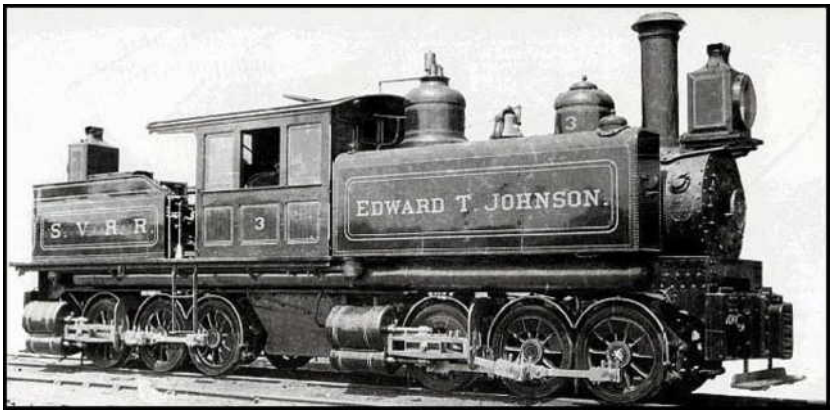
While the 2400 amazed everyone with its superior performance, and while it paved the way for thousands of American Mallets, the fact is that by the time the B&O unveiled Old Maud, there were almost four hundred other Mallets working in various parts of the world. And to be strictly correct, what we call a Mallet is actually only a Semi-Articulated engine. The Mallet as we know it is comprised of two powered bogies under one boiler, but only the forward bogie is articulated. We also tend to lump all semi-articulateds under the name Mallet when they really came in two varieties, simple articulateds (or simple Mallets) and true Mallets (or Compound Mallets). Both locomotives share the same configuration, but a simple articulated does not have the compounded cylinders that a true Mallet has. Compounding is the system by which steam is used twice; initially in a set of high pressure cylinders, after which it is then sent to the next set of low pressure cylinders in the second bogie. Compounding was really Anatole Mallet's main concern and articulation more of an afterthought. When the US adopted Mallets as their premier freight locomotive, they were built as true Mallets. But shortly after, builders switched to simple articulateds and many of the compound Mallets were rebuilt as simple articulateds.

This 1937 Henschel-built 2-8-8-4 had the largest boiler of any narrow gauge engine.

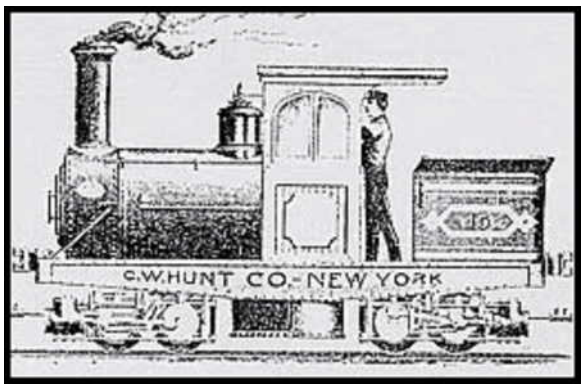
While I'd like to go into all the why's and wherefores of the American Mallet Articulated story, it's too much for this simple overview, so I've got to gloss over this important section of American and World Railroading History. Suffice it to say that by the 1920s, virtually all of the heaviest pullers on all of the major American lines were Mallets. The American manufacturers Baldwin and Alco particularly affected the Pacific market by producing many Mallets for logging and plantation use. Here in the States, mainline Mallets were usually tender engines while the logging lines preferred a side tank engine for the additional adhesion. While the Mallet design is usually admitted by most to not be the best articulated design, America's solid commitment to it created some of the very most impressive steam engines ever built.

THE KITSON MEYER

It's really a bit surprising that it took over twenty years to put into place a basic improvement on the Meyer design. In 1894 the first official "Kitson-Meyer" locomotive was unveiled by Kitson and Company of Leeds, England. It was an impressive engine that had been lengthened to allow room for the firebox to hang down to its normal position, giving the design its much needed ability to maintain a good head of steam. It was in all ways an entirely new type of locomotive…except for the fact that it simply wasn't. Embarrassingly, here on our side of the pond, two years earlier (1892), none other than Baldwin Locomotive Works had produced the Vauclain compounded "Edward T. Johnson", without question the first of the type. Kitson & Co. denied any knowledge of the Baldwin development for years, even to the point of having to make public statements of denial as late as 1920!



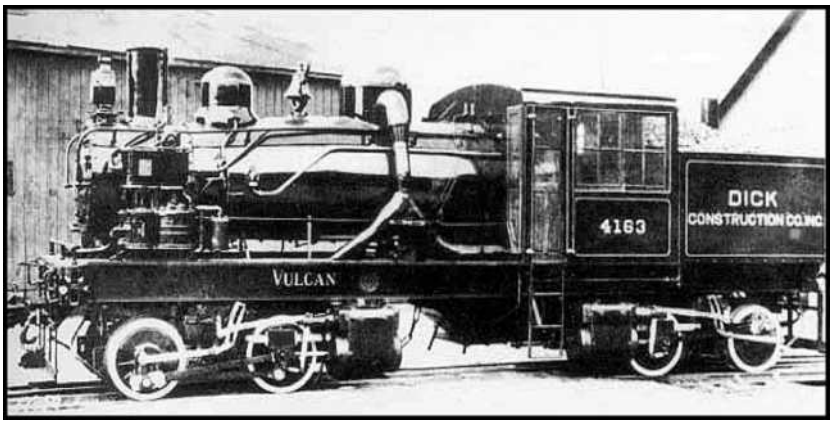
The Kitson-Meyer was not a bad design and had a lot going for it. It had begun to prove itself in the world only to be overshadowed by later developments in locomotive design. There's every reason to believe that had the Kitson-Meyer improved firebox design appeared earlier, that it would have been the premier articulated design for a good long run.



Courtesy Trackside Publications

Here's a little Kitson-Meyer that was sold by C.W. Hunt Co. in the late 1880's. This company specialized in narrow gauge industrial supplies and it's believed that these particular engines may have been built in Europe and imported by C.W. Hunt. Great little articulated to model for really tight curves!

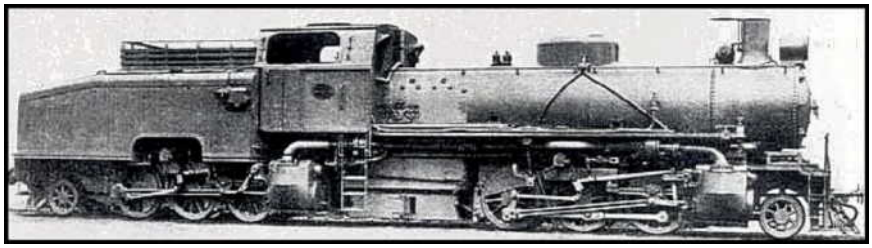
The Kitson-Meyer went on to be developed in several different ways in different countries, even here in the States where the Vulcan Ironworks of Pennsylvania built engines of what it called the "Duplex" design.



These Kitson-Meyer engines were hoped to be an effective alternative to the growing popularity of Heisler engines in industrial railroading, but only seven locomotives were built. Even so, they managed to be built in four different gauges!

Here's a Kitson-Meyer built out of a Shay!

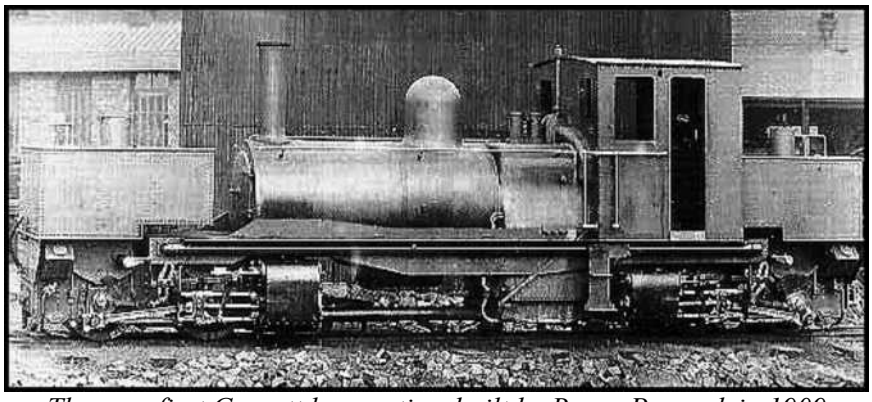
In Belgium, the Kitson-Meyer was developed into the *"Golwe"*, designed specifically for the French Colonial lines in Africa and production of these was limited.



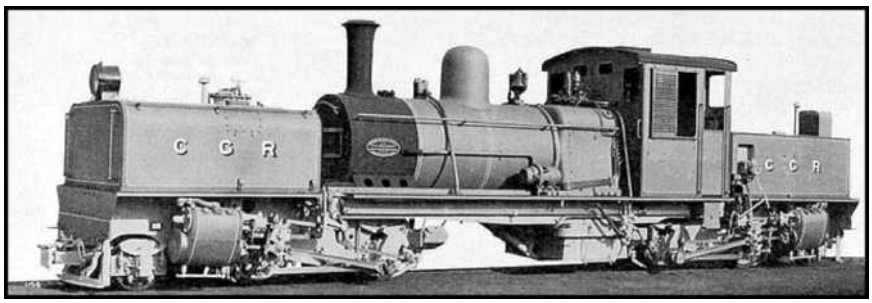
The Golwe was developed as a direct alternative to the Mallet and was built as 2-6+6-2s and the larger Super Golwe 2-6+6-4s.

All in all, the Kitson-Meyer was a very effective and workable design that probably would have seen a much greater success had it not been for another design that would soon render the Kitson-Meyer a thing of the past.

THE GARRATT


The very first Garratt locomotive, built by Beyer-Peacock in 1909
for the Tasmanian Government Railways North East Dundas Tramway. 2ft. gauge!

