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Proudly Presents



Masters-2002

Build a 2-6-6T / 0-6-6T Mason Bogie

An Adventure in 1:20.3

By David Fletcher

Join the gang and build your own South Park 2-6-6T Mason Bogie

Or North Pacific Coast 0-6-6T Mason Bogie

Chapter 1 - Getting Started

Background – Construction

We're back and its time to step things up...1:20.3!

Over the coming months, we'll be publishing a series of articles outlining the construction of a South Park 2-6-6T and NPC 0-6-6T locomotive step by step. You, the readers and frequenters of this site, are going to build your own loco right alongside me.... You are going to enjoy it, whether you like it or not!!

Before any of you say, "I enjoy making models, but could never build my own loco," let me say this:

1. If you can cut a Vegemite toast in half, chances are, with a little bit of the right kind of model research, you can build your own loco too.
2. If you enjoy making trackside structures, bridges and scenery work, you'll definitely be able to build your own loco. And...
3. If you have the desire to, then there ain't nothing stopping you.

As each article is published, you, the viewers of this fine site, will be progressing your own models ever closer to completion. While you follow along the commentary about the construction of this locomotive, you will be able to interactively discuss your questions, progress and suggestions with myself and the other model makers undertaking this project in tandem, by means of the myLargescale.com '[MasterClass Forum](#)'.

The most important point to note is this:

This will be your locomotive, you can use as much or as little of the information that comes forth from this MasterClass. The ultimate appearance, style and finish of the locomotive is up to you. All I ask is that you finish what you start.

We will be demonstrating the construction of a DSP&P and NPC Mason Bogie specifically; however there were some 146 odd Mason Bogies built for lines all over the US, some were very different to our prototypes, while others remarkably close. You can adapt the steps in this class to suit the Mason of your choice.

I encourage you all to take this opportunity to do something for yourself, no box and no warranty!!

So welcome, but first there are three rules...

- 1. That you do what's right for you**
- 2. That you have a heap of fun building your own loco...and...**
- 3. Well we'll work out the 3rd rule along the way.**

One more note before we start. To view the Mason Bogie drawings, you will need to be able to 'unzip' a file and view PDF documents. We recommend [WinZip](#) or [Stuffit Expander](#) to unzip the files and you must have the [Adobe Acrobat Reader](#) to read the PDF files.

The Structure

The class format will be similar to last year's MasterClass 2001. At this time it is anticipated that there will be 8 chapters to the class. Each chapter will come out progressively around the middle of the month from May to December. The chapters will contain two basic sections:

Background - like the 2001 class, the 'Background' is designed as a simple summary of aspects important to the history of the steam locomotive we're building. We'll look at the origins of the Bogie loco, its engineering & technology, and where they ran.

Construction - This section will cover the construction of the 1:20.3 scale model. Each chapter will cover a specific assembly of the model. Depending on your modeling speed, it is estimated that between 1-2 days will be required to carry out the modeling work for each chapter. So put aside a day or so per month for your model! As a first to the MasterClass series, in the Construction section we're offering a new concept which shall be called '**Wimp's Way**'.

'**Wimp's Way**' is all about buildability; making this model easy to build even to the inexperienced. In areas where the model requires some very fiddly and difficult or time consuming construction, a 'Wimp's Way' method will also be shown which enables the same assembly to be made in a much easier yet effective way. The 'Wimp's Way' will mean the model is simplified in some way, yet will still look correct, even if not 100% detailed accurately. It is your choice whether you want to follow the 100% prototypical method with the full detail, or take the easy route to build a strong, reliable and accurate looking model with much less trouble. Its called 'Wimp's Way' because I still encourage you to challenge yourself and your skills to build the model to the full detail. Anything short is to 'wimp out'!! Do not even consider building one side of the loco the full detail and the other side using Wimp's Way on the basis that you only run your trains in one direction on the layout!!

As you will have learned with the MasterClass 2001 series of last year, my emphasis is to make locomotive building easy, by demonstrating simple construction techniques that enable the construction of complex locomotive components. In a sense this where Wimp's Way has also come from. I learned this way of breaking down complex modeling into simple techniques during my time as a Professional model maker to Engineering firms. Essentially firms would only contact me once they knew for sure they needed the model yesterday! At that point they'd tell me to build this amazingly complex oil refinery thing, with pipes and tanks everywhere, they need it immediately and they didn't want to pay for it. You can be sure I very soon learned how to make these models in the fastest, simplest, and most effective way, without compromising the model's appearance, or I wouldn't get paid! In this Mason Bogie class I'll be keeping the techniques as simple as possible without losing the detail or accuracy, but there are areas which are very complex and difficult. 'Wimp's Way' will help some of you through the harder parts, and yes there will be a 'Wimp's Way' option for the incredible Mason Walschaerts Valve Gear'. Its about the most complex version of this valve gear I've ever seen!! No one will be unduly harassed for taking the Wimp's Way, they are viable easier options designed to help you.

The most important thing to note here is that the whole point of the MasterClass is the 'journey', not the destination. It will take time to read everything we present, and it will take time to build the model. Enjoy this time to the max, once the model is done you can't go back and enjoy the modeling again. So take your time and smell the grease! Absorb as much of the background history as your mind can handle, seek out the 'further reading' texts if you want to know more! Above all this is supposed to be fun, not a race to produce an 'ok' Mason in a few weeks!

This month we have the following:

Background - Genesis - The Perfect Locomotive. The Origins of the Bogie Loco.

Construction - Ordering the BBT Mason Bogie chassis and parts/materials list.

The MasterClass Concept – A Cooperative Project.

Cooperation occurs on many levels in this MasterClass. First off you help each other during the construction through the interactive model making forum.

This is also a cooperative project because of the specialists we bring together to collectively inject their expertise to bring this project to you. So without further ado, Its time to list the people who've already put much time into making this project happen, and will remain at the core of the project. While each help in their specific field, they are foremost railroad enthusiasts like you and will be available to clarify, discuss or answer any questions you might have through the class.

The Team:

Barry Olsen – Locomotive Chassis Design & Construction.

You will know Barry fairly well as a designer and manufacturer of what is aptly considered the most robust and reliable locomotive chassis available to the model railroad industry. Barry's Big Trains (BBT) has been producing retrofit chassis to the Bachmann Big Hauler locos for about as long as the Big Hauler has been on the market, available in both 4-6-0 and 2-8-0 configurations. Barry is foremost a designer and problem solver and as such BBT produce drives for a wide variety of locomotive types and scales. Barry is the designer and builder of the Mason Bogie chassis for this MasterClass, and without his specialized work, we would not have a loco to model. You can read more about Barry and his products at:

<http://www.barrybigtrains.com/>

Chuck Meckam - Special Component Details and Pattern Making.

Chuck of CSC Innovations has many years experience as a commercial pattern maker, making all kinds of masters for computer keyboard profiles, plastic component design and manufacture. Chuck is working with BBT in producing the masters for the Mason Bogie side rods, 6 wheel tender truck and a number of other specialized Mason parts. Read more about Chuck's work at:

<http://www.cscinnovations.com>

George Sebastian Coleman – Prototype Technical Advisor.

George is known to most of us for his long term work in the model railroad industry including a period as Associate Editor of Model Railroader. George has also been associated with Grandt Line and also produced his own kits under the South Park Line label (O scale Alpine Enginehouse). George has had a lifetime interest in all things narrow gauge and specifically, the Mason Bogie. He brings to this class and our model a level of accuracy and understanding which I could not have achieved on my own. George will also be contributing to two 'Background' sections:

-Mason Bogie engineering and Technology.

-The story of the Masons of the South Park.

Wes White, with Jerry Kitts, and Doug Heitkamp – Mason Color Advisors.

Wes will be essentially the editor and compiler of the color chapter in bringing together the various locomotive color options for the Mason Bogie. He has a close association with Jerry Kitts and Doug Heitkamp who have spent many years researching and deciphering the unusual color schemes of the Mason Machine Works. The information provided by Jerry and Doug will be presented along with later South Park Mason colors provided by Rob Sloan. Wes will be compiling the 'Background' section in the next chapter about Mason's Color Schemes.

Scot Lawrence, MLS contributor, will be supporting Wes, Jerry and Doug by providing color renderings and drawings as examples of Mason color options for you to follow.

Vance Bass – Wood cabs and Pilot (cow catcher) options.

Technical Editor to Garden Railways, Vance is also proprietor of FH&PB Railroad Supply Co, maker of fine, laser cut wood kits. You will know his work in offering wood cabs and pilots to the Accucraft Ruby, as well as the famous Ruby to Forney conversion Kit. Vance will be offering wood cab and pilot kits to this class for those that wish to have real wood cabs and pilots. I should also point out that the fabrication of the pilot and cab will be among the most difficult assemblies in this class, and therefore Vance offers a quality alternative. The class will cover the scratch building of the pilot and cab in styrene and the same CAD templates will aid Vance in laser cutting the wood cabs and pilots to the same profiles. To learn more about the Vance's kits, go to:

<http://www.nmia.com/~vrbass/fhpb/>

Vance is also serving as Fletch's proofreader.

John Welther – Model Graphics and Decals.

John has been in the screen printing business since 1973. He also worked for Microscale Industries for about 10 years. Coupling his interest in the South Park with his interest in decal making, he will be offering a set of custom decals as an option for lettering your models. We'll be working on CAD to come up with lettering templates and decoration to then be turned into decals.

Jeff Damerst - Model Graphics and Decals.

Jeff Damerst of Shawmut Car Shops has been involved in modifying and lettering large scale trains on a commercial basis for a number of years. He offers alternatives in lettering and decorating methods for your models, including decals and vinyl types. Again lettering will be based on CAD templates. To learn more about Jeff and the Shawmut Car Shops, look at:

<http://www.shawmutcarshops.com>

Dennis Kliesen- Electronic firebox Flicker kits

Dennis of Hillside Railways has been offering detail kits, and electronic components to large scalers for years, and is probably best known for his retro-fit reliable Bachmann Shay electrical wheel pick-up kits that he used to produce. Dennis will be offering the options of flickering firebox kits for the Mason model, and will also be available to discuss electronic detail options. Check his web site at:

http://members.aol.com/_ht_a/hillsidery/myhomepage/

Tom Farin - Mason Bogie Archive

Tom is owner of the Iron Horse 1:29 web site and is hosting the Mason Bogie Archive for the MasterClass 2002. This is a visual Data Base of surviving photographs of as many Mason Bogies as we can find. We're always on the lookout for more photos, unseen photos or better photos and info, so feel free to add info if you have it. The mission is to photographically catalogue as many of the 146 Mason Bogies as we can find. We are not after 100s of photos of the same loco, but at least one good photo of each Mason Bogie built. Check the Mason Bogie Database at:

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

Tom has also been made 'Archive Editor' for myLargescale.com and will maintain the archive database for this class as well as all future classes. Look for the myLargescale.com prototype archive later this summer.

Gary Brogan – Background Support (Helca & Torch Lake RR)

Gary was born and raised in upper Michigan in the Copper country heartland. His uncles and grand parents were associated with the workings of the Hecla & Torch Lake RR, a line which sported some very unusual locomotives including camel backs and Mason Bogies. The last surviving Mason Bogie in the world is today preserved at Henry Ford's Greenfield Village display and this 0-6-4T Mason is the last of the Helca & Torch Lake Roster. Gary is former Soo Line magazine editor and will be writing a 'Background' section in one of the later chapters about the Hecla & Torch Lake RR and its adorable Mason Bogie locomotives.

Steve Conkle – Background Support (Boston Revere, Beach & Lynn RR)

Steve is an MLS contributor and supporter of the MasterClass 2002 project and archive. Steve will be writing a 'Background' section on the Boston, Revere Beach & Lynn RR, the single largest owner of Mason Bogies.

Shad Pulley & Dwight Ennis - Web Site Construction and General Editors.

These two chaps are responsible for getting all this gumph on-line for all of us to enjoy. I know little about the workings of computers and even less about HTML and web construction, so without these fellas we would have no MasterClass!

Shad Pulley you all know as the owner of myLargescale.com.

Dwight Ennis is a moderator of the myLargescale.com web site.

Chris Walas - The Man with the Question: Why Don't We Do this???

Chris is the reason we're doing all of this. No don't feel bad Chris, this is a good thing! Most of you will remember his work during MasterClass 2001 while building two 2-6-0s at the same time. His modeling work is always an inspiration to me, and he has offered constant support in helping with this class. How could anyone be more chuffed than seeing one of our MasterClass 2001 locomotives finished with one's own name printed on it. A fantastic model at the conclusion of the 2001 class...Chris was the 'Master' of MasterClass 2001.



Chris Walas' fantastic MasterClass 2001 locomotive, the 'Colonel Fletcher' Aw Shucks!!

Special Note:

While we do not have Art Wallace's knowledge and extensive research at our disposal for this class, we nonetheless owe him a debt of gratitude. In 1985 he took the time to extensively review the surviving original cloth engineering drawings of the Mason Bogie and was able to reconstruct a set of 2-6-6T drawings at 1:8 scale. By producing these unique drawings he has helped preserve a piece of Mason engineering history. The drawings are not only informative about the technical workings of the Bogie loco, but are also a visual pleasure. Our CAD drawings and templates as well as the technical Bogie concepts are all based on Art's special drawing set. We are most thankful for the opportunity to use these drawings to aid our Class.

The Mason Bogie Archive

While this class is in progress, you can view photos of the myriad Mason Bogies used all over the US and Mexico, in our Mason Bogie Database and Archive. This archive is for you to use, but we also need your help in improving it. If you have a clear picture of any Mason Bogie used in any place or country, that is not currently shown in the database, please send in a photo and description to [Tom Farin via email](#).

If you have a picture but have no idea of what the loco is, or where it was taken, please ask Tom to post it on-line for examination. I'm sure with the collection of heads looking at it that we might be able to identify the Mason locomotive.

Please look at the Archive at:

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

A huge thanks to Tom for maintaining this archive site and for the number of hours he spent producing this for us.

The Prototype

The Denver South Park & Pacific 2-6-6T Mason Bogie

The North Pacific Coast 0-6-6T 'Bully Boy' Mason Bogie.

The Mason Bogie was among the first of a breed of articulated or 'flexible' locomotives designed to provide greater power to the restrictive narrow gauge lines. The Mason Bogie was the American development of the 'Single Fairlie', originally the brainchild of Scottish Engineer, Robert Fairlie. Developed in the late 1860s, running through to the mid 1900s, the Mason Bogie featured the first pivoting locomotive frame and the first practical application of the Walschaerts valve gear in the US. Designed with all the decoration and industrial art that the 'craftsmanship' period of locomotive design could offer, the endearing Mason Bogie has had a lasting impact on railroad history. This simple statement will be expanded and explained through the various 'Background' sections of the class so you can get a clear understanding of this unique locomotive.

There are essentially two basic types of Mason Bogie offered in this class, that of the 2-6-6T and the 0-6-6T wheel arrangement. The 2-6-6T is based as close as possible to the South Park engineering drawings produced by Art Wallace in 1985. Specifically we're building the smaller class of 2-6-6T used on the South Park, sometimes described as having 38" boilers plus lagging.

We have then cosmetically adapted the South Park 2-6-6T to provide the NPC 0-6-6T Bully Boy, a locomotive of very similar design to the early South Park Mason Bogies.

Before going forward to the 'Construction' section and ordering your materials, you might like to consider which of the versions of Mason you'd like to make, or what variant. We will cover the construction of these two basic types of Mason Bogie in six different variants. Additionally you can make adaptations to these six variants to model many other Mason types such as the 0-6-4Ts. Click on the drawing links to download the PDF 1:20.3 scale Mason Bogie drawing of your choice.

