MasterClass-2002

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

An Adventure in 1:20.3

By David Fletcher

Chapter 3 / Part 1 - Mr. Mason, Bogies & Boilers.

Background – Construction

Welcome back to the Mason show...and onward we march. This month we're looking at Mason's 1870 Technology and building the boiler for our Mason Bogie models. This is almost a turning point chapter in that this month your model will transform from a bunch of white styrene parts to a part-loco loaded with personal style and the style of Mr. Mason himself. We're talking 'Character' and from this chapter on, character is unavoidable. Your model will begin talking to you. The Model will also begin to be so damn stylish, it will provide the added incentive to finish. Long into the dark of the night you'll hear the cries coming out of the box where your unfinished model is stored: "finish me, finish me finish me...."

Background - Time to learn a bit more about Mr. Mason, his innovations, patents and design principles. This chapter is brought to us by George Sebastian-Coleman. George was a former Technical Editor to *Model Railroader* and *Garden Railways*, and employee of Grandt Line. For the last 30 years, George has made the delightful Mason Bogie a personal pursuit.

Construction - This month we build the boiler, we produce the coveted Russia Iron finish, build the domes, headlight and bracket, stack and running boards. Again, like chapter 2, the work of this chapter can be done without having the BBT 2-6-6/0-6-6T drive.

Detailing Article - *Patina your Boiler Jacket* - by Kevin Strong.

The class has been greatly assisted in this chapter with the experimentation and implementation of a system proposed by Kevin Strong for the production of a realistic Russia Iron boiler jacket. This system produces a jacket without paint, and of a type that very closely matches the true Russia Iron colour. Please review this article. The prototype Mason Bogie model for this class has been built using this technique. Later in this chapter you will need to decide how you wish to finish the boiler of your model. Whether to paint it, or try Kevin's system, depends on whether your model is to have a simulated Russia Iron jacket. Do not feel obliged to do this, all I ask is that you experiment with it, and decide. There is nothing wrong with using the tried and tested method of painting your boiler.

Introducing....

Mr. Jim Wilke. Many of you will have already come to know Jim through his colour support in the Mason Bogie, Masterclass Forum.

Jim is a railroad history consultant and has designed interpretive plans for the California State Railroad Museum, the Railroad Museum of Pennsylvania, and other institutions. He has also worked the railroad photography collection at the J. Paul Getty Museum and the Autry Museum of Western Heritage. Jim designed the new colour schemes of the replica Jupiter and No. 199 at the Golden Spike National Historic Site at Promontory Summit, Utah, and a colour scheme for the replica V&T No. 1, Lyon. Jim has researched early locomotive colour schemes for the past ten years and has amassed a base of information useful to Museums, restoration groups and modelers alike. We welcome Jim to our team.

Jim will be providing day-to-day advice and knowledge about colour schemes from the era of the Mason Bogie. Jim provided much info for the Colour section in Chapter 2, and will be of great assistance in helping you refine your Bogie colour schemes to a greater level of detail. This is a unique opportunity to benefit from Jim's research, and I also encourage you all to consider taking up the colour advice on your models. The Bogies rolling out of this class have the potential of being painted in a way representative of Mason's actual colour schemes for the very first time. These models will be so different to what you've previously seen that you need not worry about your models not being personalized! - No need to deviate! Folks building options 1, 2 and 5, as-built versions, have a fantastic opportunity. Let's build some models that are not only accurately made, but have an accurate paint scheme as well.

Jim will be working up colour sheets as questions arise. Also refer to his new web site of colour schemes. This web site is being set up and hosted by Scott Lawrence for the benefit of this class:

http://www.frontiernet.net/~scottychaos/ON_LINE/mbpaint.htm

Any new work that Jim does will be added to this site. Use the site to see what you models could look like, but also come to understand what 1870's schemes were like through the pages in the site. Feel free to ask Jim your question, especially as you begin to paint your models. Direct your questions to the Masterclass forum.

We Welcome...

John Clark of **Fall River Productions**. John has been developing a headlight for another project that will soon be available as a brass casting. This headlight is a stunner and is...wait for it....the big 23" box headlight size we've been after. To date, as outlined in CH1, the only headlight of that size available to us has been some limited units from Accucraft. Some of you got lucky and obtained one, most of us could not! By the time you read this, John's headlight will be very close to becoming reality. This chapter outlines how to make your own 23" headlight from styrene. John's headlight is the same size, but a whole lot more stylish! Test your skills and make a headlight for the fun of it, then replace it when the brass headlight is available. I sure will!

Here is a 3D computer model of the headlight provided by John.

Also look to his web site for updates and the other products he offers. Check out that strap iron pilot!

http://www.fallriverproductions.com/

The Mason Bogie Archive.

Keep reviewing the Mason Bogie Archive.

http://www.ironhorse129.com/

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

The Masterclass Forum.

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

MasterClass Forum

Well, this month's story refers to my third attempt at building a Mason Bogie, and is in itself an interesting story. While I was researching the Mason history to build the "Crested Butte" in 1:24 scale, I learned for the first time that a single Mason Bogie had survived and was preserved as part of the Henry Ford Collection in Michigan. I searched the web for pictures, but none were to be found. Some good leads were provided by a lady who once graced our on-line community, Marilyn Wardlow - I know not what has become of her, but I'm sure this Masterclass would have interested her. From Marilyn I learned that the loco was standard gauge, was unlike anything that the South Park ran, and was an 0-6-4T. Pictures were still to be seen...I desperately wanted to see what the elusive 'Torch Lake' actually looked like!