Ah, well, my friends I'm afraid that no matter what kind of articulated engine you hold dear to your heart; no matter how magical a Fairlie is to me or a Mallet is to you, the facts are undeniable when it comes to the engine designed by Herbert William Garratt. Of all the articulated designs, the Garratt simply cannot be beat. An absolute wonder of technical engineering, the Garratt locomotive accentuates the positive and eliminates the negatives like no other articulated steam engine in the history of railroading.



Ceylon Government Railways

Herbert William Garratt was an Englishman, (not an Australian as has often been reported). Although a talented painter, his only real love was the railroad. Garratt spent much of his railroad career in different parts of the world as superintendent of various lines where he "shaped up" rather questionable operations into functional realities. While he endeared himself consistently to the workers and operators of these lines, he seemed to have a knack for running afoul of the managers and owners. He almost invariably was either let go or walked off the job himself. But (and this is an important one) he learned much from his experience. Over a period of years he developed his idea for an improvement in locomotive design to address the difficulties and limitations of (particularly) narrow gauge, mountainous railways. Maximizing the space available for both the boiler and firebox as well as minimizing the load per axle on light rail, Garratt came up with a completely novel and yet simple approach to the steam engine.

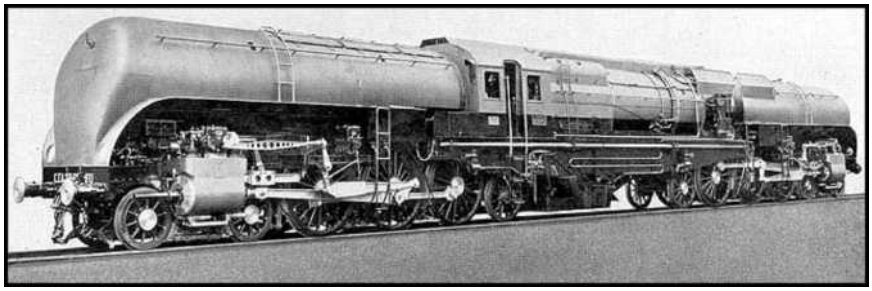
Randfontein Estates Gold Mine #R17.

A Garratt engine is defined by having two power bogies with the boiler carried on a frame slung between them. Each bogie usually carries a water tank and one has an additional fuel bunker (most often on the rear bogie).

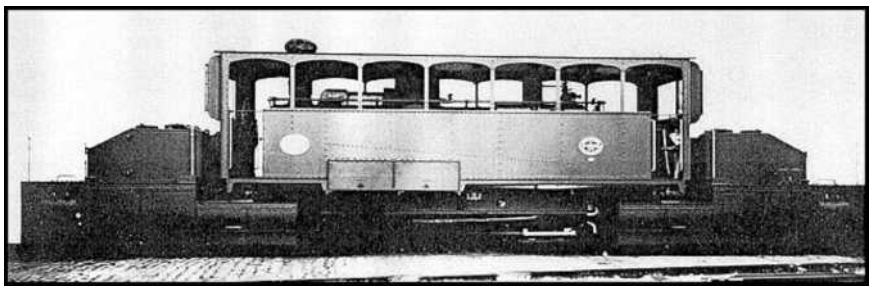
The patent rights for Garratt locomotives were granted to the Beyer-Peacock company and those Garratts built by that firm are referred to as Beyer-Garratts. Over a thousand Garratts were built by Beyer-Peacock, while eighteen other firms built an additional six hundred and twenty-eight. Garratts found their way into almost every corner of the world except North America, where Mallets held the entire articulated field almost exclusively. Still, the design was strong enough for ALCO to have licensed the patent and drawn up preliminary designs.

Many authorities believe that had steam continued in America, the Garratts would have certainly made their appearance here. As it was, even after steam had disappeared in various parts of the globe, Garratts continued to be built for many years.

While the early Garratts were small, narrow gauge engines, the design was destined grow and grow to include the heaviest narrow gauge steam engines ever built! And the styles of Garratts varied as much as any steam configuration, maybe more!



Here's an Algerian Garratt Streamliner!

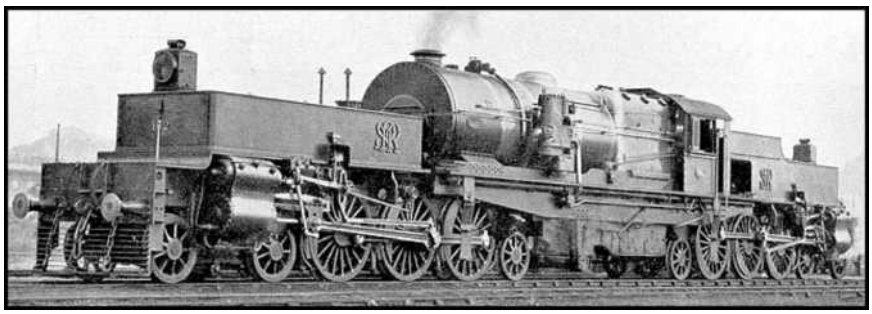


And how about SNVC Belgian Secondary Railways
Class 23 engine for something different!

For a great selection of Garratt photos online, check out Gavin Hamilton's great site at:

http://users.powernet.co.uk/hamilton/source.html

Thanks, Gavin for the use of these photos.



#162 Express Garratt of the Sao Paulo Railway.

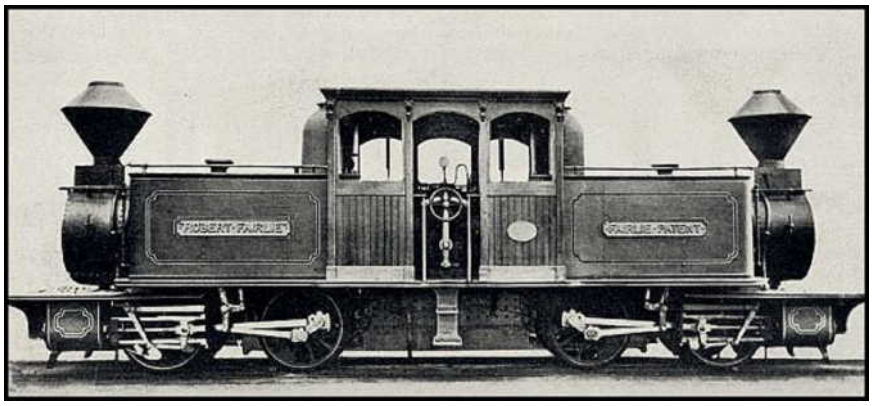
Garratts were very successful in almost every corner of the world, but the African railways used the largest number of these engines by far and the largest Garratt engines were built for there and Australia. These Garratts reached the height of the design and proved the strength of the Garratt.

Australia!

Africa!

Garratts stayed in operation for many, many years in Africa after the age of steam passed elsewhere in the world, but like all steam, its ruling days were doomed by the inevitable incursion of the diesel.

FAIRLIES! FAIRLIES! FAIRLIES!



Here's the 1874 "ROBERT FAIRLIE" destined for Norway's 42" State Railway. This engine shows the typical configuration of a double boiler Fairlie; Two separate boilers placed back to back at the fireboxes; smokeboxes at the far ends; two separate powered bogies, one under each boiler, and a central cab. If there is a standard cab for these engines, it's this wood one with center wide door and a single window on each side. This particular engine was later rebuilt as the "GOVERNOR CAIRNS" for Australia.

Ah, Fairlies! I love these engines! If Alice in Wonderland had a steam locomotive in it, it would have to be a Fairlie! The elegant yet whimsical symmetry! These were the locomotives that launched the railroading world into the wonders of articulation as well as drove the world's interest in Narrow Gauge railroading. Robert Fairlie set the basics of the design at the outset and numerous improvements along the design's history did nothing to change the basic arrangement; two powered drives (bogies) articulated below a double boiler that was joined at the firebox. The engineer and fireman were completely separated from each other by the firebox and as the fireman had the challenging task of dealing with two fires simultaneously, the job of regulating the water was given to the engineer! The vast majority of Fairlies were built to either the 0-4+4-0T or 0-6+6-0T configurations with the six-wheel bogies always employing a flangless center wheel. There were a few built or rebuilt with pilot and trailing wheels, but most of these were considered unnecessary in use. The double-boilered (or double-ended) Fairlie was considered a freak of locomotive design by many railroads simply because of its unorthodox design and much of the bad reputation of the Fairlie locomotives was propagated by railroaders who never even saw one in person! While there were definitely problems with the Fairlie, especially early on, many lines were quite happy with them, as in the Toronto and Nipissing Railway where their lone Fairlie, the Shedden, was considered the pride of the line.

Mason built only one double-bogied engine (the JANUS), and the rest of the Mason-Bogies, also known as Mason-Fairlies, had single drive bogies. Conversely, Fairlie designed and built relatively few engines with single drive bogies. He and many others considered the Single Fairlie "only half of a good idea", as not all the weight was placed on the drivers. Still, Fairlie and his constituents did produce a number of these single boiler designs, particularly early on. Some were in service over twenty years, while others lasted only a few months in service. The uneven careers of these single boilers reflected the same uncertainty and checkered careers that the early Fairlie double-boiler engines suffered continually. Much the same as the South Carolina many years before, the Fairlie design was slightly ahead of its time, at least as far as the technology of the day was concerned. Numerous problems plagued the design from the start, the number one problem being the steam connections. The early Fairlies had no articulation in the steam pipes at all and merely dealt with the bogie's movement simply through the innate flexibility of the metal pipes themselves! Seals and support springs were made of gum rubber (natural latex), a material subject to rapid deterioration under most conditions.

The maintenance of these engines in general was considerably higher than a normal engine. After all, two boilers, two drive units and all the accompanying valve gear, plus the leaky, creaky articulation added up to a shopmaster's nightmare! It's no surprise that maintenance crews in far flung corners of the world without ready supplies had problems dealing with Fairlies.