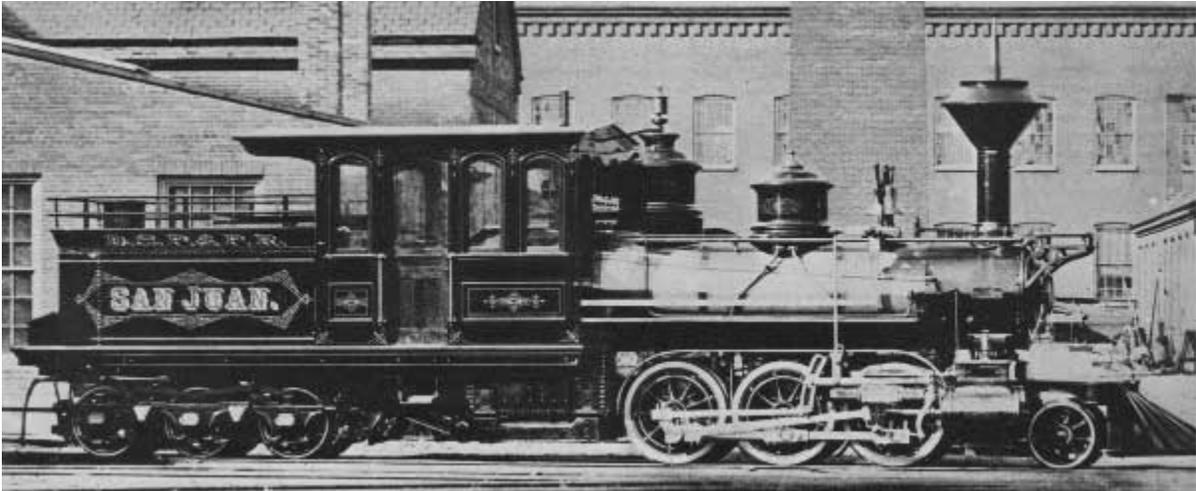
Some items to note when looking at the drawings:

- They will print at 1:1 size for the 1:20.3 model. That means what you print is the actual size of the model.
- Note that there are basically 4 types of headlight brackets used on the Mason over the years and there are variations of those 4 types as the road adapted them to suit different headlight types. The original 'as built' Mason headlight brackets were ornate, and curved half way round the smokebox front. They initially carried a smaller box headlight. These original ornate jobs were replaced by plainer headlight brackets that could support a larger headlight, and allowed for fitment of marker lights on the smokebox sides. If building the model with the original Mason style headlight brackets, you will be able to use the very fine Delton/Aristocraft/Hartland Box Headlights, to represent the smaller headlight type (see drawings). If wanting the very large Box headlight, you will have to

scratch make it. If you check the option 4 drawings, you'll see the most ornate of all the original Mason headlight brackets used on this smaller 2-6-6T. This very fancy bracket was only ever used on one light 2-6-6T, that of DSP&P #11/#46, 'Ouray', built in 1879. A variant of this type of fancy bracket was later used on the larger 2-6-6Ts, such as the famous 'Breckenridge'. If you must have this fancy bracket, then you'll be building DSP&P #11, later renumbered to #46..there was only one!

- Note that a couple of the options allow for a 'short tender' or 'long tender'. Basically the 2-6-6T delivered to the South Park were built with tenders in two lengths. The first 3 2-6-6Ts from 1878 were built with a shorter tender. From 1879 the remainder of the 2-6-6Ts were built with a tender one foot longer than the original tenders. Look carefully at the drawings and you will see the different tender lengths. The names and numbers of the various 2-6-6Ts are listed with the correct drawings. You will see in the Option 4 drawing with the long tender, just how long the whole loco gets once the frame is further extended to carry the air tank on the very rear.
- Note the changes in cab design from ornate arched windows to square windows.
- Also note the changes in the hungry Boards, or railing around the tender tops.
- Note the changes in the brake systems, from Eames Vacuum brakes in 1877-1878 to Westinghouse air brakes in 1883. I always like the Air brake systems, because this means we get to add a lot more pipe work to our model. If modeling the Eames Vacuum brake, there is no visible pipe work externally, but there is the most gorgeous brass fitment to be detailed and added to the backhead inside the cab! So you win some, you lose some!

The Six Mason Bogie Options

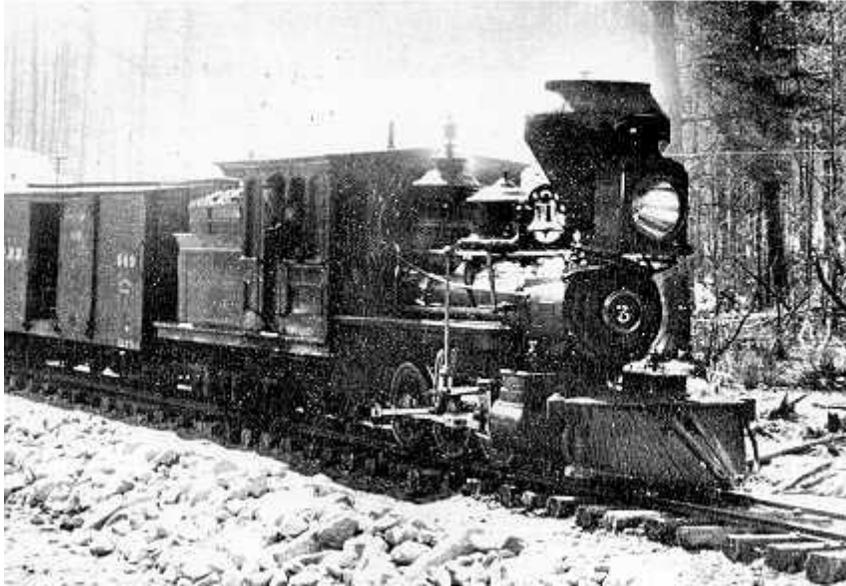


Mason Bogie - Option 1

Option 1 – DSP&P 1878 ‘As Built’ version with small coal diamond stack. The first two Mason Bogies to be delivered to the South Park in 1878 were built like this (actually the first of them was delivered as an 0-6-6T, and converted to as 2-6-6T when the 2nd loco arrived). The two locomotives were DSP&P #3 ‘Oro City’ and DSP&P #4 ‘San Juan’. It has become generally understood that these two locomotives never actually wore these small stacks in service. It is highly likely that these small stacks were removed prior to the locos even being shipped. The locomotives were fitted with the much larger ‘Nesmith’ stack on arrival at the South Park (Named after the South Park's Superintendent). These locomotives were delivered fitted with an Eames Vacuum brake system. The true 'as built' locomotives would have looked like Option 2.

[Download drawings for option 1.](#)

Note: if building this version, the stack is to be ordered from Hartland Locomotive Works and adapted for this model



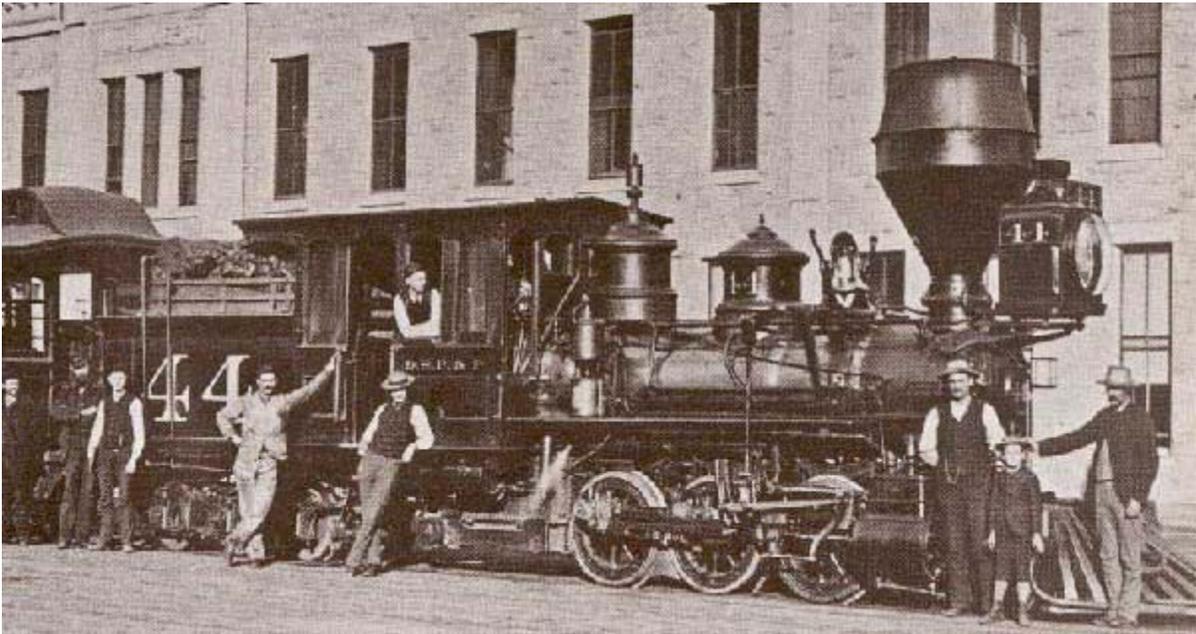
Mason Bogie - Option 2

Option 2 – DSP&P 1879 ‘As Built’ version, delivered with ‘Nesmith Stack’ and Eames Vacuum Brake. Except for the first two Mason Bogies delivered to the South Park in 1878 (above), all other Mason Bogies were supplied to the South Park already fitted with Nesmith Stacks. This version is also fitted with an Eames Vacuum brake system.

[Download drawings for option 2A with short tender.](#)

[Download drawings for option 2B with long tender.](#)

Note: if building this loco, you need to order the \$10 ‘Balloon’ stack from BBT when ordering your BBT chassis. These Balloon stacks have been supplied directly by Bachmann for our use, and will be adapted to suit both Nesmith and Congdon stack types.

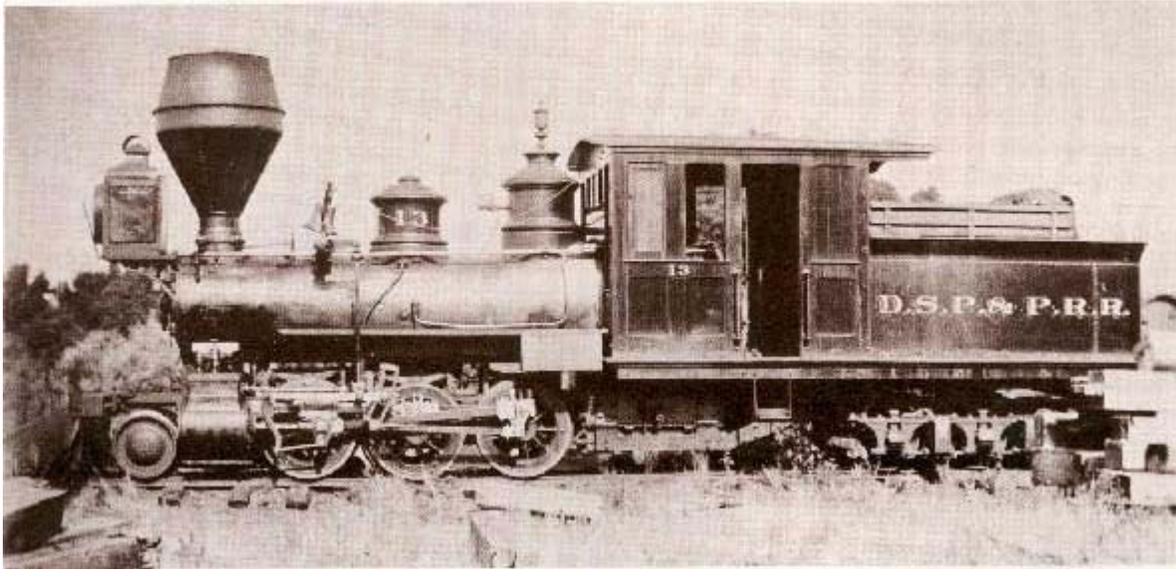


Mason Bogie -Option 3

Option 3 - DSP&P 1885 – This is specific to DSP&P #8 ‘Lake City’ renumbered #44 in 1885. This loco is a personal favorite of mine, and appears to be unique in the DSP&P roster. It featured one of the earliest fitments of the Westinghouse air brake systems, fitted in 1883, sports the new Congdon smoke stack, and in an unusual combination with this stack type, the loco retains its original arched window cab type with pitched roof. The air tank to the Westinghouse air brake system is mounted on the top rear of the tender. Plain headlight bracket with large box headlight.

[Download drawings for option 3.](#)

Note: if building this loco, you need to order the \$10 ‘Balloon’ stack from BBT when ordering your BBT chassis. These Balloon stacks have been supplied directly by Bachmann for our use, and will be adapted to suit both Nesmith and Congdon stack types.



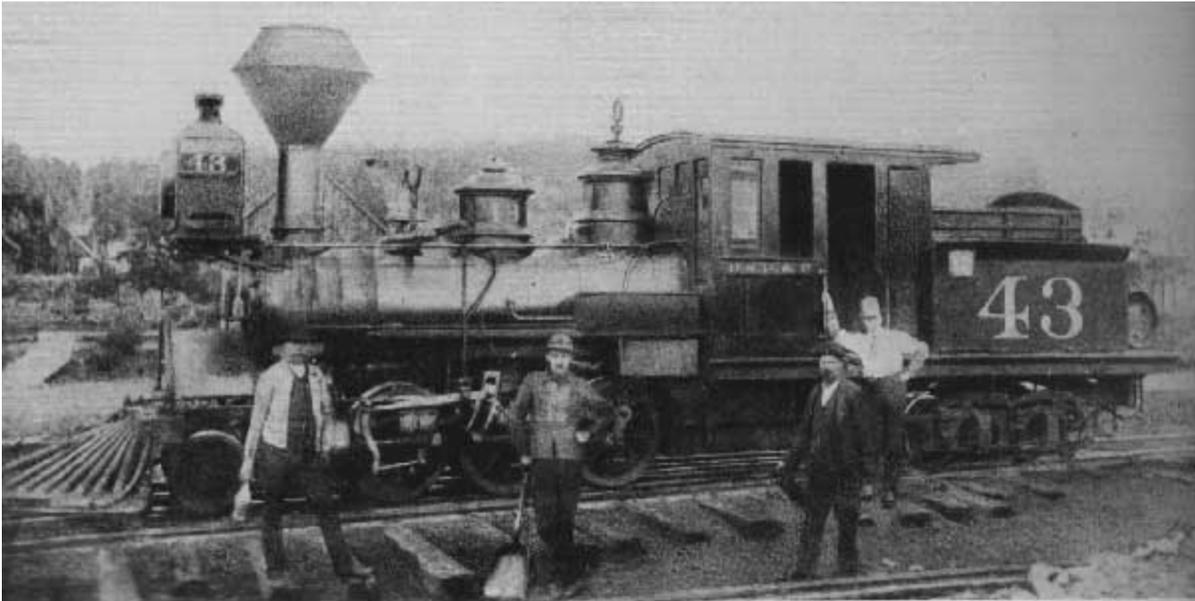
Mason Bogie - Option 4

Option 4A – DSP&P 1883-1885 – This is the most popular form in which the South Park 2-6-6T is remembered. The loco sports the air brake system, air tank on lower rear tender deck, Congdon smoke stack and new cab with rectangular windows and curved roof. The MasterClass 2002 2-6-6T prototype model will be based on this version. Other versions will be demonstrated, but this version will be built through to completion. This version of loco had all 4 types of headlight brackets, with a variety of larger and smaller headlights used. The above photo demonstrates the original Mason ornate bracket modified to support an early larger box headlight.

[Download drawings for option 4A with short tender.](#)

[Download drawings for option 4B with long tender.](#)

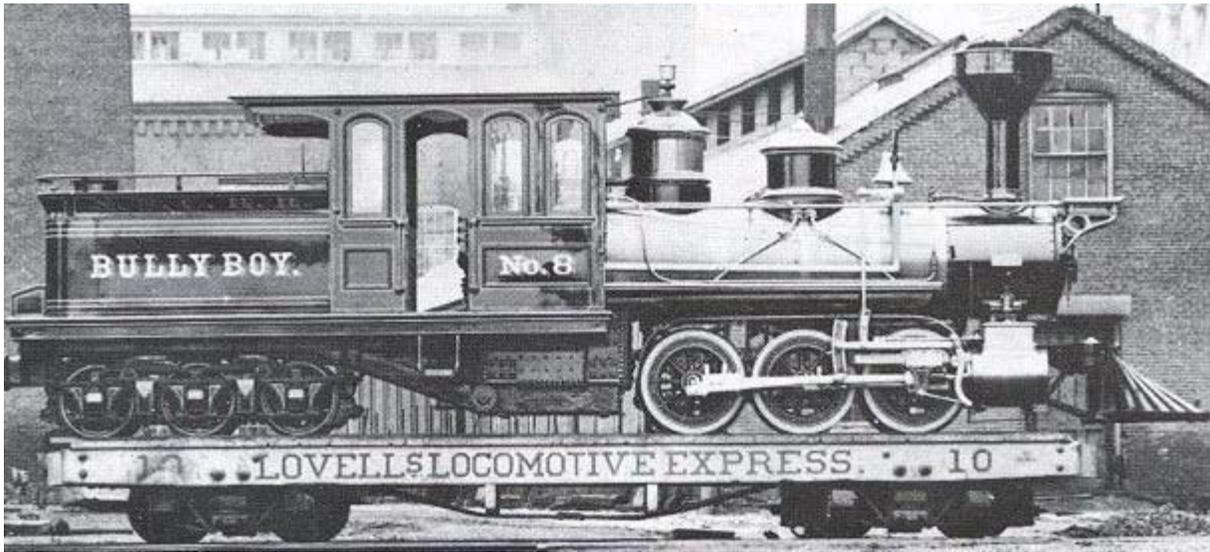
Note: if building this loco, you need to order the \$10 ‘Balloon’ stack from BBT when ordering your BBT chassis. These Balloon stacks have been supplied directly by Bachmann for our use, and will be adapted to suit both Nesmith and Congdon stack types.



Mason Bogie - Option 4B

Option 4 Variant- DSP&P 1885-1899

We will not be demonstrating this version as it is almost identical to Version 4, The difference is the use of the large Diamond stack, replacing the Congdon stack. I have no sources for making this stack, however, if you wish to build this version, you can follow version 4 and bash your own large diamond stack using 'funnels' that can be obtained in hardware stores etc.



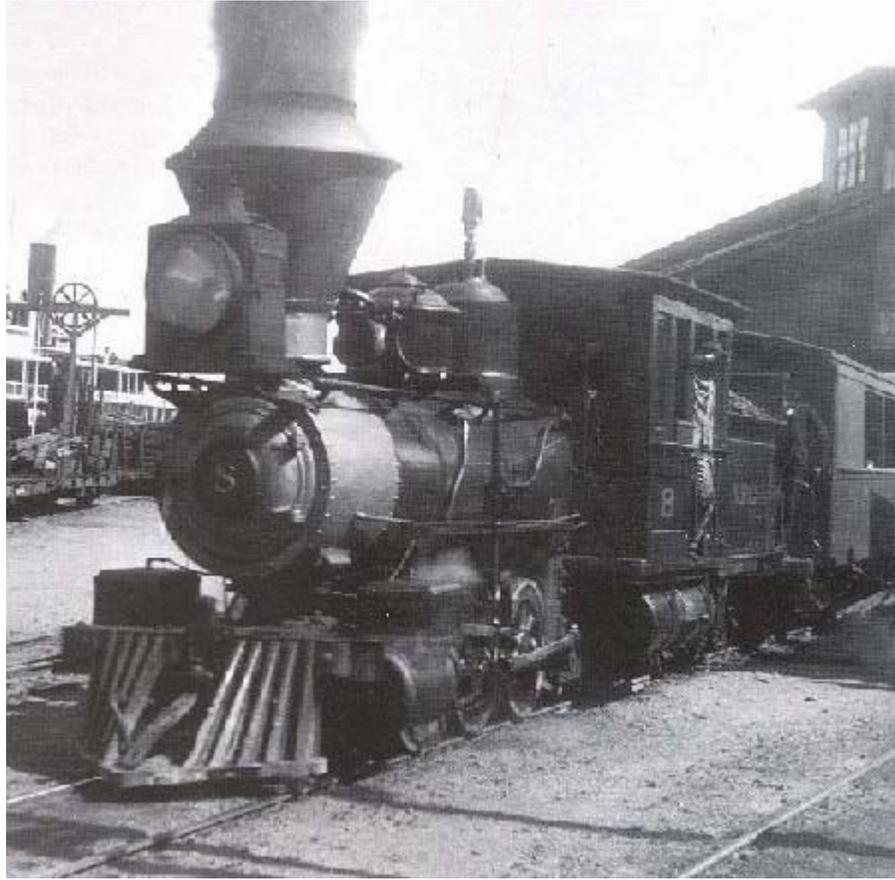
Mason Bogie - Option 5

Option 5 – 1877 North Pacific Coast #8 ‘Bully Boy’, ‘As built’ version.

This particular Mason Bogie I find to be the most beautiful of them all, with the perfect level of decoration on such a nicely proportioned frame. This model is almost identical to Option 1, however no pilot truck will be needed and the H-L-W smokestack will require further modification. The above photo shows the original ornate Mason headlight bracket, for use with a smaller box headlight.

[Download drawings for option 5.](#)

Note if building this version, the stack is to be ordered from Hartland Locomotive Works and adapted for this model.



Mason Bogie - Option 6

Option 6 – Post 1877 North Pacific Coast #8 ‘Bully Boy’. This is the version of what Bully Boy most probably looked like during her career on the road. Similar to the South Park, the NPC removed the small coal smoke stack and replaced it with a much larger NPC style stack. She also received a new cab with rectangular windows and curved roof, similar to South Park rebuilds.

The above photo shows the original Mason headlight bracket replaced by a plainer type, for use with the larger box headlight.

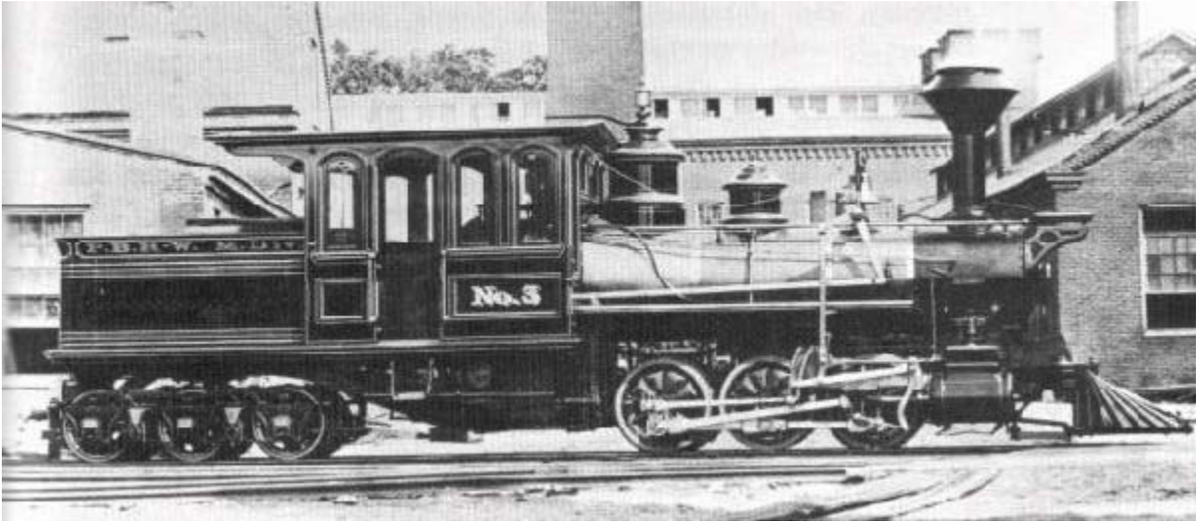
[Download drawings for option 6.](#)

Note: if building this loco, you need to order the \$10 ‘Balloon’ stack from BBT when ordering your BBT chassis. These Balloon stacks have been supplied directly by Bachmann for our use, and will be adapted to suit the NPC stack type.

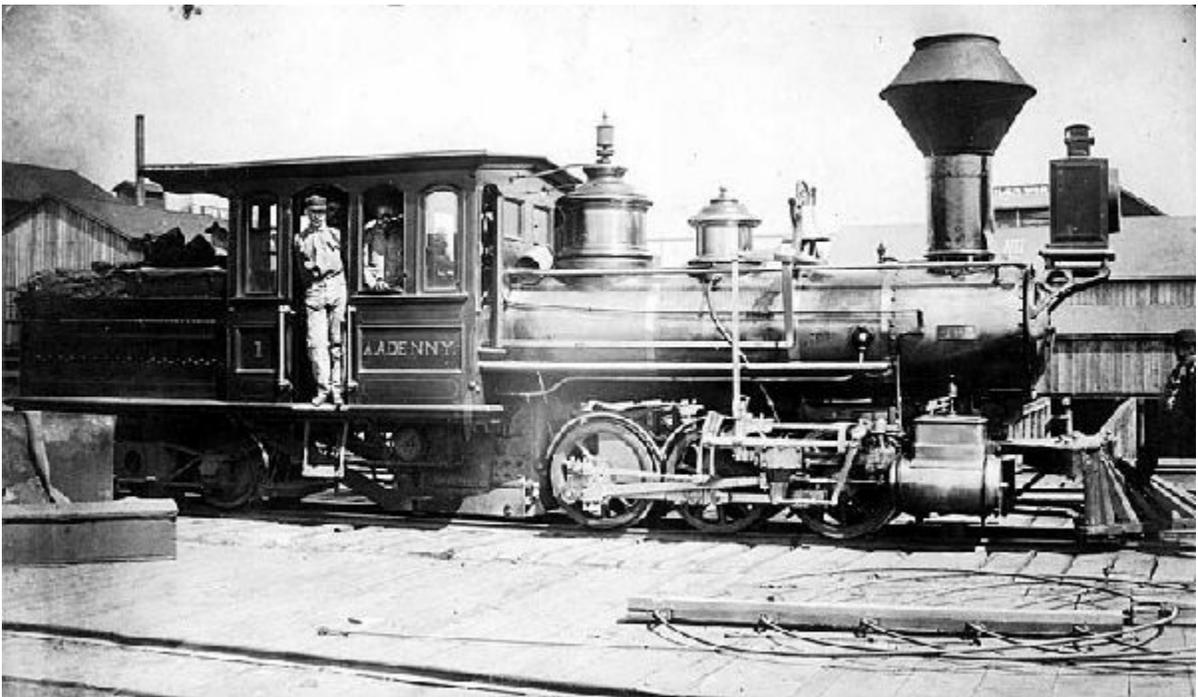
So Choose your prototype. Write it down somewhere so you remember which one you’re building, and keep an eye out of the instructions specific to the versions (generally only cabs, stacks and brake systems).

Other Options

Here are a couple of adaptations to the above locos which can be carried out with only minor kitbashing. If you want something other than the South Park look, or the Bully Boy, here are a couple of examples. Check also the Mason Bogie Archive for other options.



*This engine was originally built for the Peach Bottom Railroad in Pennsylvania.
Later it became #3 on the Ma & Pa.*



The adorable 0-6-4T AA Denny. refer to the Mason Archive for this loco's story.

Option 7C - This option will not be offered in this class! I'm always amazed at the lengths folks will go to to have their own Mason Bogie. This model is amazingly clever, having been fabricated mostly from clay, atop an LGB mechanism. I just love it! If the owner of this loco could get in touch with us and tell us more about it. I believe it was made as part of an Art project?



Signing Up!

There is no formal sign-up necessary, just start building when you want to. This class covers the construction of the Mason Bogie using the Barry's Big Trains 2-6-6/0-6-6T chassis. So as a sort of 'sign-up' you will need to order your chassis from Barry. Please refer to the 'Construction' section of this chapter for information about the BBT Mason Bogie Chassis and how to go about ordering it.

If you have other sources for a Mason Chassis with wheels of about the same size you're welcome to use it and follow along. The drive wheels we're using for this class are approx 44mm in diameter at 1:20.3 scale. The wheels are placed at 49mm centers.

Also just as a courtesy when you order your parts can you drop me an e-mail just to say you are getting your parts and will be joining the class. Don't be afraid to let me know you are embarking on this project. I will not put any burden on you beyond what is already written in this class!

[Email David Fletcher](#)

Open Forum

As each chapter comes on-line and work progresses to the next stage of the construction, there will be an open thread placed under the '[MasterClass and Articles](#)' forum, which will be your place to ask questions or discuss some great ideas you might have. I can help with anything, as I will be building the prototype model along side you all. But it would also be of great benefit to all those taking part to talk to each other about what worked and what didn't, or what can be done in an easier or cheaper way. We might also be able to get sneak peeks of each other's partially built loco.

The Big Show & Tell

At the conclusion of this MasterClass, we'll all have some of the most stylish, gog-danged masterpieces you ever saw, and no two will be alike. We will place photos of everyone's finished model in a special show & tell page, allowing you to showcase your model, and describe its background, and any oddities that might have occurred along the way.

Come and Join In

So get your tools together and get set for some fun and adventure as you embark upon the world of locomotive construction.

This first article is primarily a guide to the selection and collection of the necessary parts.

After this article, the next article will not be published for 4 weeks, to allow everyone taking part to acquire the necessary parts. We will however stay in contact to monitor how the part haul is coming along, should any of you have difficulty obtaining any of the parts, we will help find other sources...so speak up if that special dome you wanted is out of stock!!

Background

(Ex loco Scientia)

From the locomotive - Knowledge



Genesis- The Perfect Locomotive

Robert Fairlie's Dream

Many of you will have heard of the Fairlie Patent locomotive. These were an early articulated locomotive with two steam powered trucks or 'Bogies' supporting a double boiler on a rigid frame. The Fairlie Double Boilered articulated locos are without doubt Robert Fairlie's claim to historical fame! But believe it or not the Fairlie locomotive was only the result of the Robert's quest for the perfect locomotive that would enable his beloved narrow gauge railway principle to operate as efficiently as the standard gauge counterpart. Fairlie was not a locomotive designer by nature; his emphasis was on devising the perfect 'efficient' railway gauge, the locomotive was born out of that quest.