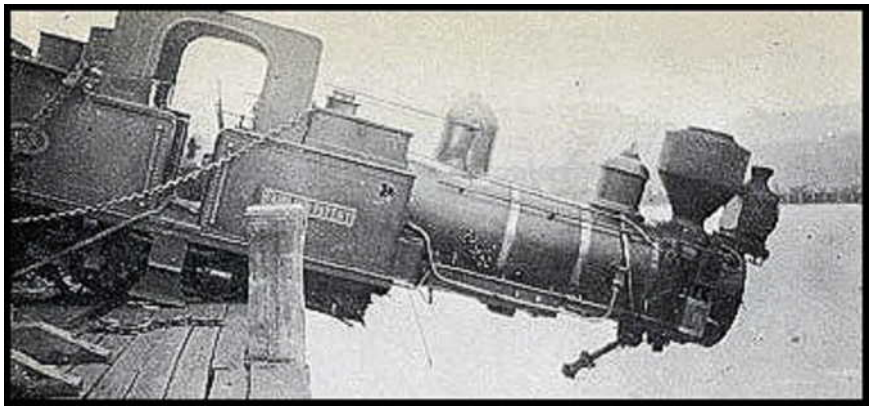
The design was also limited by the amount of fuel and water that could be carried at any one time. This severely limited the design's use in arid conditions and remote lines.

Another of the consistent complaints was the small space allotted the crew. As the engineer and fireman could only use the space available at each side of the boiler, and as the boiler needed to be as wide as possible, the cabs turned into very shallow work spaces indeed. The fireman got the worst of the deal because there was often barely room to open the firebox doors! This was particularly true in England where the narrow loading gauge forced many a fireman to work with his rear end hanging outside the cab!

In fact, this was the Fairlie's fatal design flaw. During its reign, the Fairlie overcame its articulation weaknesses. Bogie articulation became stronger and more dependable; steam pipe connections were made leak proof, and various methods were employed to carry more fuel and water. But past a point there was simply nothing to be done to find more space for widening the boiler, which in turn defined a size limitation on just how big a Fairlie engine could ever get. As railroads demanded larger and more powerful locomotives, the Fairlie just couldn't grow enough to compete.

Yet with all its faults and shortcomings, the Fairlie was not an unsuccessful design by any means. Hundreds of Fairlies were built by thirteen different locomotive manufacturers. The wheels of Fairlies graced the rails of England, Ireland, Wales, Canada, Peru, Chile, Uruguay, Venezuela, Brazil, Cuba, Australia, New Zealand, India, Burma, Norway, Sweden, France, Luxembourg, Germany, Portugal, Russia and, yes, even the D&RG's "Mountaineer" here in the good ol' US of A. They were also built to a variety of gauges; 2',30", 3', 42", 3'7"(Brazil), standard gauge as well as five –foot broad gauge! The design had a decent life from its inception in 1865 to operating locos well into the 1920's.

Fairlies had a history and reputation as something of a failure on most railroads for a variety of reasons, but under the right conditions in the right places, Fairlies ruled. Single Fairlies in particular proved disappointing in most applications, having less power and most of the shortcomings of the double-boiler version. Even though the single-boilers were used almost exclusively on light passenger traffic, they offered little to recommend them over traditional fixed chassis locomotives.



My favorite photo of a Single Fairlie! A New Zealand “R” class couldn’t stop its consist in time and was pushed over the edge of the loading dock! The articulated bogie dropped off and into the salty deep, leaving the rest of the engine (and crew!) safe and sound!

On normal, even, and relatively straight track , even the double-boiler Fairlies showed little or no advantage over standard designs of the day. However, in the difficult, steep, windy, mountainous terrain of Mexico, the Nitrate Railways of the Chile/Peru border, and the Russian Trans-Caucasian Railway, the Fairlies found the ideal conditions to prove themselves not only the equal but the superior of any other existing contemporary motive power. Here, in what were probably some of the most challenging environments for railways on the planet, the Fairlie design proved to be everything that its originator had intended it to be.

While the basic configuration of Fairlies never really changed (with just a couple of exceptions that we'll look at later), the design had a number of unique looks across the globe and over the course of its time. Cabs varied from wood to metal, very open to completely enclosed. There was even a special, unique cab design for South America consisting of two separate sections of roof, one over the engineer’s area and one over the fireman's area with an open area directly above the firebox. Most of the South American Fairlies used these very open cabs;

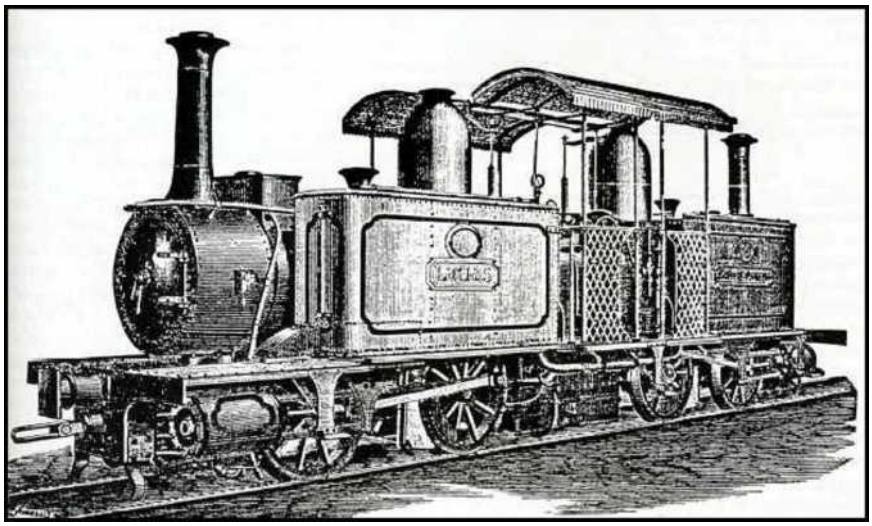


Photo courtesy Trackside Publications

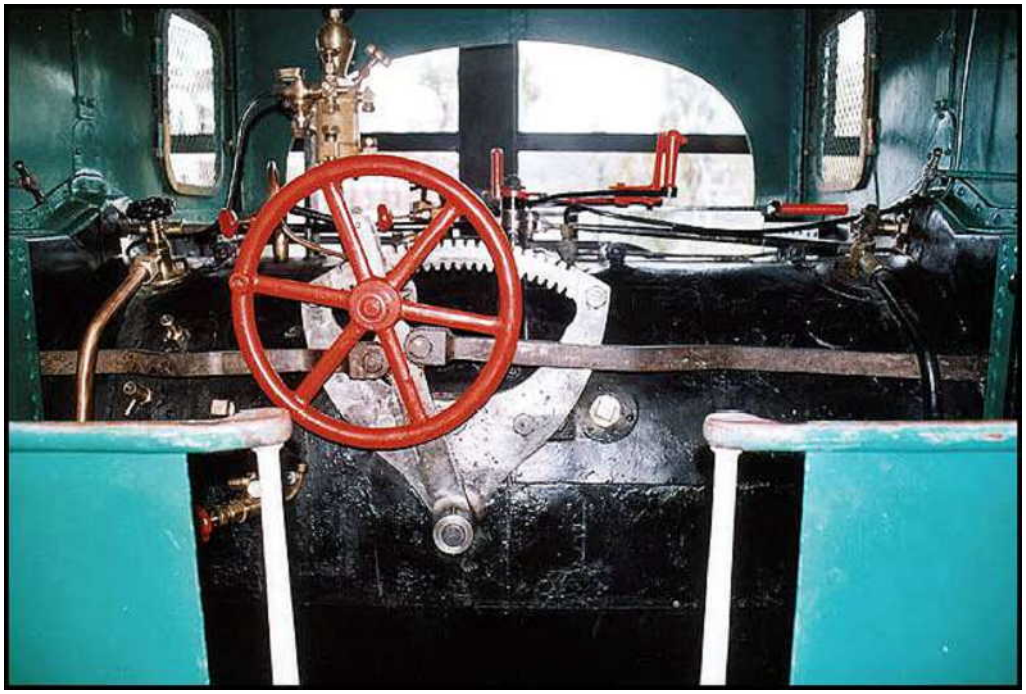
Here’s the Lagunas (1872) of the Patillos Railway of what was then part of Peru.
It shows the typical "South American” cab that most of the Fairlies of this area sported.

Three of the very earliest Fairlies were sent to Australia for the Southern and Western Railway of Queensland in 1866. At this time, locomotives that were sent overseas were shipped dismantled and crated. Two of the Australian Fairlies were uncrated and assembled and put through a series of performance tests. The disappointing results of these tests were to haunt Fairlie for many years to come. These early engines suffered horribly from steam seal problems. But these Australian engines had other problems as well. Poorly designed bogie springs and badly placed eccentrics (outside the frame but behind the drive wheels!). The engines performed so poorly that the third engine was never even uncrated and all were returned to Fairlie with a grumble and a huff. The Australians in essence called the Fairlie design a piece of junk, while Robert Fairlie blamed the Australians' poor assembly and maintenance as causing the failures. Bad maintenance or not, the three engines were completely rebuilt upon their return with new valve gear and tanks. The engines continued to be rebuilt through different owners and never did turn in a decent day's work.

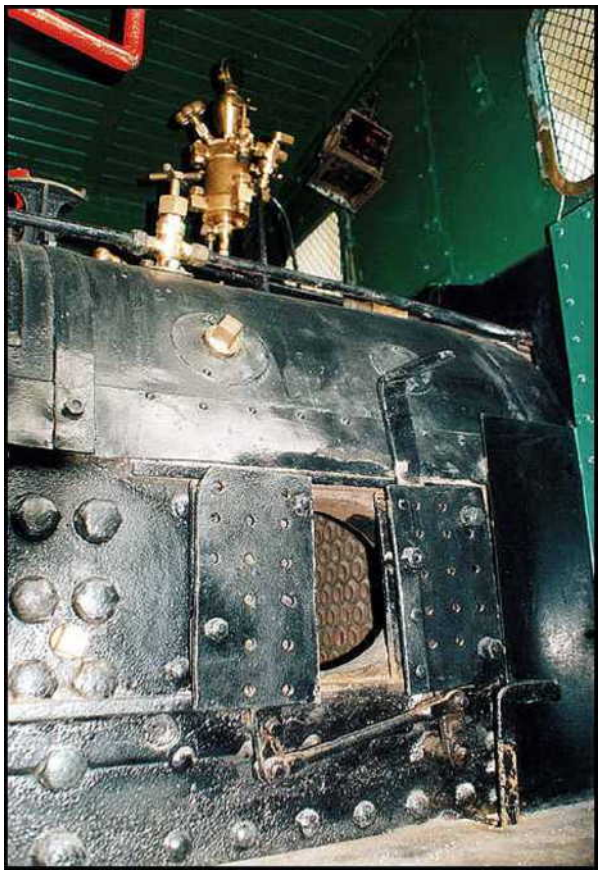
That didn't stop Australia's little neighbor, New Zealand, from taking the plunge in 1872, when two Vulcan Fairlie double-boiler 0-4+4-0T's showed up. These were the JOSEPHINE and the ROSE.

Josephine still exists in a museum today, at the Otago Settlers Museum in Dunedin, NZ.

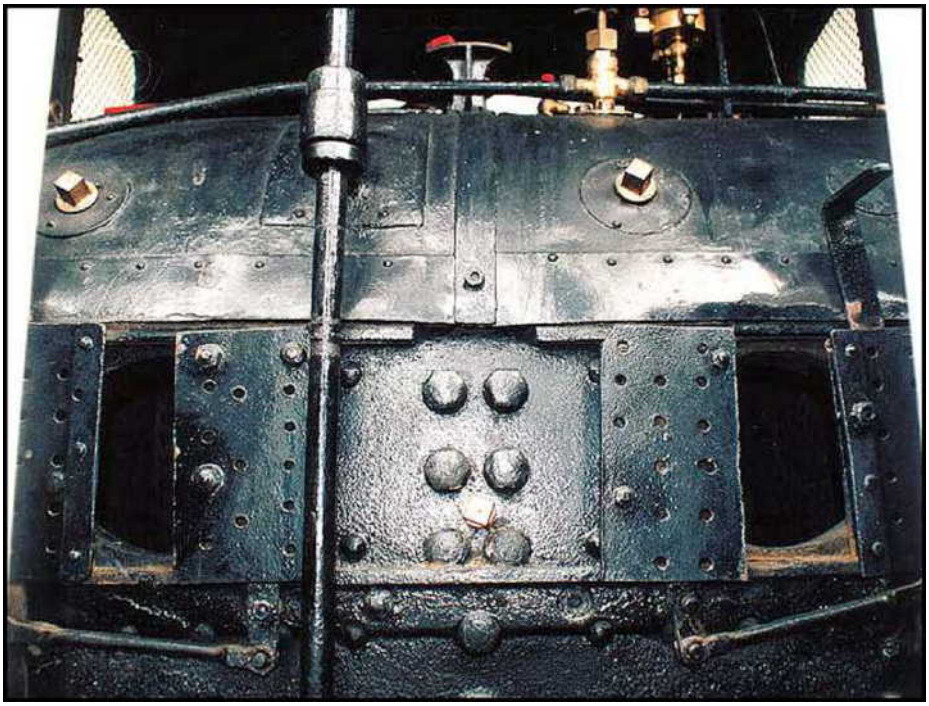
We're very fortunate to have these color photos of Josephine, as she looks today, captured by our MLS roving reporter, David Fletcher himself!



Here's the driver's (engineer's) side with a good view of the Reversing Lever (wheel). While the wheel was the typical control for this, many Fairlies had a more standard style Johnson bar.



Here's one of Josephine's firebox doors. Fairlie designs were only generally standardized, and many variations existed. Elements of the locos changed as improvements were incorporated, but different manufacturers had their individual design elements to add as well.



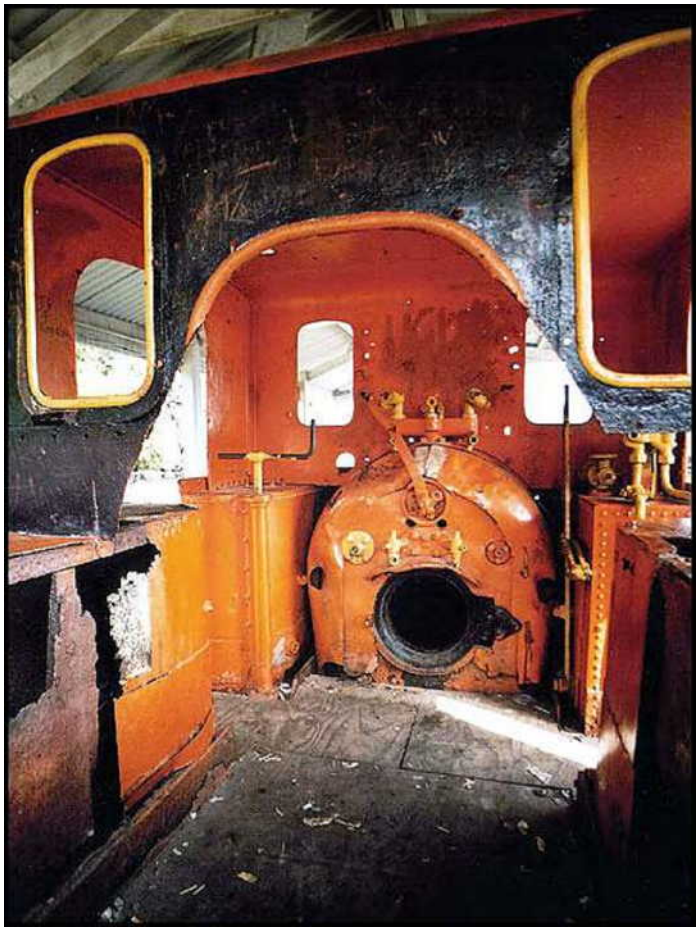
A view of both fire doors on the fireman's side - what a job he had!

Leave it to intrepid Dave to get under the bogie! Here's a shot of the steam pipe arrangement (interior bogie chassis).

Her sister engine had a much shorter life, being scrapped after a head-on collision in 1878. But the design had a career there and Fairlies appeared in a variety of colors and trims, mostly greens and reds. New Zealand also became one of Fairlie's biggest customers of Single Fairlies and here they proved to be the successful exception. Australia even wound up buying some of the used ones! Mr. Fletcher once again comes to our aid with photos of the Avonside single Fairlie, R28, on display at Reefton, NZ.

Here's out Master Class Master on R28!

R28 isn't in the best of shape...



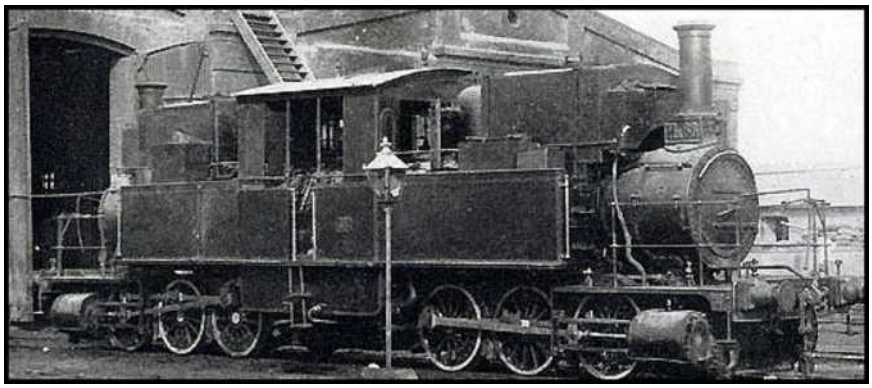
...as this interior shot shows! A pity all the more for the fact that R28, outside of the Ffestiniog Rwy. and the Mason-Bogie Torch Lake, is the only remaining Single Fairlie in the world. The style of the R28 is typical of the limited number of Single Fairlies produced.

I should say here that, unfortunately, the existing records of Fairlie engines are rife with misinformation and uncertainty as well as being woefully incomplete. Robert Fairlie himself is responsible for much of this. He swapped shipments, claimed successes with engines that no longer existed, and generally stretched whatever information he could to present the most positive appearance to the public. Fairlie was continually rebuilding and upgrading locomotives and claiming them as entirely new constructions.

At any one time it seemed as if there were more Fairlies running on more railways in more places than might actually be the case. Also, many of these engines were purchased by railroads that didn't keep the best of records, resulting in more than a few mystery Fairlies. This, coupled with the fact that most Fairlie manufacturers were located in England where many records were destroyed in WWII, adds up to at best an incomplete picture of the Fairlie story.

More often than not, Fairlie Patent locomotives distinguished themselves only as high maintenance, finicky disappointments and most railroads didn't really want to hear the name Fairlie after a number of years, despite the design's continual improvements. But Fairlies did find a niche in the world in at least three different areas.