The story begins where Chapter 8 'Background' MC2001 finished. The British parliament in the mid 1840's set up a Royal Commission to investigate the railway gauge issue with a view to adopting a national standard. There were only two major gauge contenders, and both were supported equally by two of Britain's most famous Engineers. Robert Stephenson fought vigorously for the adoption of his 4ft 8 1/2" gauge (later known as Standard Gauge) and Isambard Kingdom Brunel fought for the national gauge to be 'broad gauge' of 7ft 1/2". In nearly every field trial the broad gauge won the day, running trains faster, smoother and hauling greater loads, with locomotives some 5 years older than those being used on the Stephenson gauge. Brunel won the battles, but lost the war. The Royal Commission chose to adopt the Stephenson gauge of 4' 8.5" as the national standard on the basis that only 274 miles of the broad gauge had been laid as opposed to the 1900 miles of the Standard Gauge. Brunel was ordered to regauge his rails.

From that day onward all public railways and all passenger railways by law were to be built to the Standard Gauge.

This ruling did not affect the many smaller industrial lines, and mining tram ways. These lines, adopting very narrow gauges of around 2ft, were generally horse drawn or used gravity and winches. As the industrial revolution went into full speed through the 1850s, these small lines began to feel the burden and the need to mechanize their lines with locomotives.

The Ffestiniog Railway

This is where the story of narrow gauge begins!

In the 1830s the slate mining region of southern Wales decided to build a railway, to become known as the Ffestiniog Railway. The line was to be horse drawn, hauling the empty wagons up hill, while gravity would power the return trip of filled slate wagons. The rail gauge adopted was incredibly narrow at around 1' 11 3/4".or just under 2ft. At that time, such a railway just never thought a steam locomotive would ever be needed. Before long nearly all the slate quarries in the area were using the little railway and the traffic on the line had increased to such an extent that the directors began to think about mechanization.

By 1850 the Ffestiniog railway was openly talking about steam locomotives for the line. The directors were also wanting to upgrade the line for passenger service. Steam was the way to go. There were two big problems with this:

1. The British Government's Standard gauge law for passenger lines, and
2. Engineering resistance to building steam locomotives for such a narrow gauge.

Brunel was openly hostile to the concept of a steam railway on such a ridiculously narrow gauge, stating that the trains would be unstable at best, uncomfortable and inefficient. Robert Stephenson simply believed that it was impossible to even build a steam locomotive for such a gauge.

Rather than regauging their short-sighted line, the Ffestiniog directors pressed on with their dream of a steam railway and 1862 advertised for locomotive builders.

The answer came in the form of tiny 0-4-0s deigned and built by George England & Co. of Hatcham Ironworks, New Cross, London. By 1865 the boom hit the slate region and these 0-4-0s were soon overburdened, the line needed help, and it would not be found in conventional locomotive design.

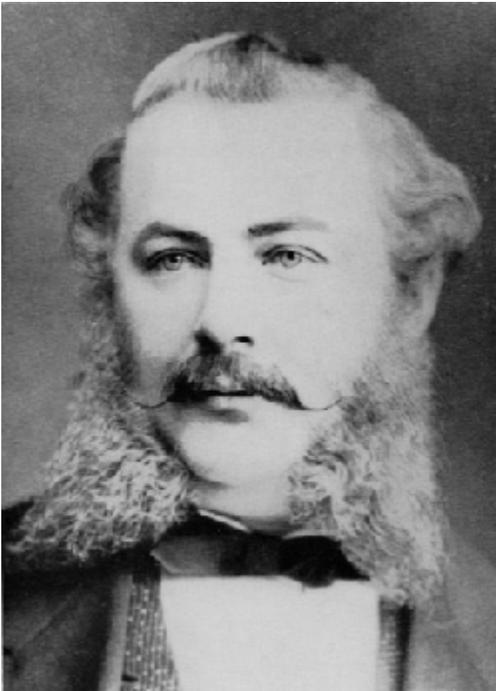


A typical George England 0-4-0 of 1864, restored at the Ffestiniog. 'Palmerston'.

Robert Fairlie

Robert, born in Scotland in 1831, learned the locomotive trade by working in the famous Crewe Shops, serving the London & North Western railway, and working for Brunel's Great Western Railway at Swindon. He later became Chief Engineer for the Londonderry & Coleraine Railway, then went to India to help establish the Bombay & Baroda Railway. His time working for the Colonial lines would have a profound impact on his regard to rail gauges and the concept of efficiency. In the early 1860s Robert

returned to London and set up a private practice as a consulting engineer. Becoming more and more frustrated with the popular thinking about locomotive design and railway construction, Fairlie would publish two landmark papers, whose purpose was to challenge the very notion of what was considered efficient design, both in terms of locomotive design and the planning of the lines themselves.



In 1864 he published a pamphlet entitled "Locomotive Engines: What They Are and What They Ought to Be". In his writing he questions the locomotive weight distribution, and the number of un-powered wheels supporting that weight. He also speaks about locomotive inefficiency with the need to turn locomotives on turntables and the wasted grounds needed to service such locomotives. Fairlie believed locomotives were designed with such inefficiencies because there was no real challenge to design them in any other way. Railways were built with the widest possible curves and leanest grades possible, a literal paradise to the locomotive designer. In such a paradise, Fairlie believed locomotive engineers had become complacent, careless and even negligent in their duty in designing efficient locomotives.

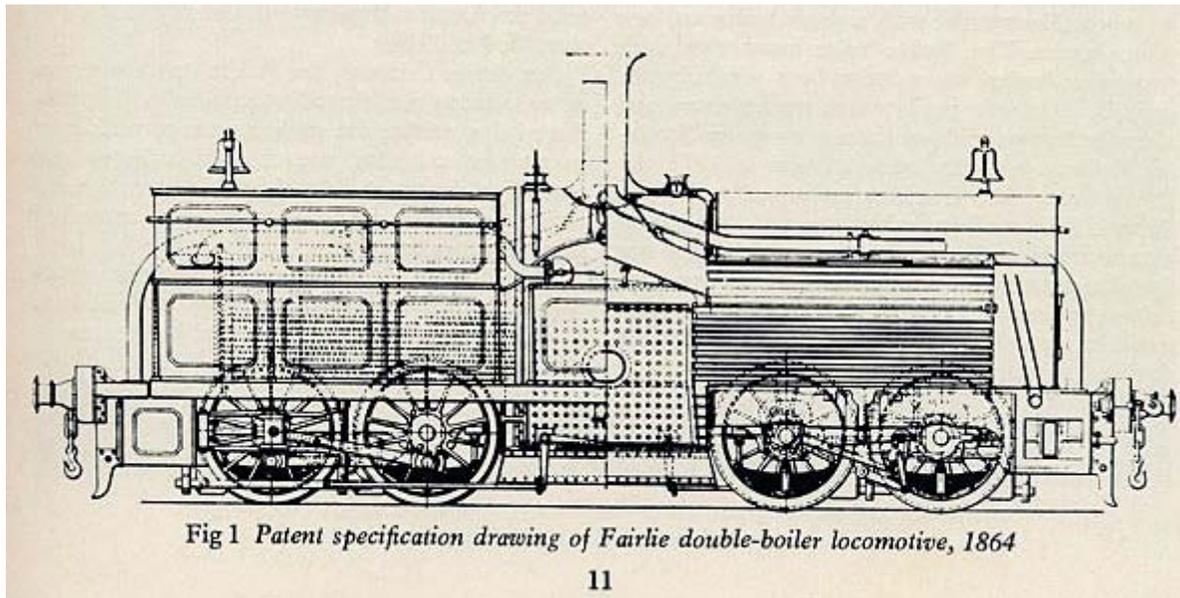
On the heels of that paper, Fairlie then went on to champion the notion of ‘Surface Lines’. This was the very essence of what Narrow Gauge would ultimately become. Fairlie proposed lines that could follow the natural gradient of the land (hence Surface Lines). They would have steeper grades, sharper curves, lighter rails, shorter sleepers (ties), lighter bridges, fewer tunnels and so it went on. The emphasis was that by building surface lines, a major component of the construction costs would be saved. These lines were cheaper to build, and could be built to serve areas previously considered inappropriate to railway construction. Now both Robert Stephenson and Brunel had examined this sort of thing before, and such lines were deemed unsuitable for the successful operation of a steam locomotive.

This is where Fairlie’s thesis really comes together. Yes narrow gauged ‘Surface Lines’ are inefficient, and unsuitable to steam locomotives when thinking of conventional locomotive design. However Fairlie’s intent was to match the ‘surface lines’ concept with his treatise on ‘what locomotives ought to be’. Only with the correct, properly designed locomotives, could the ‘surface line’ concept work. It became Fairlie’s ambition to not only promote the surface line concept in Britain and her colonies, but also provide the design principals on which locomotives could be built that would enable these line to run as efficiently as the Standard gauge. Fairlie’s answer was his double boilered double bogie steam locomotive, today known as the Fairlie Patent Locomotive. This was Fairlie’s ‘Perfect Locomotive’.

It is important to note that neither the ‘surface line’ concept, nor the articulated double boilered locomotive was actually Fairlie’s invention, but it was he who put it all together with a logical methodology.

In 1864 Fairlie took out a Patent for his double boilered, double bogied loco called ‘Improvements to Locomotive Engines and Boilers’. The Patent was 14 pages long and contained 21 drawings. The basis of the design went to the very heart of what he considered inefficiency in conventional locomotive design:

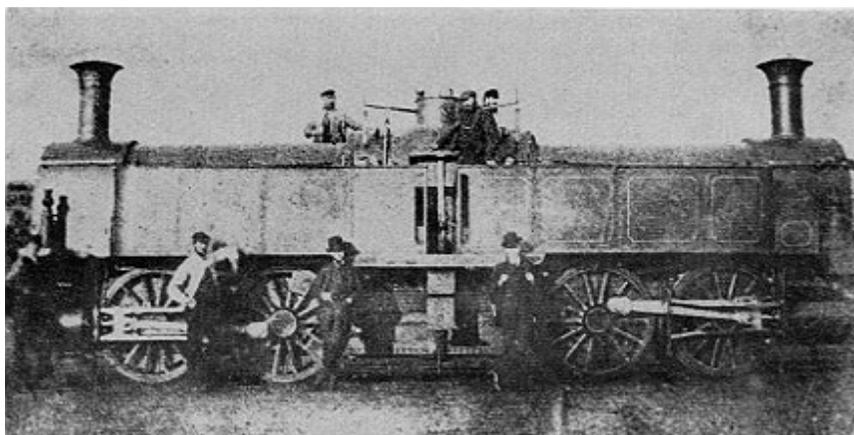
1. All of the locomotive’s weight would be carried on driven wheels. There should be no dead weight in a locomotive that does not contribute to tractive effort. Fairlie ensured that all of the locomotive’s weight was supported by driving wheels, including the water and coal load. There would be no unproductive tender weights dragging behind the locomotive.
2. To power the larger number of driving wheels, two boilers would be used, fueled by a common firebox, thus only one crew would be retained to work the locomotive. Fairlie also believed two shorter boilers off a common firebox would prove to be more efficient at heating water than one long boiler.
3. To support the aggregate load and length of the loco comprising two boilers, and all water and fuel loads, the chassis would be articulated in the form of two powered bogies. This would enable the long locomotive to flex and meet the sharp bends and twisting trackage of his ‘Surface Line’ concept.



The original design drawing of Fairlie's double boilered loco. Note the single stack devised to serve both boilers, with the smokebox nested about the central firebox. No Fairlie locos were ever built with this configuration.

In the patent documents, Fairlie also mentions the possibility of a single boiler supported by articulated driving units. While Fairlie would not initially design this type of loco himself, it is this single boilered Fairlie loco that would later come to the attention of William Mason of the Mason Machine Works in the US.

Strangely the first double Fairlie patent loco would be built to Standard Gauge in 1865 by James Cross & Co, St Helens, Lancashire. The locomotive was named 'Progress' and went to work at the Neath & Brecon Railway. Amidst problems of leaky steam pipes and draft problems in the double boilers, the locomotive would ultimately be purchased by George England & Co. in 1869. This was the same company that was building little 0-4-0s for the Ffestiniog Railway.



The first of the Fairlie Patent double locomotives, 'Progress' 1865.

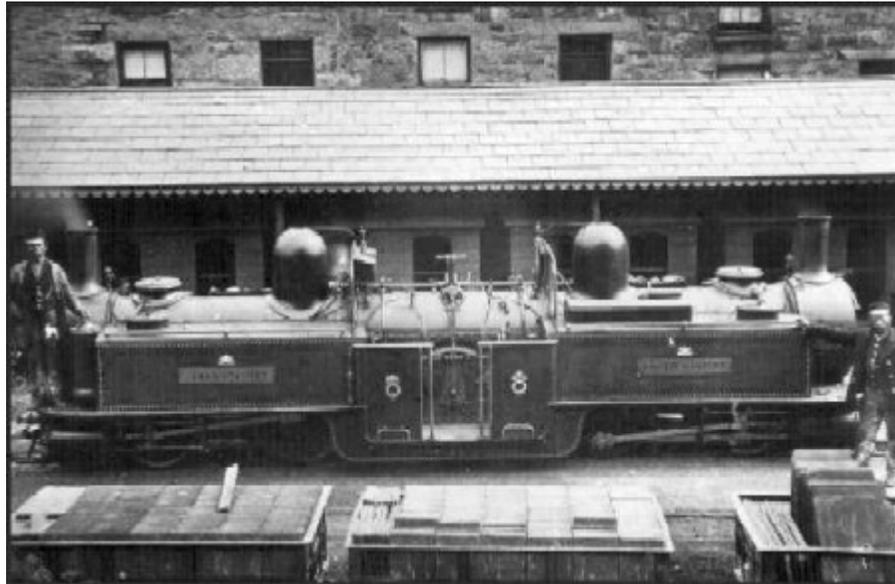
Fairlie would champion his narrow gauge railway concepts and double locomotive around the world, and would you believe it was us poor unsuspecting Auzzies that copped the first blow. Fairlie would help promote the adoption of 42" narrow gauge in 4 Australian states, and the northern state of Queensland was the first to order three of the Fairlie Double Boilered narrow gauge locos in 1867. These three 0-6-6-0 are reported as being the most unsuccessful locos in Australia's history!! Two of them never even got unpacked

from the crate! The locomotives were also built at James Cross, St Helens, under the supervision of Charles Douglas Fox. Among problems of weight, breaking rails, and leaking steam pipes, the real issue was the double boiler fueled by a single firebox. One stack tended to draw air right through the boiler, drawing in cold air via the other stack. As a result the loco would not steam properly. When the first of the 0-6-6-0s was unpacked, it was found to be 20% heavier than the specs called for. During trials the engine steamed poorly, ran out of water, threw numerous curves out of true, and finally derailed..all in only 20 miles! The locomotives were returned to the UK. This fiasco could have seen the end of the 'Perfect locomotive' had it not been for Robert's wife!

In 1862, soon after arriving home from India, Fairlie would marry the daughter of George England, and there is no doubt that this relationship with George England provided the opportunity for Fairlie to prove the viability of the Double locomotive on the narrowest of gauges; the Ffestiniog. Teaming up with George England Jr and J.S. Faser, Fairlie acquired the George England & Co works and began trading under the new name 'Fairlie Engine & Steam Carriage Co'. Their first locomotive of 1869 was the answer to the Ffestiniog's cry for help. The locomotive was a double boilered 0-4-4-0 named 'Little Wonder'. The 'Little Wonder' proved to be a reliable and powerful loco on the restrictive Ffestiniog rails. Fairlie worked to improve the design, and soon the twin boilers were served by separate central fireboxes. Two firedoors were provided for the fireman to fuel both boilers separately. Soon the Ffestiniog was calling for more of the Fairlie patent locos, and other locomotive works were starting to build them. In a cool marketing coup, Fairlie allowed other firms to build his loco asking for no royalty payments. The Ffestiniog became a benchmark of what could be done in narrow gauge if the right equipment was used. It proved the very point that Fairlie had been promoting. Some 300 Fairlie locomotives would be built by 13 engineering firms in 4 countries.



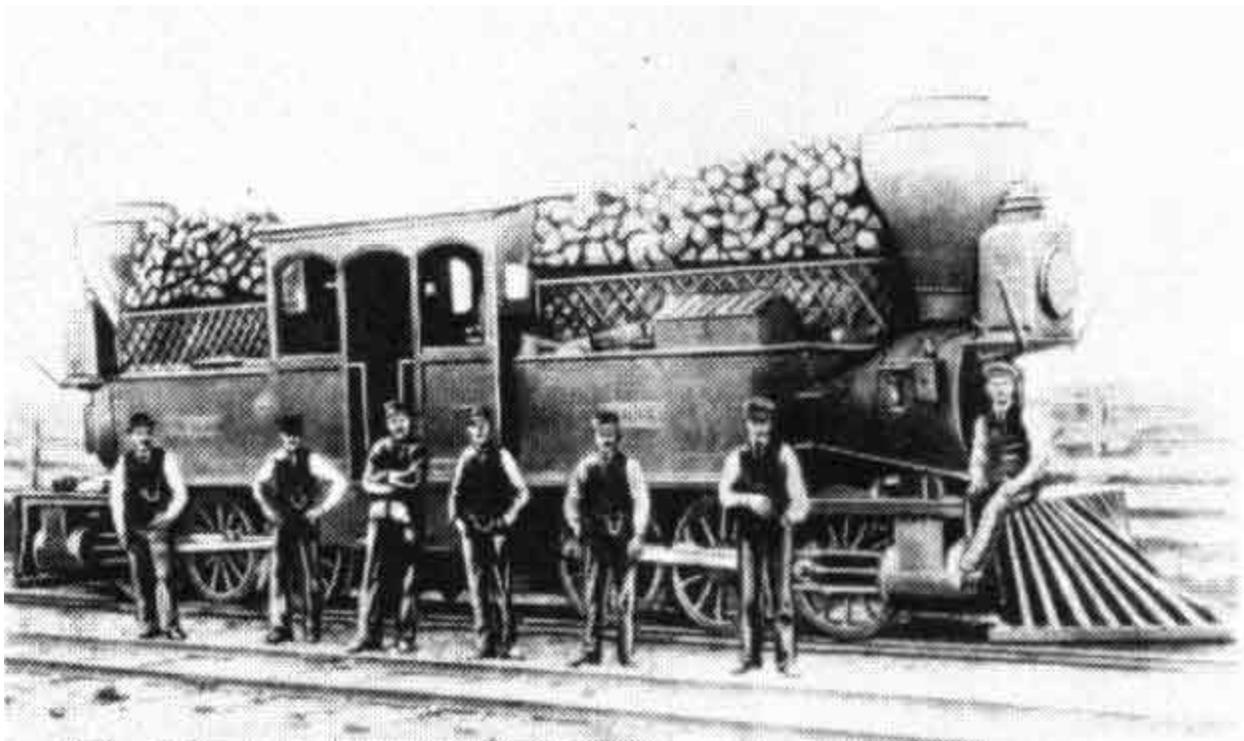
The 'Little Wonder', the Ffestiniog's first Double Fairlie seen hard at work on the slate line. The loco is a great success.



The 'James Spooner', the Ffestiniog's second Double Fairlie locomotive.



The disused boiler of a Ffestiniog Double Fairlie 0-4-4-0. Note the double firebox serving the two independent boilers.



The Double Fairlie in Canada. Note the fuel storage location on these locomotives atop the side tanks and boiler. The fuel placement aided the tractive effort of the locomotive but made them difficult to fire.

The Fairlie loco would ultimately have mixed success internationally. Today the only Double Fairlie locomotives still in operation are those found on the Ffestiniog. There does appear to be some truth in what Fairlie was promoting. The locomotive would prove to be particularly brilliant on the very narrow lines, such as the Ffestiniog, and less successful on the wider gauges where larger conventional locomotives could be used.

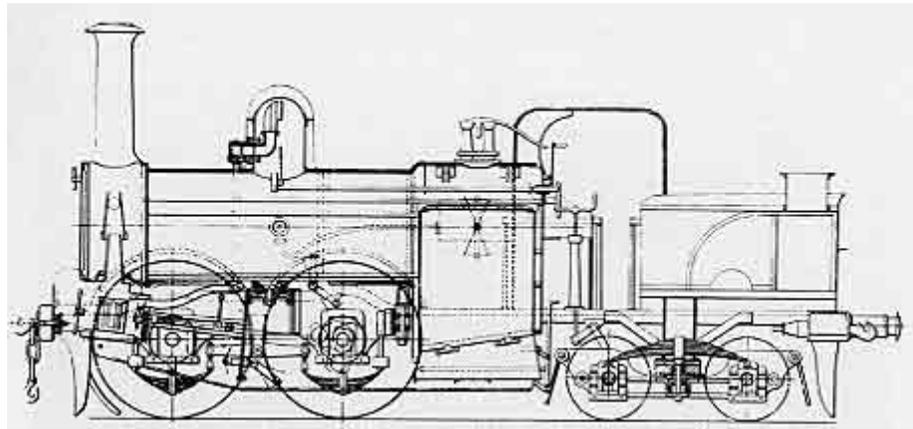
Some will say that the Fairlie locomotive was singularly unsuccessful and that even the crews at the Ffestiniog dislike running them. I'm not sure of the truth in that, as the line holds these locos up with the utmost affection. The Ffestiniog Fairlies today are about the most unique and adorable locos you're likely to find on your travels. Certainly there is no question to the truth in Fairlie's original patent design principles, for every modern diesel, and electric bogied loco works on exactly the same Fairlie design principle. Every wheel is powered and all the loco's weight rests on driven axles, including the fuel loads. The chassis is flexible with two or more powered trucks and there is no need for turn tables....The perfect locomotive.

The Single Fairlie

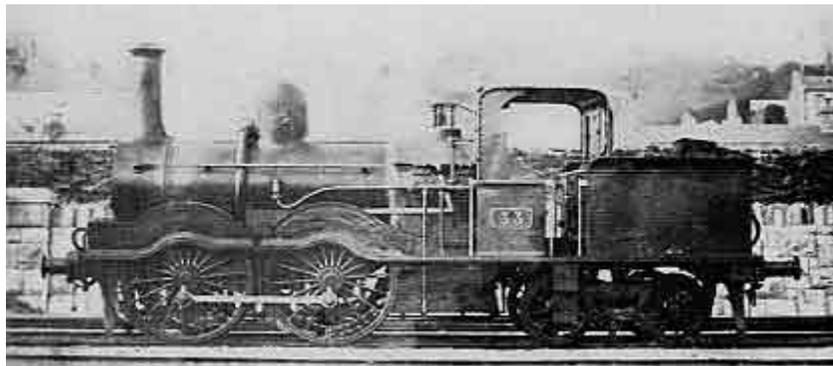
While Fairlie did not initially design a single boilered version of his loco, he was smart enough to recognise that someone could design such a loco, and as such included the principle in his original Patent submission. The concept of a single boilered loco, on a single powered truck actually goes against Fairlie's basic concept of an all powered axle loco. Once again weight is spread on unpowered wheels. If the double boilered Fairlie loco was considered a good idea, it is said that the Single Fairlie was only 'half a good idea'. Its easy to see why Fairlie wasn't interested in pursuing the design.

The first 'Single Fairlie' was designed by Alexander McDonnell in 1869, and built at the Inchicore Works of the Great Southern & Western Railway, Ireland. The locomotive had some innovations not seen on other Fairlie locos before. The design was a simple 0-4-4T, with a single boiler, cab and tender on a common

frame, supported by two 4 wheel trucks. The lead truck was a steam driven unit, while the tender truck was unpowered. Unlike other Fairlie locos, the blast pipe was fitted up through a slot in the smokebox base that enabled the powered truck to pivot while keeping the blast pipe within the smokebox without using flexible, complicated joints. It is this loco, more than any actual Fairlie double loco that is behind the design of the Mason Bogie in the US.



Design Drawing of the First Single Fairlie, 1869.

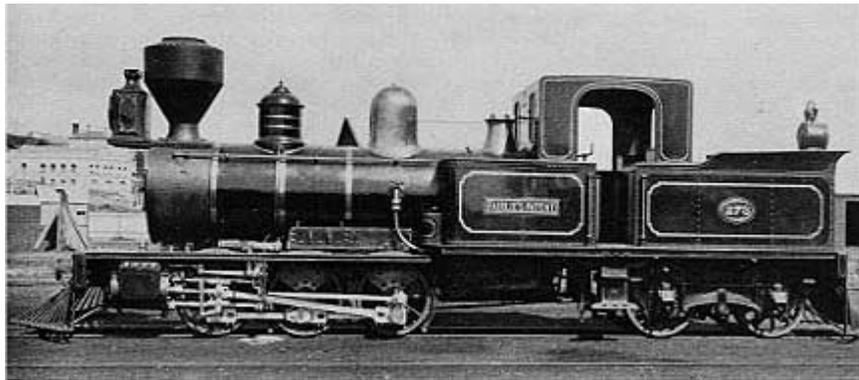


The First Single Fairlie at work in Ireland.

Two of the Single Fairlie type were built for service in Ireland, and amidst problems of leaky steam pipes to the flexible powered truck, the locomotives both saw service for some 20 years. Sometime in the early 1870s, C.E. Spooner, owner and chief engineer of the Ffestiniog visited Ireland and saw McDonnell's Single Fairlies at work. The Single Fairlie would also soon be pressed into service at the Ffestiniog and in other countries where narrow gauge lines were adopted. Some of the most impressive Single Fairlies would be found running on the 42" gauge lines of New Zealand. Several of the NZ Fairlies have survived both intact and as rusty relics used to shore up river embankments. If you have the \$\$ and the ambition, there are a number of such locos waiting to be removed from the mud and restored!



The 'Taliesin', a replica Single Fairlie, now at work on the Ffestiniog Railway.



The 42" gauge 'R' class Single Fairlies of New Zealand, 1878.

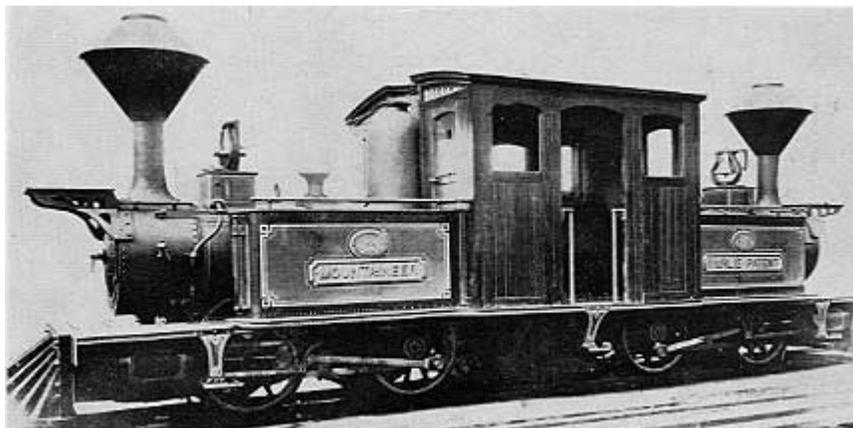
General Palmer, Narrow Gauge and the Fairlie Loco.

William Jackson Palmer was the founder of the famous Denver & Rio Grande Railway, an extensive narrow gauge network in Colorado, New Mexico & Utah. He was educated in England, and learned his railway background in the 1850s while working for the Pennsylvania RR under J. Edgar Thompson. Called to duty during the Civil War, he became a General for the Union forces. After the war General Palmer went back to the Railroads and found employment at the Kansas Pacific.

While the Kansas Pacific was pressing toward Denver, Palmer envisioned building a Transcontinental Railway that would run South from Denver, tap the enormous mineral wealth in the Rockies enroute, and ultimately reach Mexico City via the state of Texas. He went to his KP employers with the idea, but found little support for such an ambitious project. Undaunted he continued to develop the proposal with the intention of selling the idea to large New York investors. While traveling east to New York, Palmer happened to meet William P. Mellen, an influential lawyer from NY and his beautiful daughter Mary. Mellen, taken by the Palmer's railroad plans, promised to help him find financing. Palmer was taken by Mellen's daughter Mary. They were married in 1870 and went to England on their Honeymoon.

While visiting England, Palmer decided to visit Wales and see what all the hoo-haa was about with the Ffestiniog railway. The Ffestiniog had become quite well known internationally as the impossible steam railway that worked! At the Ffestiniog, Palmer got the opportunity to see the 'Little Wonder' at work, had discussions with the railway's management and got some personal time with Robert Fairlie. Palmer left the railway with no doubt about his plans. The Denver & Rio Grande would be narrow gauge, and would be supplied with the 'correct' locomotives to operate such a line. The accessibility problem in the Rocky mountains called for exactly the type of solution Fairlie was offering. Fairlie made no secret of the fact that even the Ffestiniog's 2ft rail gauge was really too narrow, and real efficiency would be found with the marriage of the correct gauge with the correct Fairlie Patent locomotives. As Fairlie himself liked to call it, the 'Ideal Fairlie Gauge' was between 36" and 42" depending on the topography. General Palmer would adopt the 36" gauge. Less than one year after his meeting with the Ffestiniog, Palmer rode the first train on the Denver & Rio Grande from Denver to Colorado Springs.

The first couple of years called for the railway to run along the plains to the east of the Rockies, and as such, tiny conventional locomotives were put to work on these easy grades (Baldwin Class 25 2-4-0s). By 1873 the railroad was heading into the mountains. It was time to fill the order for the 'perfect' narrow gauge locomotive.. a Double Fairlie! The D&RG's Double Fairlie was built by the Vulcan Foundry in the UK in 1873 at the cost of what is said to be three times the cost of the D&RG's Baldwin Class 35 2-6-0s of the same year. The loco Weighed 62,000 pounds (close to the weight of a C-16) and had a tractive effort of 9,280 pounds (about a third more than the Class 35 2-6-0s). The loco, like so many of the Fairlie locos pressed into mountain service, was aptly named 'Mountaineer'. I should try and do a count of just how many Fairlie locos were called 'Mountaineer'!



The D&RG's only Double Fairlie loco, the 'Mountaineer' of 1873. This would be the first and last Double Fairlie to be imported into the United States.

Palmer's initial reports about the locomotive's performance were good. She served the D&RG including the La Veta Pass area, for about 10 years, and was later scrapped in 1888. The 'perfect' locomotive would not find fame in the US. The D&RG's 'Mountaineer' was the first and last Double Fairlie to be imported into the US. She was not viewed favorably by her owners, maintenance personnel or crews, and was considered less efficient to operate than conventional locomotives. The loco was also said to be hard on the rails due to her weight and size. The unsuccessful performance of the Double Fairlie in Colorado no doubt contributed the loco not finding acceptance in the US. The 'Mountaineer' however was not the only Double Fairlie type to be tested in the US. The other loco has an unusual story all her own, and this is where the fun really starts.....enter WILLIAM MASON!! Yeeehheheheh!!

William Mason Experiments With the Fairlie Patent in the US.