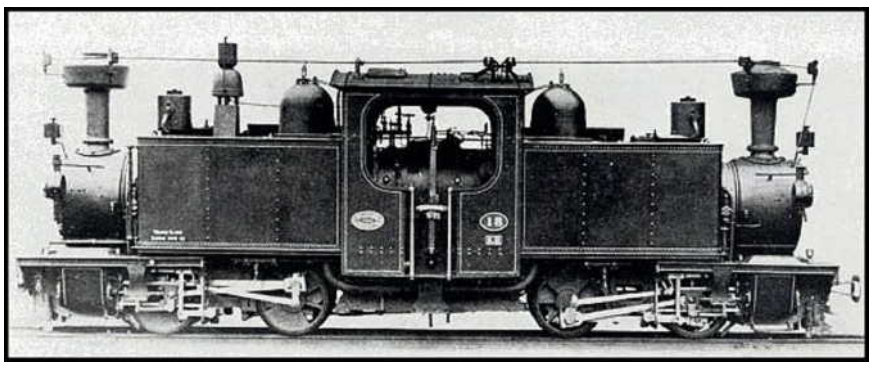
Early in 1871 an Imperial Russian Commission recommended that a 42"narrow gauge railway be built in Russia. The recommendation was based on a visit to the Festiniog Railway, demonstrations of the locomotive Little Wonder, and conversations with that most impressive and influential promoter, pamphleteer and salesman, Mr. Robert F. Fairlie himself. Five 0-6+6-0T Fairlies were delivered to Russia the same year. One improvement made at this time was the adoption of a support frame for the boilers that the bogies pins were attached to, adding strength and stability.



An 1871 0-6+6-0T upgraded to burn oil for the Trans-Caucasian Rwy.

Forty-five Fairlies were used on the Russian 5ft. gauge Trans-Caucasian Railway. This railway was partially made up of earlier lines and as such, it utilized twenty-eight existing Fairlies from those lines. In addition, the Kolomensky Works of Russia built an additional seventeen 0-6+6-0T Fairlies. These engines were used to haul oil from the developing oil industries over the steep Souram Pass in the lesser Caucasus range and although they were originally built as wood burners, they were all eventually converted to burn oil.

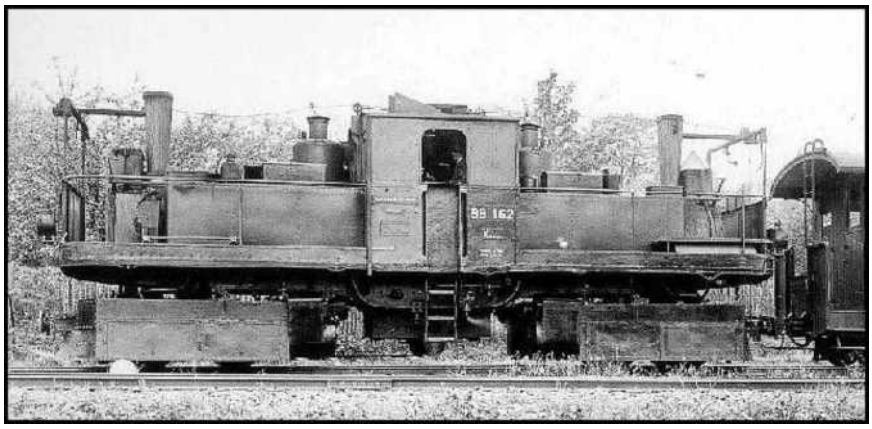
Northern Europe was host to a selection of Fairlies in Sweden, Norway and Germany. Two 0-4+4-0T'swere built in England for the State Railways of Saxony, a 2' 5 1/2" (75cm) gauge line. While they were English built, they nonetheless had a very unique look. These locomotives were considered expensive to run and were later replaced by the much more successful Meyer articulateds.



The Saxon Railways also hosted the only compound Fairlies ever built, which were built by the Saxon engine works in 1902.

Here is one of the few existing double Fairlies in the world, and probably the oddest of the bunch. This engine has been restored and is displayed at the Dresden Verkers museum. Here's an opportunity to model a Fairlie without having to worry about any rods or valve gear!

This was indeed a rare bird and I'm not sure how anyone could have been convinced into a double boiler with compounded cylinders like a true Mallet. Apparently the steam from both boilers had to be run to the high pressure cylinders and then all the way back again to the low pressure cylinders, and then once again divided and sent to the two separate smokestacks! Considerably more steam travel than a standard Mallet configuration! But it must have worked well enough, because two of the three built were still in operation in the early 1960's! These engines were also unique in that the cylinders from both bogies were pointed inward as opposed to the usual outward positions.

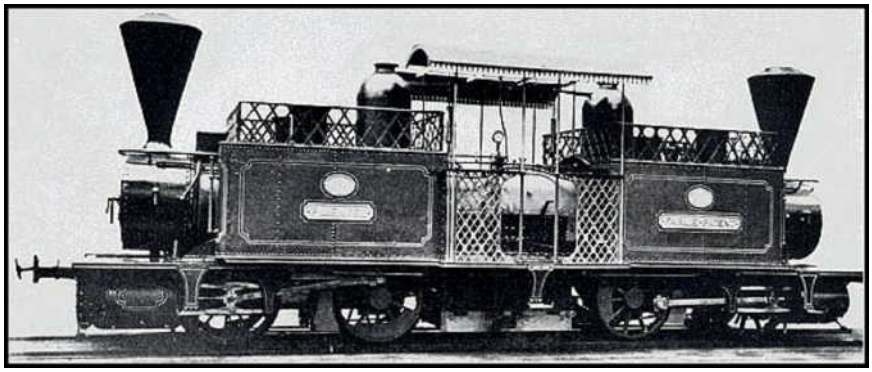


The full-length roof and steam and brake controls at both ends were to let the crew control the engine from the forward position in either direction. The full-length roof was removed when it was decided that it was just as effective to run from the center cab.

While Europe was home to a number of Fairlies here and there , it was the New World that was much more welcoming to the design.

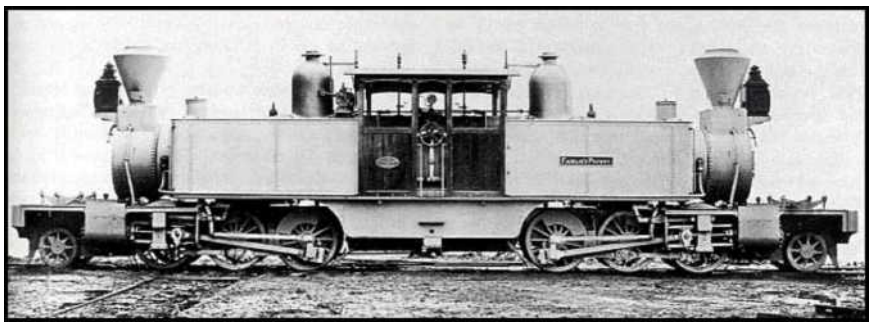
High in the province of Tarapaca (originally in Peru, but later ceded to Chile) were incredibly rich nitrate fields and naturally railways soon sprang up to service them. These railways grew very extensive, with many offices, processing plants and towns along the different lines. Eventually, these lines would consolidate into what is usually referred to as the Nitrate Railways. The rigorous job of carrying the nitrate from high in the Andes all the way down to the seaports of Pisagua and Iquique fell to the Fairlie engines. The first engine here was the Tarapaca and it was this engine that introduced the "South American" cab, which was formed by two separate narrow arched roofs over an open frame. The cab sides were made up of open latticework. (See the engraving of the "Lagunas" above and the Pimental photo below for examples).

Fairlies proved be the right engine for the job in the dry, winding and steep environment. They outperformed traditional rod engines so well that one of the American rod engines was sarcastically renamed "The Swindle"! The Fairlies actually used less fuel and water while pulling heavier loads. And here where freshwater had to be distilled from sea water in a costly procedure, Fairlies became the engine of choice for man-years.



Vulcan foundries built the Pimental in 1873.

There are only a handful of examples of Fairlies with pilot wheels. The Yorkshire Engine Works built ten 0-6+6-0T's in 1872 for the Pisagua Railway before that order was canceled.



Five of these engines were re-gauged to five feet and sold to Russia; the others were later rebuilt as 2-6+6-2T's for the Nitrate Railways in 1882; it's interesting to note that these pilot wheeled engines were considered unsuccessful. It is believed that these engines were the largest locomotives built in England up to that time.

Now we come to one (actually three) of my favorite Fairlies. These beauties were built by The Avonside Engine Co. in 1872. Here's the ESCALADOR DE MONTES. Translation; Mountaineer! "Mountaineer" was one of the most common names given Fairlie engines, the other most common name was "Snake."

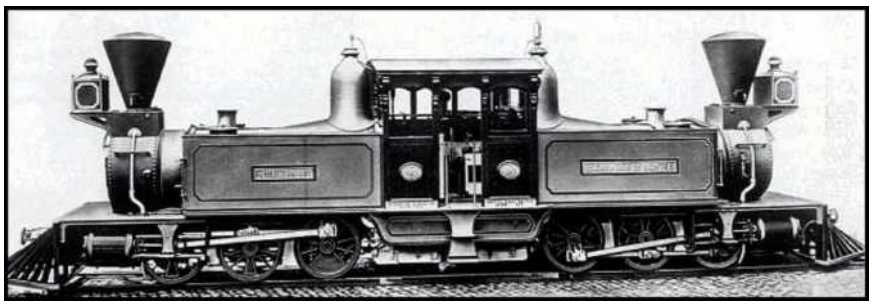


Photo courtesy Trackside Publications

The Escalador De Montes!

These three-foot gauge 0-6+6-0T's are what I think ALL Fairlies should have looked like! Well, at least more of them should have looked like this. The sleek lines break away from the more traditional boxy looking Fairlies and the wagon top boiler and cowcatcher pilot give it a definite New World look.

An interesting note on these engines is that there is considerable doubt as to where they were shipped and whatever happened to them. The only thing certain is that they were initially shipped to Spain, presumably for export to South America by a Spanish agent. It's been suggested that they were for the Venezuelan government, but it's possible they went to Peru as well. They were built without the established South American cab, but there were two standard gauge engines that looked similar that went to Uruguay a few years later. Anyone out there have any more info on these mysterious beauties?

While Fairlies were employed to varying degrees throughout South America, the real success story for the Fairlie double-enders was just south of our own border in Mexico. Here, from Mexico City to Vera Cruz, articulateds were to rule as the only engine type on the line for fifty years!