Through the Background sections of this class, you'll come to learn more about William Mason, but as a simple intro, lets begin by revealing that he was born in Mystic, Connecticut in 1808, but had a love for British design and came to have an understanding for the British theories and practices through his trips to the UK and through his British engineering associates. It has been suggested that his unusual locomotive design and decoration concepts were born out of his mixing US engineering with British artistic flair. William Mason founded his locomotive works at Taunton Mass. in 1852 after leaving a career in building textile machinery. Between 1853 and 1883 Mason would build some of the most stunningly beautiful locomotives in the US, completing 700 by the year of his death in 1883. William tended toward perfectionism, and its been said that he was more interested in locomotive design for the fun of it, than to actually make any money out of it. To the frustration of some railroads, Mason's perfectionism tended to delay delivery. He was innovative, and rarely took accepted design philosophies at face value. Above all he believed his locomotives should be beautiful, which they were. This meant the perfect union between the functional and the aesthetic. His drive to remove undesirable clutter from the clean lines of a locomotive brought about many innovations in locomotive design. He was the first to use horizontal cylinders on the long framed locomotives such as the 4-4-0. Previously locomotives had slanted cylinders with an awkward appearance. To avoid the ungainly, asymmetric appearance of counterweighted wheels, he invented the hollow cast iron spoked wheel, and counterweighted these wheels by pouring lead into the spokes. Perhaps Mason's most famous contribution was the adoption of the Walschaerts valve gear, the first in the US, used on one of his Mason Bogies from 1874.

Mason's use of artistry and functional decoration through the 1860s would inspire many of the other leading builders such as Rogers and Baldwin, leading to the industrial art era of American locomotives through the 1870s and 1880s.



William Mason's 4-4-0 'Highland Ligh' built for the Cape Cod Central RR in 1867 typifies Mason design and decoration in the 1860s

As M.N. Forney, an authority in motive power (as in Forney locomotives), once said of William Mason: "He was a wonderfully ingenious man and combined with his ingenuity a high order of artistic sense, so that his work was always most exquisitely designed. It might be said of his locomotives that they are melodies cast and wrought in metal."



The famous B&O #25 'William Mason', now preserved at the Mt Clare Museum in Baltimore, was built at the Mason Machine Works in 1856.

Through the 1850s to 1870, Mason would build leading edge 4-4-0s and 4-6-0s. In 1869, always looking for ideas to improve the steam locomotive concept, Mason came across the Fairlie Patent locomotive.

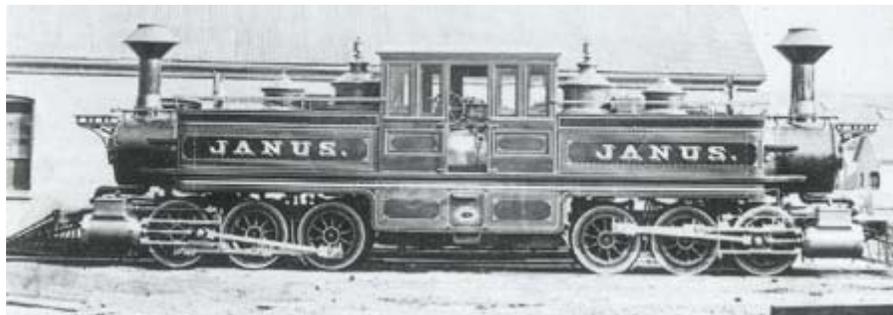
Mason's First Fairlie type locomotive.

The dates are not particularly clear, as different texts give different dates for the construction of Mason's first Double Fairlie type loco. But it was either 1869 or 1871 that Mason built a large standard gauge 0-6-6-0 version of Fairlie's double boilered, articulated loco. The locomotive was named 'Janus', named after the God of that name, Mason Works Construction number #438.

According to "American Steam Locomotive" by Brian Solomon, the Janus design may have been intended to be symbolic of the junction of the Central Pacific and Union Pacific in 1869, creating the first transcontinental railroad. After being tried out by two other railroads, it was purchased by the Lehigh Valley where it was used as a pusher. It was scrapped in 1877.

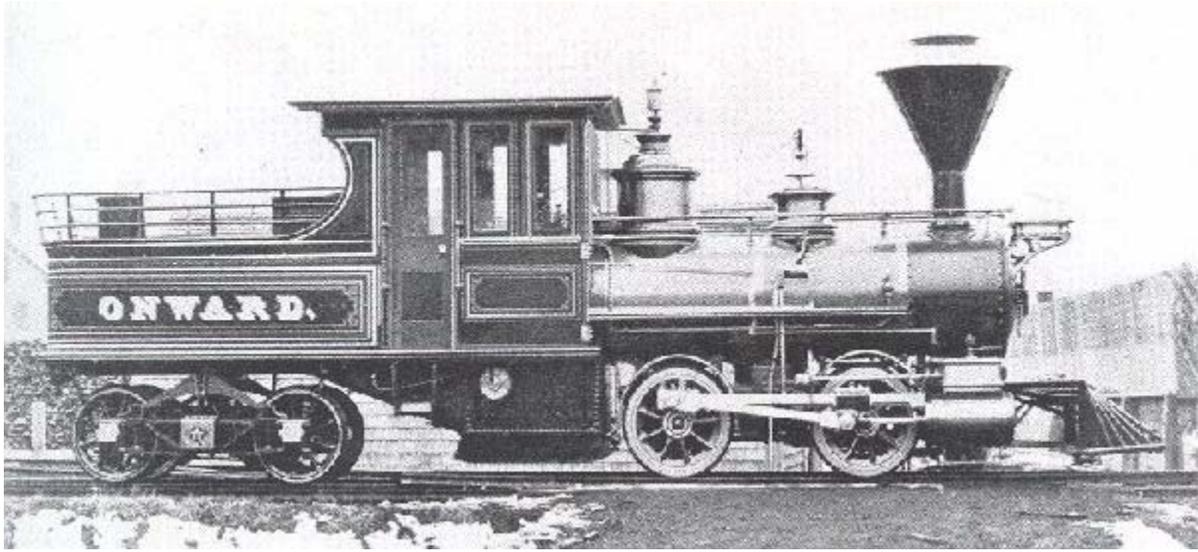
But according to "The Fairlie Locomotive" by Rowland Abbot, the Lehigh performed the mother of all kitbashes on this locomotive ... cutting it in half at the middle of the cab, creating two 0-6-0 switchers! (Tom Farin - Mason Archive).

The locomotive it seems was not a success, and it probably suffered from many of the same ailments as the typical Fairlie loco.



William Mason's first Fairlie type loco was this large 0-6-6-0 Double Fairlie, called 'Janus', probably built in 1871.

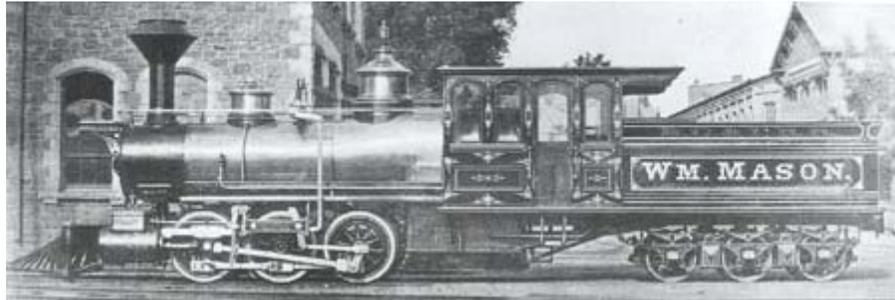
Not giving up on what seemed like sound engineering theory, William Mason experimented further with the Fairlie articulated design and in late 1871 built his first 'Single Fairlie' design, a small 36" narrow gauge 0-4-4T, named 'Onward', Mason Construction number #461. The locomotive was delivered to the American Fork RR in 1872.



The tiny 'Onward', William Mason's first 'Single Fairlie' type loco, later to be known as a Mason Bogie, 1871.

These early Mason articulated locos suffered the same leaky steam pipe joints to the swiveling trucks as Fairlie was having. The pivoting steam pipes, external to the boiler, also tended to allow the steam to cool, reducing the locomotive's efficiency. Mason never to accept the status quo, worked to resolve these simple problems plaguing a theoretically good locomotive design.

1874 was the year of innovation for William Mason in solving some of the Bogie problems. He first patented a design whereby the steam delivery pipe ran from the steam dome forward to the smokebox, then looped back under the boiler to the center bearing plate of the steam truck. By running the steam pipe from the boiler to the chassis through the bearing point, Mason minimized the lateral and vertical torsion in the steam pipe. From the central bearing plate, the steam pipe then ran forward between the chassis frames to the cylinders. In developing this design Mason would also introduce a new type of valve gear to the US. Since the Bogie loco now sported a steam pipe running between the frames to the cylinders, there was little room left to install the Stephenson's valve gear between the frames also. A new valve gear was needed, fitted external to the frames. The valve gear also needed to be adaptable so that the forward and reverse functions could be controlled from a point near to the bearing point in the chassis. The Walschaerts valve gear was the answer. Mason fitted the new valve gear for the first time in a standard gauge 0-6-6T Bogie loco, named W.M Mason c/n 536 in 1874. The loco went into service at the New Bedford RR.



Builder's photo of the W.M. Mason, the 1874 Mason Bogie with the first Walschaerts valve gear in the United States.

In fitting the new valve gear to this locomotive, Mason would go down in history as having brought about the first practical application of the Walschaerts valve gear in the US. His locos also began to feature the characteristic Mason Bogie external forward/reverse rig mounted above the boiler. It was important to keep the forward/reverse linkages between the loco's superstructure and pivoting bogie close to the bearing point, or the lateral play in the twisting bogie would cause the distance between Johnson bar and valve gear to change when running curved track. This in turn would reduce the amount of steam cut off in the steam chests, and in a worse case scenario, throw the loco into reverse!

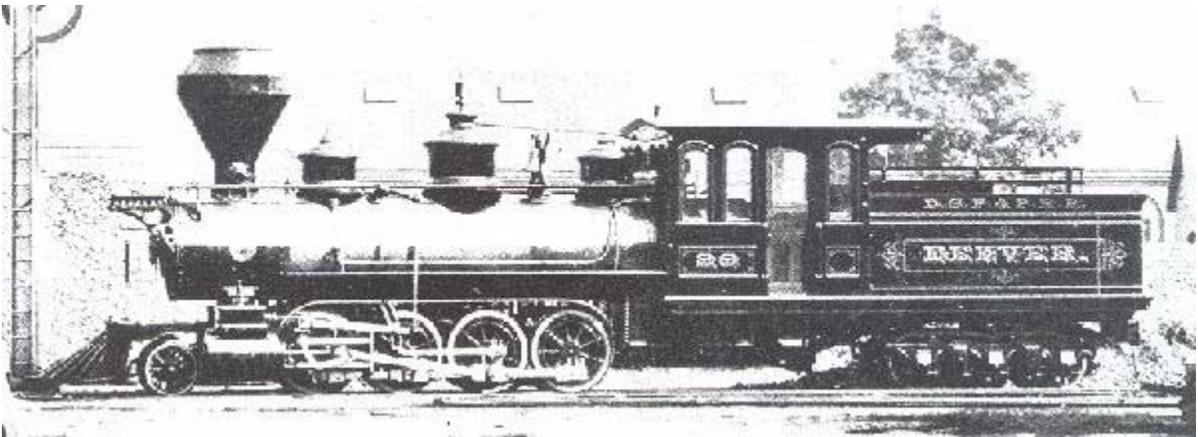
The Walschaerts valve gear was invented in 1844 by Belgian Engineer, Egide Walschaerts (1820 -1901). This valve gear would gain recognition decades later as one of the most efficient types and would become the most widely used on steam locomotives. First introduced in the US as we know by William Mason in 1874, it was then adopted in the UK in 1876...on an 0-6-6-0 Fairlie loco!! Well well well!!

When Mason developed these Single Fairlie type locos, it was his intention that the loco be generally run tender first, kinda like a cab forward. In this way the unpowered tender truck became the pilot wheels to help the loco negotiate twisting trackage. In practice however, the railroads ordered them and ran them boiler first or in both directions. In response to a request by a new Colorado NG RR for a Mason Bogie with a Pilot truck, Mason patented a special pilot truck that was linked to the main equalized suspension of the chassis. The first of the new locos fitted with the patent pilot truck was delivered to the Denver South Park & Pacific RR in 1878. The loco was numbered DSP&P #4, 'San Juan' C/N 597 and was the first of the famous 2-6-6Ts. This was actually the second Mason Bogie delivered to the South Park. The first, DSP&P #3 'Oro City' also of 1878, was delivered as an 0-6-6T type but was converted to a 2-6-6T when her new Mason pilot truck arrived with the San Juan! (Thank you George!)



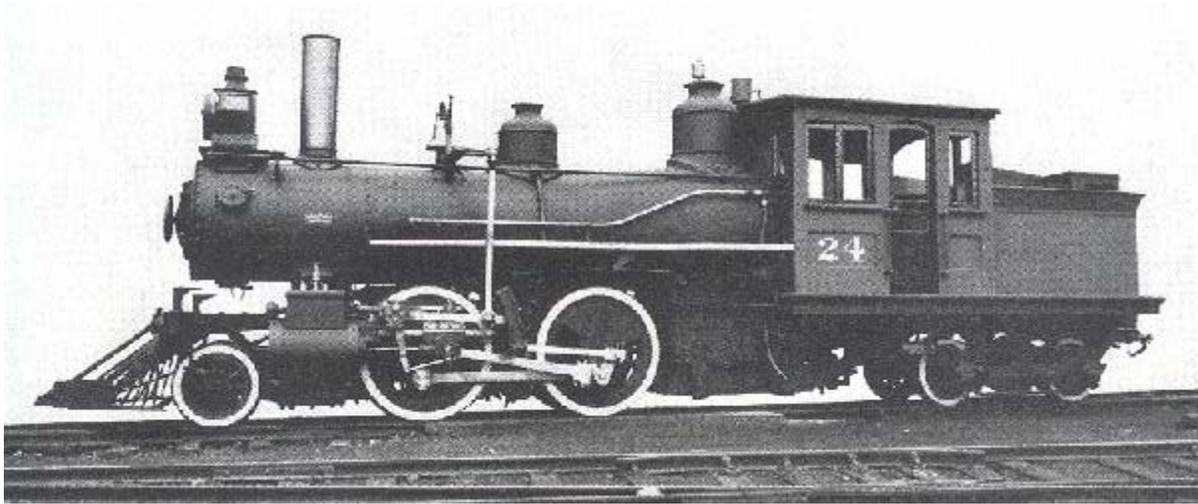
Builder's Photo of the first 2-6-6T Mason Bogie delivered to the South Park, DSP&P #4 'San Juan' of 1878.

Mason continued to develop the Mason Bogie into the perfect narrow gauge loco he dreamed it would be. Entering 70 years of age, Mason stayed hard at work building his beloved locomotives. The largest he would personally oversee built in his factory were the last Mason Bogies to be delivered to the South Park. Four of these monster 2-8-6T Bogies were delivered in 1880. The South Park would be the second largest owner of Mason Bogies, with 23 locos on the roster in 4 basic classes.



The last DSP&P Mason Bogies were there huge 2-8-6Ts. The South Park had been a good customer to the Mason works.

The other good Mason customer was the suburban line, the Boston, Revere Beach & Lynn RR. This line would eventually own 32 Mason Bogies over the years. The last of the Boston Masons were built long after Mason had died. The last Bogie loco delivered to the BRB&L was built by Alco in 1914 and followed the traditional Mason design.