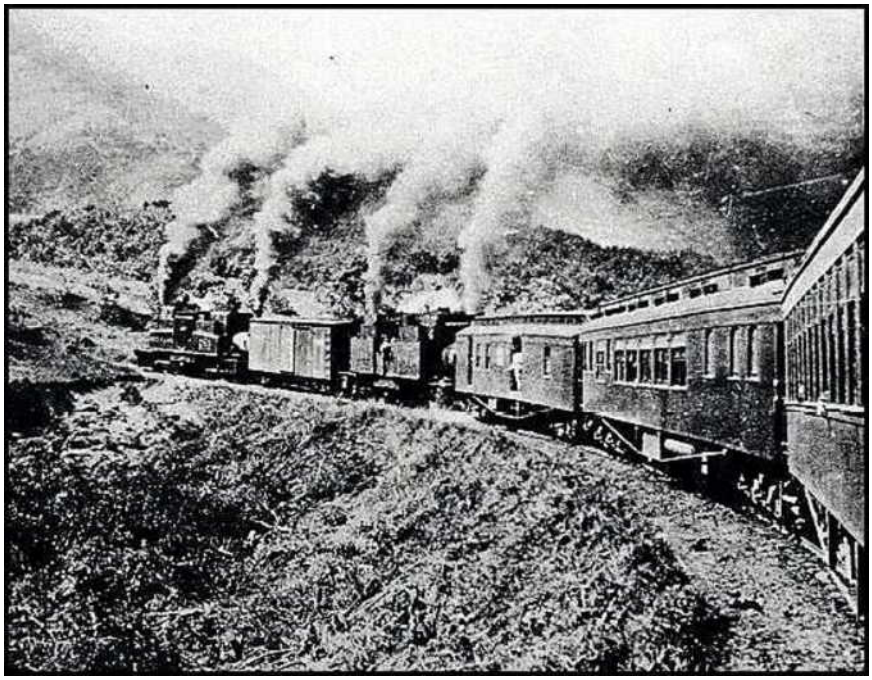


Photo courtesy Trackside Publications

I love this shot of double-headed double-enders! Not very clear, but what a sight! Four stacks churning away! The boxcar between the engines was the solution to the derailing forces of the lead engine's rear bogie and the front bogie of the second engine when headed downhill.

The Mexican Railway (Ferrocarril Mexicano, FcM) became operational in January of 1873 and it climbed from sea level to over 8,000 ft. When ordering engines, a maximum ruling grade of 4.7% was used, although some short sections rose to 5.24%! Fairlies were integral to this mountainous line and several were already in operation when it opened.

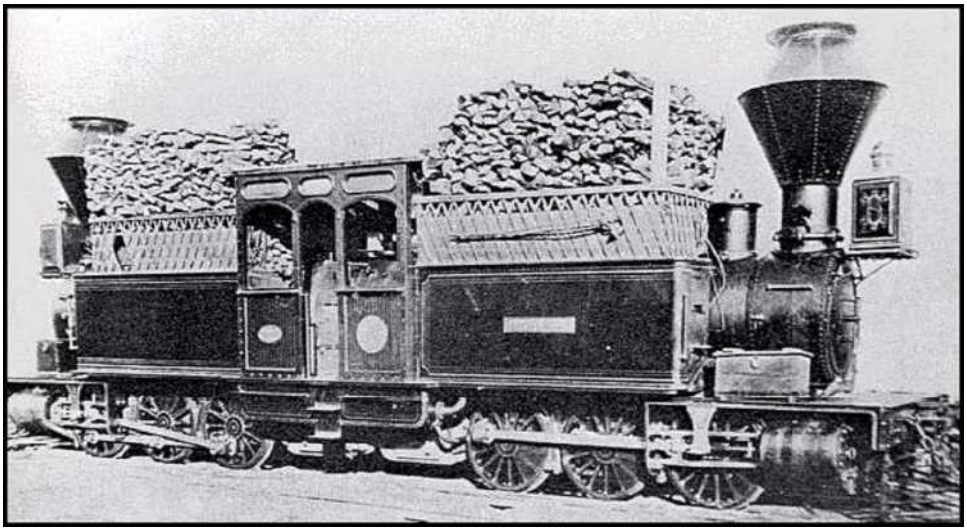
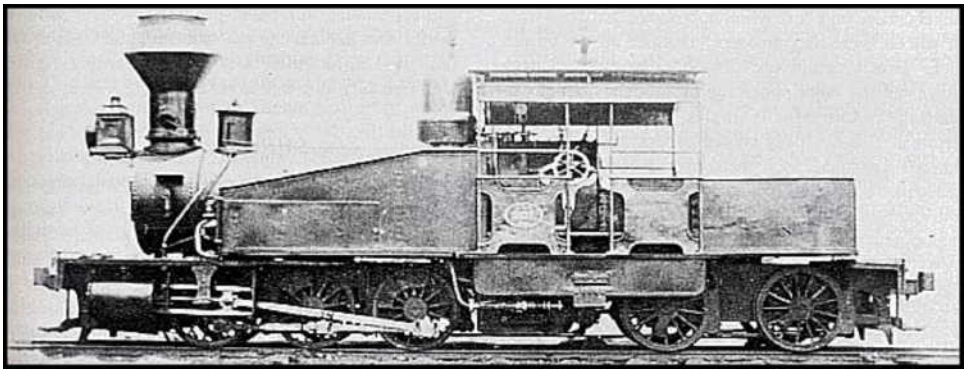


Photo courtesy Trackside Publications

This picture of FcM (Ferrocarril Mexicano) #28 shows how wood was stacked for the long journey. Wood was piled high on these engines as wood was available only at one end of the line and on the return trip coal was used for fuel! Two extra crewmembers were needed to handle all the wood on board.

In the early days of the line, many engines sported only one headlight that would be moved from one end of the engine to the other as needed.

Of note for modelers; the Mexican Railway favored inside valve gear and used them on all of their Fairlies except some of the last of the line. The inside valve gear is considerably easier to model than any other kind, so look to the FcM for Fairlies to build! And if you're looking for something even a bit more funky to model, here's FcM#40, a real life locomotive bash! It's a homemade Single Fairlie bashed out of a Double-boiler Fairlie!



FcM#40. Photo courtesy Trackside Publications

This one is thought to have been constructed by the railroad itself specifically to service the Vera Cruz terminal with its tight dock curves. Here you can also notice the metal heat reflector over the cab roof. This was standard on the FcM for a long time, not just on its British made Fairlies, but apparently on all engines, including the Mason Bogies built for the line by American builders Mason and Baldwin.

As elsewhere in the world, the FcM's demands for greater motive power grew through the years and the Fairlies that were delivered to the FcM in the early part of the 1900s grew huge in size compared to their ancestors. The last of the Fairlie's built in England were once again the largest and most powerful locomotives built there up to that time! These were serious, heavy movers; thoroughly modern steam engines in which the problems of years before had been erased. Mexicano #183 was one of the last batch of three very large Fairlies delivered.

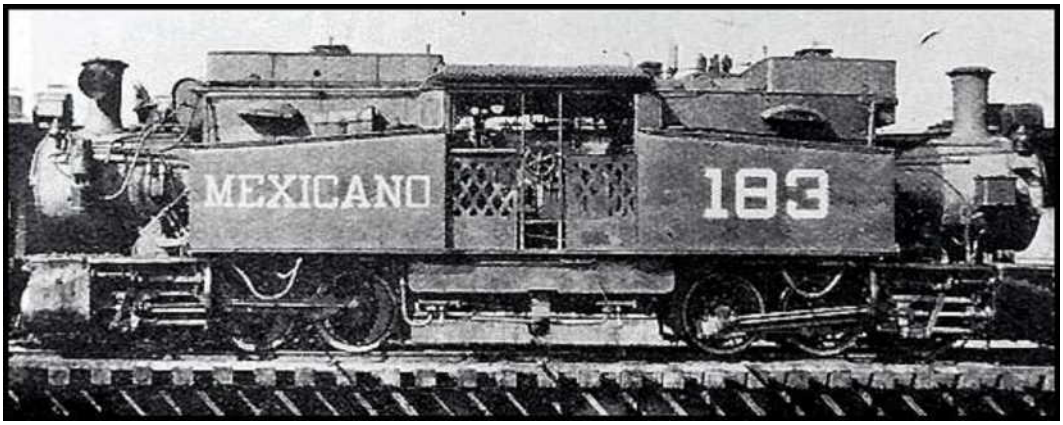


Photo courtesy Trackside Publications

What a great beast this is! For a look at #183 a little later in her life, see the photo that opens this article. The latticework cab sides in that photo have been replaced with sheet metal and the water and oil tanks have been redone. As delivered in 1911, these 137 metric ton Vulcan Foundry engines were capable of burning coal or oil, but by this time the FcM had long converted to oil and in fact, all of the FcM's earlier Fairlies were upgraded with additional oil tanks.

The FcM was also to host two incidents on the line that spoke volumes on the stability of the Fairlie design. Fairlies had early on gotten a reputation as being unstable. This was due to the early, inferior bogie mounts. But on the FcM, on two separate occasions, Fairlies became downhill runaways. Here on the winding treacherous curves, runaway Fairlies developed speeds of up to 70MPH! One of the engines ran downhill a full thirty miles. Neither derailed, a testament to Fairlie's design.

In the same way that the US made Mallets the success they were there, the FcM saw the Fairlie design reach its zenith by a complete commitment to it over an extended period of time. These last Fairlies were vast improvements over their finicky predecessors of forty years earlier. Steam joint leaks and mechanical problems had been minimized by new designs and materials, and switching to oil resolved the challenges of fuel supply and firing.