The last Bogie delivered to the Boston Revere Beach & Lynn RR was this large 2-4-4T, built by Alco in 1914.

Of the 700 locomotives William Mason would build to 1883, about 146 were Mason Bogies. Of the Mason Bogies built, 88 were narrow gauge (some were later regauged). The Mason Bogie design would comprise about half of the firm's locomotive production between 1871 and 1890.

Well that should do it for this month! That serves as a basic intro to Mason, the man and the machine. We'll look more at the machine and roads that used them through the chapters of this class. We'll look at the advantages of the design, and what was their failing.

Next Month..Mason's wacky colours!



As a source of inspiration, MC2001 Master, Chris Walas, eager to get building a Mason-like machine before the class started, built this superb rendition of what a Mason Built narrow gauge Double Fairlie would have looked like. The loco, named 'Palindrome' is inspired by Mason's 'Janus' and is built to the Narrow Gauge scale of 1:20.3. Well done Chris!

References and Further Reading:

The Fairlie Locomotive - Rowland A.S. Abbott. David & Charles Newton Abbot.

[American Narrow Gauge Railroads](#) - George Hilton. Stanford University Press.

[Narrow Gauge Steam Locomotives...](#) - Brian Solomon. MBI Publishing Co.

The South Park Line, A concise History - Colorado Rail Annual #12, Chappell, Richardson & Hauck. Colorado Railroad Museum.

1850s-1990s Locomotives of Australia - 3rd edition -Leon Oberg. Kangaroo Press.

Cavalcade of New Zealand Locomotives - A.N.Palmer & W.W. Stewart. A.H. & A.W. Reed.

Ffestiniog Railway...The first 150 years.Doug Jackson. City Press Services, Manchester (Tourist history book).

Ffestiniog 150, The History of the Ffestiniog Railway - Peter Johnson. Ian Allan Ltd.

Australian Railway Historical Society Bulletin, Vol 53, No. 773. Article - Whitton, the Intercolonial Delegates' Picnic and the Fairlie Engine.

For some cool Fairlie and Mason web sites, take a look that these:

Surviving Fairlie Locomotives.

<http://members.aol.com/belpaire/fairlie.htm#11>

This is a list of all surviving Fairlie bogie locos around the world, and also has a shot of the only surviving Mason Bogie. A very nice site.

The Ffestiniog Railway.

<http://www.ffestiniograilway.org.uk/>

<http://www.festrail.co.uk/>

Fairlie Locomotive restoration.

<http://www.merddin-emrys.co.uk/>

The Masterclass 2002 Mason Bogie Pictorial Archive

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

Ted Kierscey collection

<http://www.narrowgauge.org/ncmap/ted/final.html>

Collection of original Denver South Park & Pacific Photographs. look here for photos of Mason Bogies hard at work on the South Park in the late 1870s.

Masterclass 2001 'Background' chapter - The origins and workings of the Steam Locomotive.

[Chapter 1 - The 1875 Baldwin 8-16-D 2-6-0.](#)

[Chapter 2 - Origins of the Locomotive Chassis.](#)

[Chapter 3 - On the Trail of the American 4-4-0 - The Quest for Locomotive Perfection.](#)

[Chapter 4 - All about Boilers](#)

[Chapter 5 - The Locomotive Cab: Bringing Folks in out of the Rain.](#)

[Chapter 6 - Pipes, Knobs & Levers: Taming the Horse from the Footplate.](#)

[Chapter 7 - Getting Excited about Tenders.](#)

[Chapter 8 - Isambard Kingdom Brunel -**The Little Giant!**](#)



Construction

The BBT Drive, Materials and Parts list

No special skills are required to build this loco, and no real special tools are needed either. I will ask your patience tool to be kept sharp. Talk to your loco, listen to what its telling you. If things are not going well today, paint is not going on smoothly, or parts are not fitting properly, and your frustration is rising, this is a good indication that it is time to stop for today.

You will need a sharp knife, a razor saw, a drill and bits (power or hand is OK), long nose pliers, cutters, fine and course sand paper, some metal files, soldering iron and solder and a good deal of enthusiasms and courage. While I do not own a Dremel hand power tool, I suspect such a tool would be very useful to this class, especially in making those arched windows in the famous Mason cab!

The Barry's Big trains Mason Bogie Chassis



*The BBT Mason Bogie Drive Kit. Note in this photo that the side rods are a test article as is the tender truck.
The Mason side rods and tender truck are still in development.*

This class covers the construction of the Mason Bogie using the Barry's Big Trains 2-6-6/0-6-6T chassis. You will need to order your chassis from Barry.

When ordering from Barry, please specify the following:

1. The chassis you need is either a 2-6-6T type or an 0-6-6T. Specify which type of Mason Bogie you'd like to build. If you're building your own version of a Mason type 0-6-4T or such, then request a chassis with no rear truck.
2. Specify if you will not be needing trackpower (even if intending to use Battery, ask yourself if the wipers could be of use).
3. Specify if you want the Bachmann 'Balloon' stack for an extra \$10. These stacks are required for options 2, 3, 4 and 6.

The cost of the BBT Mason Bogie Chassis is \$250.00. USD

This is a 'near cost' deal, and is heavily discounted from what the BBT drive actually costs.

BBT Chassis features:

...and now for a word from our chassis designer and manufacturer - Barry Olsen!

We at BBT have been building damn good drives for the past eight years. They have served well, as I have been advised. We have been introducing improvements over the years and hope those improvements have served well also.

The Mason Bogie drive represents a whole new body of improvements which were introduced/shown at the Queen Mary Show 2002 for the first time. Those of you who attended were able to see the preview model.

But, all of these improvements are really for the Bachmann 10th Anniversary locomotive. These items of improvement include; our first equalized front axle, a reed switch chuff sending switch, a vertical motor mount, double-thread worm gear, improved drive gear ratio, and countershaft drive...Standard!! The new drive makes use of the Bachmann Annie two-part side rod, so a price reduction is in order for that, but a countershaft drive and equalized front axle are additions to our standard offer.

The point is this, we have come this far and are now striving to build the best largescale drives in the world. The signers to the Mason Bogie project who chose the BBT drive, are not guinea pigs, but will be my 'body of proof' of the progress we have made I want your feedback; problems?? pleased?? displeased??

We're making this drive available to the project at near cost, but your feedback will help us towards our goal. And, of course, the drives are warranted and fully supported by BBT.

The chassis comes as a complete 2-6-6 or 0-6-6 chassis, including the steam truck and tender truck, and whole loco frame and locomotive side rods and main rods (not the valve gear).

The M-B drive consists of the following:

The BBT drive:

- Vertical mount, Pittman motor
- Equalized rear axle
- Reed switch chuff sender (two magnets in back of blind driver)
- Countershaft Drive, Ratio 29.5:1
- Ball-Bearings on the flanged drivers, Thick-walled brass tube for the blind driver.
- Capstock extension forward to carry the cylinders and rearward to finish the top of the drive.
- Lube port for gear inspection and lubrication
- BBT Pickups for track power (delete option avail.)
- Two-part, hinged siderods and single mainrods and single crosshead.
- Bridge Stock (Capstock extrusion) frame from pivot (around motor body) back to Tender truck.

Tender truck

- Six wheel tender truck, sideframe and bolster castings (masters by Chuck Meckem), with pickups
- 26" Wheels and axles by Sierra Valley Enterprises

Pilot Truck BBT

- 24" SVE wheels, with pickups

These items comprise the BBT Drive kit for the Mason Bogie. Of course laid out for the 2-6-6 configuration. Please specify if you wish to have the chassis made in an 0-6-6T format or any other format type.

Order your Mason Bogie BBT 2-6-6 & 0-6-6 chassis by e-mailing Barry at: barry@barrysbigtrains.com or you can download and print an order form on Barry's web site: <http://www.barrysbigtrains.com/orderinfo.asp>

Remember to also e-mail David Fletcher of your intent to start, and just a basic note about which version of Mason you'd like to build. This will help me tailor the MC2002 words to better serve your needs. E-mail David Fletcher at:

fletch@myLargescale.com

Important Note:

The BBT Mason Bogie chassis will be available as standard in Barry's product range and will remain available to modelers long after this class is finished. The chapters will remain on-line for future modelers to enjoy. As mentioned, the BBT Mason Bogie chassis is being offered at near cost for this project as a special discounted offer. This deal cannot be retained beyond the duration of the Masterclass. Make note that the BBT Mason Bogie chassis will return to normal price after Chapter 6 goes on-line in October 2002. All orders must be received by Barry prior to 15th October 2002 for you to get the discounted chassis. After that time the chassis can be purchased along with any of the BBT chassis options at the normal advertised price.

The Discounted BBT Masterclass 2002 Mason Bogie Chassis offer till Oct 2002 - \$250.00 USD

The BBT Mason Bogie Regular Price is \$400.00. After October 2002, the chassis will return to \$400.00 USD

Commercial Parts Required

There are surprisingly few commercial parts to be purchased for this model. A lot of this model will in fact be scratch made because there are few commercial parts that are the correct 1:20.3 size for our model. Most of the parts we're using, that are purchased from Hartland Locomotive Works (H-L-W) or Aristocraft, are very cheap at between \$3 to \$10 ea.

Together with BBT and CSC Innovations, we are exploring options of manufacturing some selected locomotive components that are not available commercially, that would be of benefit to class members as well as other 1:20.3 modelers. These will be mostly 1:20.3 detail parts. We will keep you up-to-date on new product developments during the class.

Smoke Stacks

'As Built' - Small Diamond Stacks

If building either of the 'As built' versions of the 2-6-6T or 0-6-6T, with the small coal burning smoke stacks, you might like to kit bash the stack from the standard Hartland Locomotive Works 4-4-0. Please order the diamond stack from H-L-W by calling the parts dept and specifying the stack used on the Vonita Jean 4-4-0.



*The H-L-W Diamond stack - The unit to the right is standard H-L-W.
The unit to the left is the same stack with some of the top removed
to bash it into the Mason 'As Built' look.*

Option 2, 3, 4 & 6 - Various Balloon Stacks.

We kitbash the Nesmith, Congdon and NPC stack from the standard Bachmann 4-6-0 'Balloon' stack. Bachmann Parts dept is usually a busy place, and obtaining parts can be difficult if these parts are not immediately required for repair reasons. As such, Bachmann have provided the MC2002 team with a cache of these Balloon stacks in advance for distribution to the MC2002 members. Please be sure to request the Bachmann 4-6-0 Balloon stack from BBT when ordering your chassis. The stacks cost is \$10.



The Bachmann 4-6-0 Balloon stack ready for modification.



Demo of the Bachmann Balloon stack made to be a DSP&P Nesmith Stack



Demo of the Balloon stack made to be a DSP&P Congdon stack

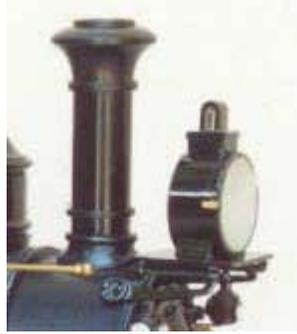


Demo of the Balloon stack made to be the Bully Boy NPC stack.

Other stacks options.

If building locos other than the specific 6 options listed, some other stacks options are:

1. Kitbash your own Balloon stack using simple 'funnels' available at hardware stores.
2. For a long conical type stack, contact H-L-W parts dept and request the 'Inyo' stack. This type of stack can be seen used on some of the Mason Bogies in the Mason Archive.
3. For the classic straight 'capped stack' used on later era Masons such as the 2-4-4Ts of the Boston Revere Beach & Lynn, you cant go past the H-L-W straight capped stack.



H-L-W Straight Capped Stack

4. Another option of a very stylish smaller Diamond stack is the D&RG C-16 stack. Contact Aritocraft parts dept and speak to Navin about the Delton C-16 'wood burner' Diamond stack. (this stack is not actually a wood stack, but that's what Aristo Call it!).Aristo C-16 diamond stack Part No, ART 80200-39, \$2.50



The Aristocraft C-16 D&RG Diamond Stack

5. Other options are the very fine brass stacks made and sold as parts by Accucraft. these stacks come in various sizes, from 1:24 scale to 1:20.3. Check with Accucraft as to what is available.

Mason Bogie Domes

The domes required in our 6 options are actually only one type of dome! Note how the sand and steam domes on our Mason prototypes are virtually the same diameter?

Please order **two** of the brass fluted **steam domes** from either Hartland or Aristocraft. Specify that you need **TWO of the Steam Domes only**...no sand dome is needed! This is the **steam dome** type used on the Aristocraft C-16 and the Hartland older style 4-4-0. The domes from both companies are very similar. If one company has run out, ask the other, or put your domes on order. As Hartland's are made in the USA, you'll likely be able to get a dome faster from them. You are really after the turned brass components, as we will be making the tubular sections ourselves to make the domes taller.

Note: The H-L-W dome profile is actually a lot closer to the true Mason style than the Aristo version. So if possible try to get the H-L-W (Hartland) domes.

Aristocraft Part No: Steam Dome, ART 80-200-20. Also ask for 80-200-22(whistle).

When calling H-L-W, just ask for the fluted brass steam dome, and whistle.



The two brass steam domes you need. One of these steam domes will be modified into a Mason sand dome. Note in this photo, the unit to the left is made by Aristocraft, the unit to the right is made by H-L-W. The H-L-W dome is more appropriate for use on the Mason Bogie, but the Aristo version can work.

Other Mason Domes options.

-If you are not building our specific 6 Mason types, but another from the Mason Archive, such as AA Denny, then you should in fact ask Aristo or H-L-W for the C-16 or 4-4-0 brass fluted **sand** and **steam domes**, one of each. In this way the sand dome will be smaller than the steam dome. Remember when following this option to order ONE steam dome with Whistle, and ONE Sand Dome.

The Aristo Sand dome Part No: ART 80200-16 C-16 Sand dome \$2.50

-The remaining option is to scratch make your own domes using brass drawer handle escutcheons. Please refer MasterClass 2001 chapter 4 for instructions on how to make them.

Mason Bogie Hand Rail Stanchions

There are two sizes of hand rail stanchions required for this model.

For cab door grab rails, you will need **8 individual Aristocraft C-16 brass hand rail stanchions**, Hartland 4-4-0 brass stanchions or similar

Aristocraft Brass Hand Rail Stanchions Part No: ART 80-200-23. (Hey Steve..I got the number right this time!!)

For the locomotive's boiler hand rails, you will need a larger stanchion. This could be problematic. You will need 4 stanchions that are approx 9mm tall from boiler to hand rail. **Suggested options are:**

Ozark railing stanchions OM-129-1 (these are about 8mm tall)

Trackside Details, TD-88, Handrail Posts, "(Large style, for LGB mogul, etc.)" They are brass, 6 for \$7.50 U.S. (Approx 10mm tall)

Thanks to John Lyans and Kevin Miller.

The stanchions that come on the Lionel 0-6-0T are also perfect! Check also some of the brass parts from Billings Boats sailing ship parts, and also engineering supplies that supply live steam model making. As a last resort go ahead and use the C-16 hand rail stanchions.

The Mason Bogie Cab

The cab will be scratch made using 2mm styrene overlaid with 1mm wrapping and detail elements. This is a difficult part of the model to make. Full templates will be provided in which to trace and copy.

A wood cab kit option is provided. This wood kit, made by Vance Bass, is a laser cut, easy to assemble kit which is cut from exactly the same templates as used for the styrene cab. Please take up this option if the cab becomes too difficult, or you want a real wood cab. See Vance's e-mail and web site in the 'team' list at the beginning of this chapter.