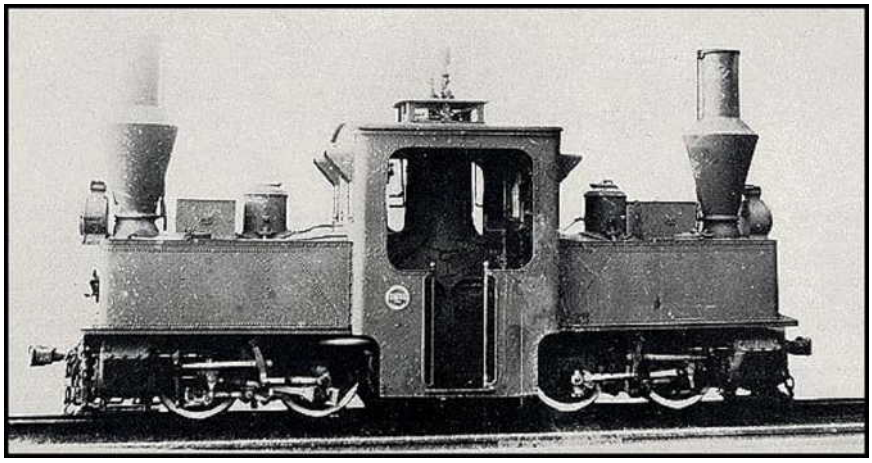
Fairlies served the line until it was finally electrified in 1924.

All in all, the Fairlie design was serviceable, once the early technical limitations had been resolved. Fairlies proved their worth in difficult terrain and developed into solid, dependable locomotives. But by that time, newer superior designs had relegated the Fairlie into less than a memory. While the Fairlie was not the original articulated design, it was the first articulated to enter the public awareness, spurring on further and different designs. We owe the Fairlie a debt of gratitude for pointing the way to greater things.

WHEN IS A FAIRLIE NOT A FAIRLIE?

Both the Fairlie design and the Fairlie name had additional moments in history, outside the standard Fairlie Patent design.

It was in 1887 that artillery Captain Pechot and M. Bourdon arrived at their design for a double boiler, double bogie engine called (can you guess?) the Pechot-Bourdon locomotive.



A Baldwin built Pechot-Bourdon of 1921 for the government of Japan.

The main difference from the Fairlie Patent was claimed to be the single, central steam dome as opposed to Fairlie's standard two dome arrangement. Actually, the fact is that Fairlie had already built at least two single, center dome engines very early on. That fact aside, fifty-two Pechot-Bourdon locomotives were built to service the 1ft.11 5/8in. gauge military railways of France. However, once World War I broke out, Baldwin was contracted to supply an additional 280. It's not surprising that at least two of these little engines still survive in museums.

I've always been a fan of heroic failures, and the FcM provides an example hard to match; the Johnstone "Class D" articulated annular compound engine;

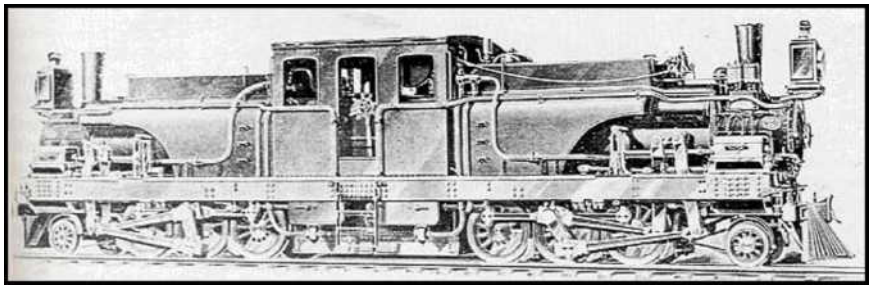
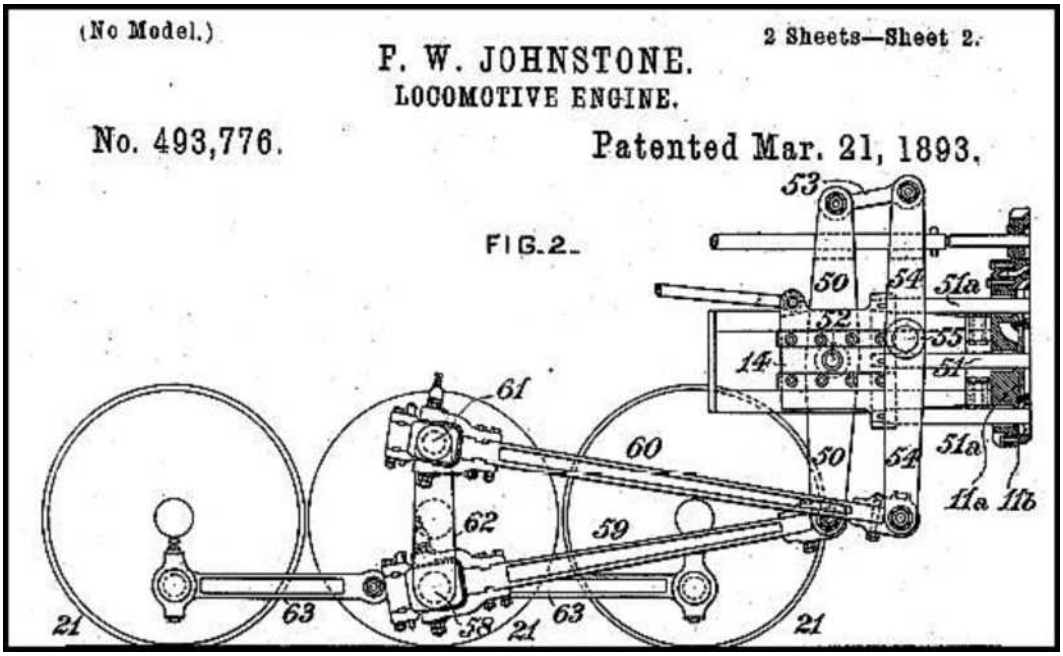


Photo courtesy Trackside Publications

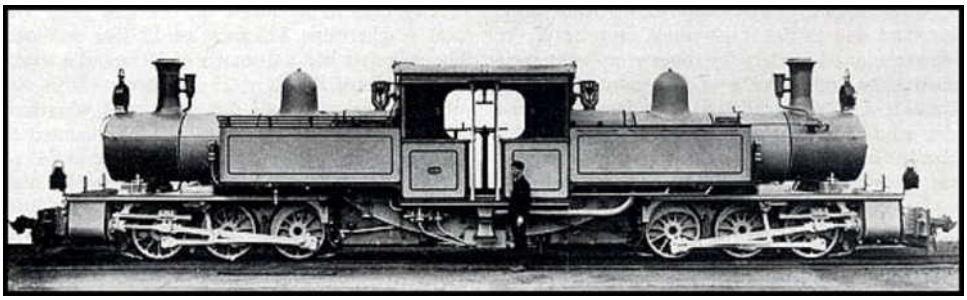
At first glance, this engine looks much like some of the later, more modern Fairlies, but look again! Notice anything missing from the bogies…like maybe cylinders?

Francis W. Johnstone was the Mechanical Superintendent of the Mexican Central Railway and he produced a series of different articulated designs, although only this design was ever actually built. Although impressive in its way, it was doomed to failure from the start. It seems Mr. Johnstone wanted to push the envelope a bit and included a few too many unproven features in the design, apparently to avoid, at least inpart, the Fairlie patent. The main offending weakness in the Johnstone was the mounting of the cylinders on the mainframe as opposed to on the bogies. This was supposed to be the design's strong selling point. It wasn't. The wheels were driven by a complex series of levers designed to transfer power as well as compensating for the movement of the bogies side to side.



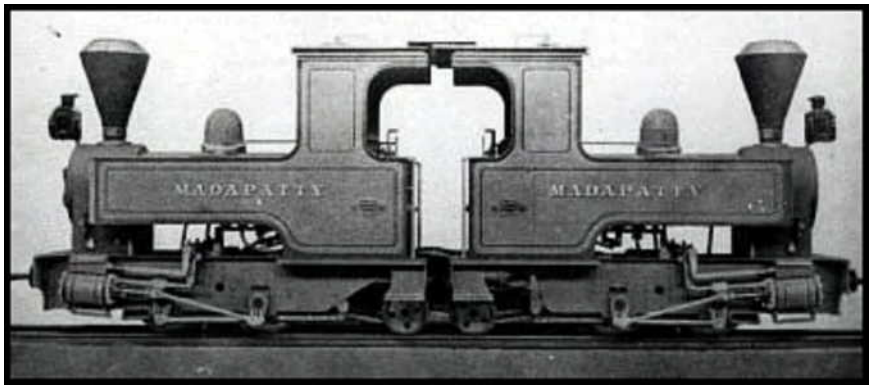
Here's a detail of the Johnstone patent showing the intricate lever system. While this arrangement did away with leaking steam joint problems as intended, it created a nightmare of maintenance and wear! But Johnstone didn't stop there. He also decided to try annular compounding of the cylinders, in which the center high pressure cylinders were surrounded by the outer low pressure cylinders. This type of compounding proved unworkable due to lack of heat conservation and condensation problems. Built by Rhode Island Locomotive Works in 1893, the three engines constructed proved to be absolutely disastrous to run. Not surprisingly, they were returned to the manufacturer within two years where they were quietly and wisely dismantled. They did manage the run down to Mexico and back to the builder, at least!

The Fairlie Duplex



In 1901, the Vulcan Foundries produced a Fairlie with two separate boilers. Although the overall length of the locomotive is extended, the engineer and fireman no longer had to communicate across the boiler! There was more room for opening firebox doors and swinging shovels in the comparatively large cab. The first seven of these "Duplex " engines were for the State Railways of Burma, but others were later built for Japan and Russia.

This Fairlie Duplex is not to be confused with the Vulcan Ironworks Duplex, which was a Kitson-Meyer design. Nor was it to be confused with what was also known as a "Duplex" engine made by several manufacturers worldwide. This kind of Duplex was not actually an articulated engine at all , but a pair of separate locomotives with an articulated connection;



This particular Kerr-Stewart Duplex set was built for India in 1910.