Pilot's (Cow Catchers)

There are no detailed pilots of the right size and style available for our model, so we'll be scratch building the pilot in chapter 2. If you find that work too difficult or fragile, please contact Vance Bass about obtaining a wood pilot kit of the same profile.

Other options - Not Perfect, but can get you out of trouble!

Wimp's Way #1 - If you have a Bachmann 1: 20.3 4-4-0 pilot spare and wish to use it on this model, go ahead and use it, it is the correct size. We cannot however purchase these pilots from Bachmann as parts.



The Bachmann 1:20.3 4-4-0 Pilot..use it if you can find one!

Wimp's Way #2 - The Bachmann 2-4-2 'Columbia' old time loco has a pilot that is the right size for this project, but is a little crude. Use it if you must. The same pilot type is used on the wood versions of the Bachmann 4-6-0.

For more modern versions of the Mason, such as the 2-4-4Ts etc, use the Bachmann 4-6-0 modern pilot. These are a great pilot that have the socket for the couple included.

Headlights

As noted in the prototype section, these Mason Bogies carried several styles of headlight bracket to support a variety of larger and smaller headlights. Generally the Mason Bogies began service fitted with a smaller box headlight. As larger smoke stacks were introduced and larger headlights were also adopted, the original headlight brackets were modified and later replaced by larger, yet plainer, brackets to carry the larger headlights. The decision over the style of your model may affect what you have to either make or buy in the headlight department!

The Smaller Box Headlights - for use with the Original ornate Mason headlight bracket.

The finest Box Headlight ever made in large scale is readily available. It is the classic 1:24 scale box headlight used by H-L-W and Aristo on their C-16s and 4-4-0s. This Box Headlight model was developed as a 23" lens light, representing the larger headlight at 1:24 scale. It is also an appropriate size for a smaller type box headlight on our 1:20.3 models.



The Aristocraft Big Box Headlight. The H-L-W unit is identical.

Part Nos.

-Aristocraft C-16 Headlight, ART 80200-40, ART 80200-40A, ART 80200-40B, Incl Box headlight, lens and brass rim.

-H-L-W Box Headlight, simply ask for the 4-4-0 Box headlight and all the trimmings with it.

The Large Box Headlight - for use on later era Mason Bogies on a plain headlight bracket.

There are no commercially available large box headlights that are large enough for our 1:20.3 Mason so we'll be scratch making the headlight. Specifically we are needing a Colorado style Box headlight with a 23" lens. Everything commercially available is smaller than that. If you don't want to make your own light, then go with the original smaller lights as noted above.

Very Small headlights used on the first Mason Bogies of the South Park.

The very small headlights seen in many of the photos of the Masons fitted with Nesmith stacks can be adopted on your model using the Bachmann 2-4-2 small box headlight. This same headlight is the one used on the LGB Moguls, and is also found of the 1880s style Bachmann 4-6-0.

Headlight Brackets

We will be scratch making our Headlight bracket to Mason & C&S styles.

Trackside details make a nice large South Park style brass headlight bracket of a similar size to what we need (1:22.5 scale), the part No. is TD-90.



Trackside details South Park style Headlight Bracket.

Other options - Not Perfect but will get you out of trouble!

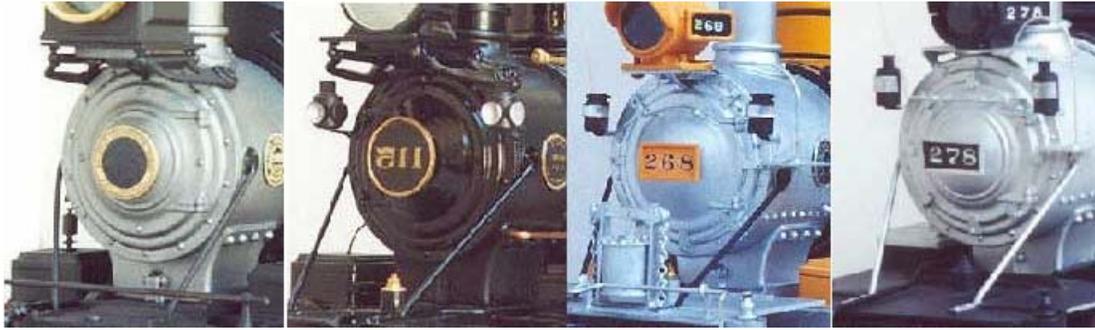
Wimp's Way #1 - The new Headlight bracket developed by H-L-W for the Lilly Belle 4-4-0 is exactly the right size and is essentially Mason ornate 'as built' style. This style of headlight bracket was used on many Mason 4-4-0s and 4-6-0s as well as the Bogie locos. I have a feeling that the prototype that Walt Disney used to build his Lilly Belle 4-4-0 was of Mason manufacture. This headlight bracket will serve your needs if you wish to avoid making your own. Please call Hartland parts to acquire one of these brackets...Specify you are after the 'Lilly Bell' headlight bracket, not the regular H-L-W brackets.



The Mason style headlight Bracket available from H-L-W. Note also the H-L-W Box headlight as an option, and also the H-L-W boiler front can be adapted for your Mason if you don't wish to scratch make your own. This boiler front is the correct diameter. In this view you can see the closeness of the ornate brackets, and smaller box headlight, appropriate for use on our 1:20.3 Mason Bogie early versions before the large 23" lens headlights were adopted.

Smoke Box Fronts.

The Aristo/Delton C-16 smokebox front is a very fine, adaptable and appropriately sized part for use on our Mason Bogie. The only problem is that you'll have to order the entire smokebox to get the smokebox front!! We'll cut the front off for use on our model. The Aristocraft C-16 smokebox Part No. is ART 80-200-28. Cost is \$10 (Make sure you get the wood burner version). This particular front is very adaptable due to the number of concentric circles found cast onto the front. By sanding off different detail one can obtain a wide variety of smokebox appearances.



*All of the above smokebox fronts are adapted from the same Aristocraft C-16 smokebox part.
 Note that by sanding the details, adding clamps etc, the same part can have many faces.
 This part is suitable for the Mason Bogie.*

We'll also demonstrate how to scratch make your own smokebox front in a Mason style for little cost.

Other Options -Not Perfect but will get you out of trouble!

Wimp's Way #1 - The typical H-L-W 4-4-0 boiler front is the Right Size!! WOW! Its not the correct styling, but you could probably make a cute early version Mason with this front. This is an option if you wish to avoid making your own. Talk to Hartland parts about obtaining one. See photo under 'headlight brackets'.



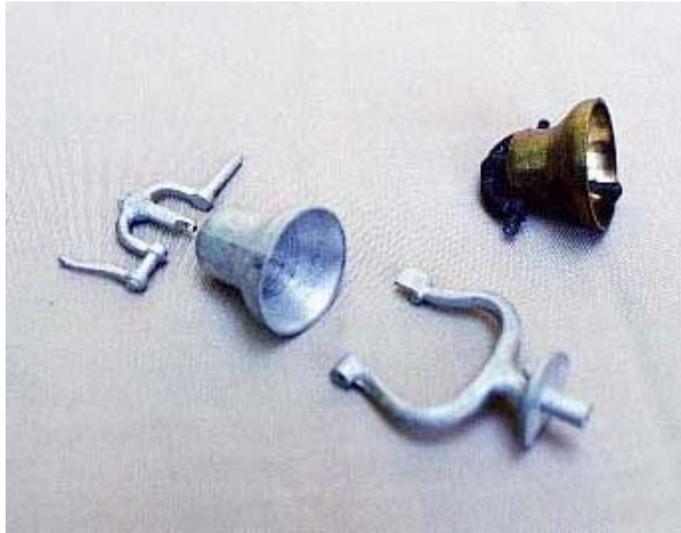
Wimp's Way #2 - Although parts are not available, if you happen to have a Lionel 0-6-0T superstructure in your junk box, not only should you use the brass hand rail stanchions, but you can use the smokebox front too. This smokebox front is closer in style to the Mason style than the H-L-W unit.

The Lionel boiler front modified to fit the 1:24 scale model of the 'larger boilered' Mason. This same part will fit on our narrower boiler 1:20.3 Mason Bogie.

Bells

We need quite a large bell for our Mason. We need only the bell itself, not the yoke. The Bachmann 4-6-0 bell is perfect if you happen to have a spare.

Also Ozark makes a Bell kit that is great and is the right size. part # OM-138, \$5.50.



The Ozark bell kit is to the left, the Bachmann 4-6-0 bell to the right.

Other Materials Required

I should note here that I have real difficulty working in fractions of inches, 1/16", 1/32" are just too damn hard to measure, so I work in millimeters (mm).

For a conversion factor, there are 25.4mm to the inch.

It would be of great advantage to everyone if you used a ruler for this project, that had inches on one side and millimeters on the other.

The following list is the basic materials we'll be needing. You do not have to purchase everything up front. If you wish to see the context in how these materials are used, then await each chapter and then purchase what you need. You may find other ways/materials of doing the same model part. Also some of these materials may not be relevant to your 'altered' version Mason. There will also be a few odds and ends needed in addition to this list which we'll show along the way, nothing expensive, but I do need to show the context so you can purchase the correct looking parts. Specifically these are PVC pipes and brass escutcheons. Both available at hardware stores for little \$\$\$. You must see how we use these items before purchase.

Styrene materials

Charles Cole has put together a styrene kit for the Mason Bogie project. He has made up a packet with the styrene required to build the MB. Each kit has 2 sheets 12 x24 inches in 020,040,080, and an 8 x 12 inch piece of 0100. Contact Charles at chuckger@msn.com Kit price is \$13.94 shipping included.

If you'd like to get the styrene on your own:

Plastic/styrene sheet- available in A4 sheets from Evergreen. The same type of sheet styrene can be purchased from plastics manufacturers/plexi-glass suppliers for a fraction of the cost. Ask for 'High Impact Polystyrene', it will come in pretty large sheets, enough for about 6 Bogie locos and other projects!. Not a lot of sheet styrene will actually be required in this project. The largest quantity will be in the 2mm thickness. An A4 sheet size is about 12"x8"..book size!

Styrene Thicknesses required

- 2.5 mm thick (elements of the pilot and some details) get 1 A4 sheet.
- 2 mm thick (cab walls, side boards, tender sides and floor, cab roof) ..about 6 A4 sheets worth
- 1 mm thick, ..about 4 A4 sheets worth.
- 0.5 mm thick.. about 4 A4 sheets worth.

Evergreen styrene strips

- 0.020x.030" (0.5x0.75mm) 121 M2 (to be used to make rivet heads and domed bolt heads)- get 1 pack
- 1/16" dia Rod 222 SA (to be used for boiler stays and larger rivets) -get 1 pack.
- Evergreen styrene tubing
- ½" tube, Evergreen type 236 SB get 1 pack (two tubes) will be used to scratch build the Air compressor.
- 11.1mm dia tubes, evergreen type 234 SB Get one pack, will be used for tender corners.

Plastruct ABS Tubing

- 4.8mm plastic tube TB-6 – 1 length,
- 3.2mm plastic tube TB-4 – 1 length,
- 2.4mm plastic tube TB-3 – 1 length,
- 9.5x6.4mm RHS plastic tube RT-12 – 1 Length (part of the valve gear!)
- 4.8x4.8mm SHS square tube ST-6 - get 2 Lengths (to be used to bolt & Brace loco)
- 6.4x6.4mm SHS square tube ST-8 - get 6 Lengths loco framing.
- 9.5x9.5mm SHS square tube ST-12 - get 2 Lengths loco framing.

Brass Rod

K&S Metals or similar - purchase from model shops, get about 2ft length of each to start with.

- 1.5mm Brass rod (either model supplies, or go to a welding supplier and ask for 1.5mm brass welding rod...much cheaper than model suppliers)
- 0.75mm brass wire.
- 2.0mm brass rod. (K&S No. M30)

Copper Tube

Do not get copper rod. It must be tube because we squish the ends to make flat bolting surfaces.

- 1.5 mm dia Copper tube, get about 2ft worth. (K&S No. 117)
- 2.0 mm dia Copper tube, get about 3ft worth. (K&S No. 118)
- 3.0 mm dia Copper tube, get about 2ft worth. (K&S No. 120)

Tailor's Press studs

Metal press studs (Dress snaps), 4mm dia, smallest ones you can buy at the local sewing/cloth shop. These will be used for stop cocks and valve handles!!

Circuit Board mini nuts and bolts

Tiny chrome nuts and bolts from Tandy electronics /Radio shack, use to bolt transistors to circuit boards etc, very small screws, required for a whole bunch of things!! Bolts are 1.5mm dia approx and 12mm long., get the nuts, the bolts and tiny washers.

Brass Nuts and Bolts

These are essential. Tiny brass nuts and bolts :

- Get about 20 8BA brass nuts and bolts, about 1/2" long
- Get about 20 10BA brass nuts and bolts, about 1/2" long.
You will need these for the valve gear.

Glues and adhesives

I only recommend two types:

1. Styrene weld Solvent Cement, supplied by Plastruct etc, this is a clear water like cement that welds styrene together, very easy to use and very neat and tidy.

CAUTION & WARNING. These welder type glues are based on a rather nasty chemical, M.E.K, that is a very dangerous substance. The Plastruct one might be a modified or re-engineered cement, but pure MEK has been linked to Cancer. Always use in a well ventilated area. Pity, nothing glues styrene quite like the old MEK.

2. Aryldite (5 min type), this is a two part epoxy type glue, which is best purchased in a pre-packaged syringe, making it easy to mix the two parts accurately. I use a lot of this on my locos. Where ever parts cannot be bolted to the loco, and solvent glue cannot fix dissimilar materials, then the Aryldite is used. I reinforce all joints and bonds from the inside with this glue. It's real strong.

I am not a big fan of super glue, or Cyano Acrylate, it's just too brittle, doesn't bond anything except fingers and fogs up clear windows, shiny Russia Iron paint etc. Not a good glue to use. We will however use a few drops here n' there on valve handles etc.

Painting

There will be discussions about painting as we work through this class. None the less, you should probably aim to use the paint manufacturers you are used to using. No surprises! In the next chapter we'll actually take a look at Mason's color schemes.

Locating Those Parts

The following trains stores, mostly have on-line purchasing service, and 1800 phone numbers, however, I've provided the regular phone numbers so our non US buddies can call too.

Aristocraft Parts: Call Ph (973) 351-9800, Ask for Navin, or anyone in Parts.

You can check exactly what parts you're ordering, by comparing my list of ART parts with the exploded C-16 diagram found at the Aristo Web site <http://www.aristocraft.com/>, need Adobe program to view exploded diagrams found under 'Tech Support', look under exploded diagrams for C-16.

Hartland Locomotive Works Parts Dept (H-L-W):

Speak to Phil Jensen (Da Maaan!!)

H-L-W Parts Dept: Ph (402) 571-2933, Call 9-12am Tues and Thurs only. When you're done speaking to him about parts, you'll have just spoken to one of Largescale's living legends. See the myLargescale.com [interview with him here](#).

For all Ozark, Accucraft parts, Precision Scale parts, Call:

Caboose Hobbies Ph (303) 777-6766

Also On-line purchasing service, (Which I use all the time) www.caboosehobbies.com go to shopping cart, look under Accucraft, Ozark, etc and look for the part SKU No's listed above.

See you in a few weeks- When we start construction!!!

Good luck and good Hunting.

Fletch,

Melbourne Australia, June 2002.