Even Baldwin got into the Duplex act with this one built for the McCloud River RR. Problems developed with the complex throttle (which was connected to both engines) resulting in it being turned into two separate 0-6-0s.

This style of Duplex engine had several versions, some were simply two engines coupled back to back while others had linking control mechanisms for both engines. This type of Duplex wasn't very successful usually and most, if not all, were eventually split up into two separate locomotives.

The Modified Fairlie

Photo courtesy Trackside Publications

A great one, this is. NOT a true Fairlie, and although it looks like a Garratt, it isn't that either. It's really just a Kitson-Meyer in sheep's' clothing. In the early part of the 1900's, the Garratt was cornering the rather large market of South Africa. To compete with the Garratt patent, the North British Locomotive Company designed the "Modified Fairlie". Whereas the Garratt had its three separate sections, the Modified Fairlie was a single frame housing boiler, cab, fuel, and water with two separate powered bogies at either end, similar to a Kitson-Meyer or Fairlie. But it didn't have the real design advantages of a Garratt, and only five were built in England and eleven more by Henschel in Germany. Functional as they were, they were simply outclassed by the Garratts.

ARTICULATED LARGESCALE MODELING!

So what good is all this information on articulated steam engines if nobody builds any models of them in large scale? There are a lot of articulateds out there and we're probably all familiar with the articulated available from the major manufacturers; LGB's European Mallet and both the Sumpter Valley and the Uintah versions of the only narrow gauge Mallets built in the US. Then of course, there's MTH's and Aristo's versions of mainline American Mallets!

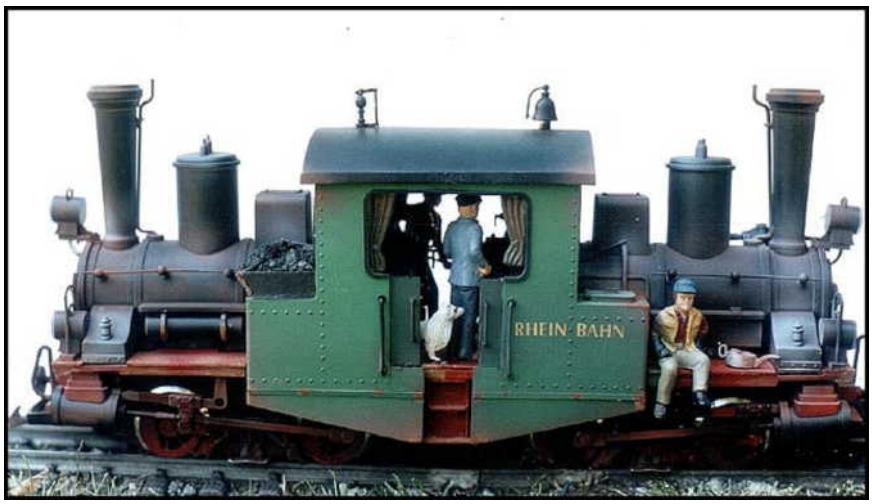
But Mallets, Garratts, Kitson-Myers and… ahem… even Fairlies are being built in large-scale by modelers around the world. Here are just a few;

Many of you will already be familiar with Allan Cash's beautiful logging Mallet;

Check out Allan's Mallet Modeling article here:

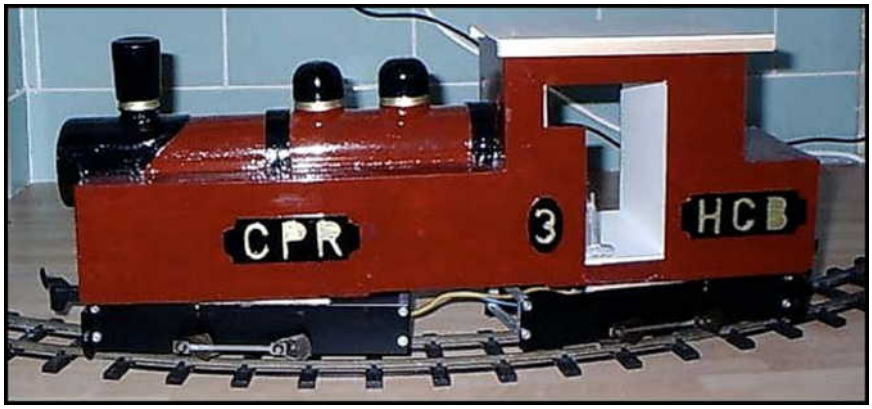
http://mylargescale.com/articles/articles/mallet/mallet01.asp

In Germany, Wilhelm Budde took two Lehman OTTO's apart to build this great little freelance Fairlie Duplex engine:

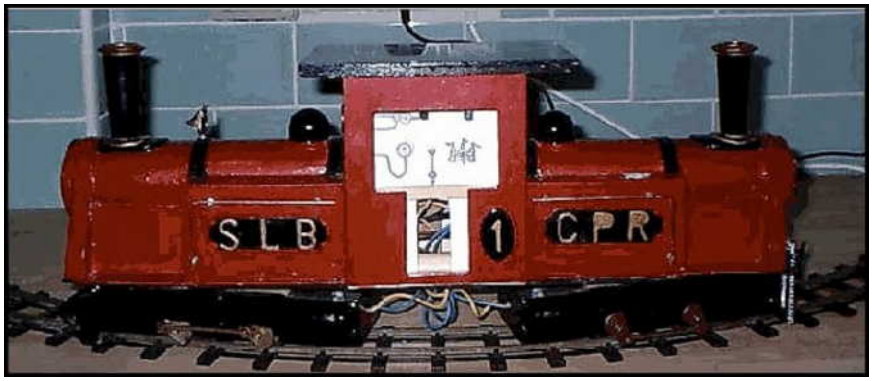


Armed with that success, Mr. Budde then turned his talents to the Garratt design and turned out what I think is one of the most charming model articulateds I've seen:

I used a pair of these Lehmann motor blocks to build my "What If…" Porter Kitson-Meyer:



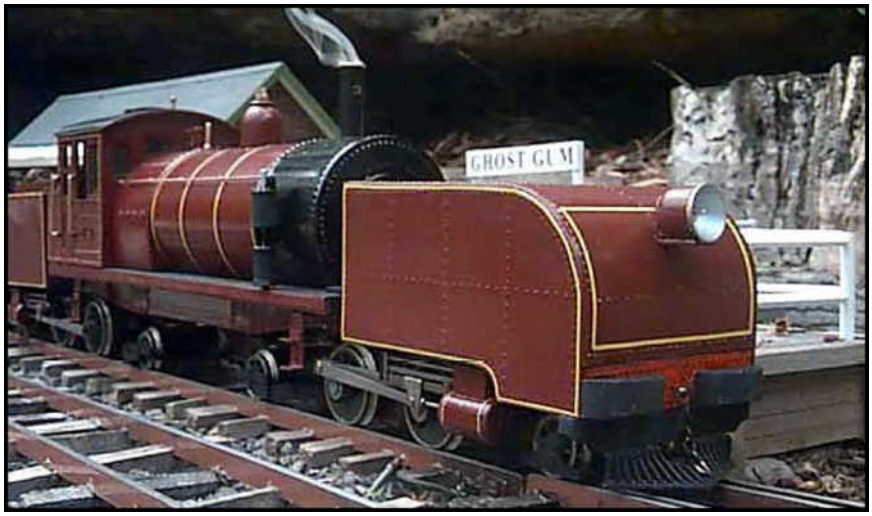
Then there's the irrepressible Mr. Ralph Brades and his battery operated articulateds. He uses I.P. Engineering battery motor blocks. Here's his Meyer;



And here's his Fairlie:

Our own MLSer, Bob Baxter made this great logging Mallet out of two Bachmann Porters:

Over in Australia, Greg Hunter has built two "Hunter-Garratts" for his Sandstone and Termite Railway. Greg built the first Garratt from two Bachmann 2-4-2 Lynns. The larger blue Garratt, No.6, was built using two Bachmann ten-wheelers.



You can see more of these engines at:

http://www.users.bigpond.com/huntergpmj/gregs/SaTR.htm

One of my favorite Fairlies has to be this one built by the Warley Model Railway Club in the UK. The HO gauge railway takes its inspiration from the "Far Twittering & Oysterperch Rwy" drawings of the British cartoonist Rowland Emmet. And yes, both the engine and the engineer are double-headers!

Forgive me, but I can't help but include photos of my own Fairlie models. None are prototypical.

The PALINDROME was my first Fairlie and is based (very loosely) on the Mason Bogie JANUS.

LEFTY is an improbable 2-2+2-2ST Porter-inspired fantasy that I build mostly left-handed due to an injury and surgery.

Anna was my third Fairlie and based loosely on the PIMENTAL, from a Peruvian narrow gauge line.

404 is my most recent Fairlie and is a narrow gauge version of #183 of the Mexicano line.

Obviously, I'm Fairlie obsessed. But for me, of all the various articulated designs, I find the Fairlie the most intriguing visually.

Hopefully, this article has illustrated the fact that there's an articulated out there for everyone; no matter what size, configuration, or style. So what are you waiting for? **GET BUILDING!**

I'd like to extend a special thanks to Mr. Donald Binns for a wealth of information he gave me in a single telephone conversation.

He is also the author of these books, all of which were important reference for this article:

"Articulated Locomotives of the World" –D. Bradford Barton Ltd. 1975.

"Meyer Articulated Locomotives; The Definitive History" (with Gunter Koch) –Trackside Publications.1997.

"Fairlie Articulated Locomotives; Vol.1-On the American Continent" –Trackside Publications. 2001.

Other references;

"The Fairlie Locomotive" Rowland A.S. Abbot, David and Charles. 1970.

"Narrow Gauge for Us" Charles Cooper, The Boston Mills Press (date?).

"When Steam was King" W.W. Stewart, A.H & A.W. Reed Ltd. 1970.

"Origins of the Garratt Locomotive" Richard L. Hills, Plateway Press 2000.