Then in late 1999, after pictures of my South Park 2-6-6T 'Crested Butte' appeared on-line, a fella by the name of Gary Brogan first contacted me with all the missing info I had needed, and pictures for the first time. My first reaction to seeing Torch Lake was...'eerrrr'. She was nothing of the Mason elegance I had expected, she was perfectly industrial, and worse, can I say it, she was ugly! But the more Gary and I spoke, the more I came to love the little Torch Lake. She has a history all her own, and some very unusual stories stay with her. Gary Brogan was raised in the area where Torch Lake ran, and members of his extended family are tied up in the history books along with the little loco. It is even possible that his grandfather once fired Torch Lake. Gary and I hit it off and have been firm friends ever since. He will be writing a background section for our Masterclass later in the year all about 'Torch Lake', the last Mason Bogie in the world.

In early 2000, Gary and I started talking about building a Model of 'Torch Lake'. We had few specs to follow and no drawings. Some information, later proved to be wrong, stated that the Torch Lake had 36" drivers. So, following the many photos Gary provided, I scaled up a new drawing proportioning the loco to the known wheel size. Like Crested Butte, with 37" drivers, we used the same Lionel 0-6-0T toy as the basis for the chassis, and assumed the model to be 1:24 scale, on the basis that the Lionel wheels worked out to 36" at 1:24 scale. The chassis was re-engineered with new side rods, and gears removed to produce a very smooth running and reliable mechanism, a far cry from the Christmas 0-6-0T she started out as. The model that came out was surprisingly small, quite a lot smaller than the 1:24 scale model of Crested Butte. We just assumed the loco was a tiny thing and went about our business. The model went together well with a scratch made superstructure over the Lionel 0-6-0 toy, a Delton freight truck served

as the tender truck. The front and rear draw beams were made from wood, with scratch made foot boards from brass.

As fate would have it, we later found the data we were using to be completely wrong, and the Torch Lake was not the tiny loco we had thought. The drive wheels were in fact 42". Now since the model had been proportioned entirely from the driver size..the cab boiler etc were all proportioned from that wheel size. The Lionel wheel size at 42", meant the model was infact 1:29 scale after all! Hence the reason why the model seemed so small compared to the 1:24 Crested Butte, when both prototypes would have been similarly sized! Gary was delighted the model was 1:29, because this meant the 45mm rail gauge was almost perfect for the original weird Helca & Torch lake rail gauge of 4' 1"!

Much about the prototype remained a mystery as we set about building the model. We never saw the rear end of the loco properly in any photograph at the time, and thus most of the rear was complete guesswork. We laugh about it today because photos have now proven our guess work to be surprisingly accurate, especially for a loco with a rear end like nothing ever seen before. We've since let these many such fortunes be the result of Grampa Brogan's spiritual guidance. I hope you enjoy the 1:29 scale 'Torch Lake.

Background

William Mason:

Background on his life and machine works

By George Sebastian-Coleman

John Lozier's assertion that William Mason is better described as "innovator" than "inventor" seems well made. Although willing to claim many "firsts" for himself (and having gotten others to agree), more thorough research shows that Mason most often refined others ideas, made them practical, and produced beautiful machines incorporating those ideas.

Early Life

William Mason was born in 1808 in Mystic, Conn., a major seaport of that era. His father was a farmer and blacksmith, so he gained early knowledge of "machine" work—the distance between blacksmithing and machining being quite small in 1808. When he was 14, he and his brothers were apprenticed to a spinning machine at a nearby cotton factory. (His father may have been under separate contract to the machine shop of the factory.) His experience in his father's shop and an apparently innate mechanical gift meant that he soon earned a reputation for being able to repair and maintain all of the machinery in the mill. Indeed, only a year later, Union Company Mill, which was just being built, borrowed William to set up all the machinery at the plant. When his first apprenticeship ended, the Union Company took him on as an apprentice in their machine shop. Three years later William took his first true job in the Utica, N.Y., mill district as a machinist.

Mystic Connecticut Daniel Packer, to whom William had first been apprenticed, contacted him during his stint in Utica, enquiring if rumors that they were using power looms were true. William told Packer that the rumors were false, but that he was confident he could set one up, and Packer hired him back to do so. Although it's disputed whether Mason's were the first power looms in the United States, they were certainly among the first. Several accounts note that these looms made diapers. Actually "diaper" was a type of twill with a diamond pattern in it. Mason also developed a power loom for weaving damask, but it was extremely complicated and not used in production.

A nationwide depression in 1829 closed many mills, including Packer's, and for the next three years the multi-talented Mason turned to other means for a living: violin making and portrait painting. Mason's fine-art skills must certainly be taken into account for his later obsessions with form and balance, not to mention decoration, in the designing of machinery, particularly locomotives.

With a recovering economy, Mason could not resist the lure of a machinist's income and in 1832 he contracted with John Hyde to build some power looms similar to those he had done for Packer. In doing so, Mason effectively set up his own shop: he contracted out non-critical items to a Willimantic machine shop and rented space there for himself and an assistant to construct the looms. Mason made about ten dollars a day on this project and his future in machining was effectively guaranteed. The loom contract led to a contract with Asahel Lanpher to work on perfecting the "ring" frame for spinning. Mason developed a commercially viable design in 1833 and, overcoming the prejudice against earlier versions, saw it become the standard of the industry. Lanpher's business failed in 1834 and Mason was asked to run the shop for the creditors.

The economics of cotton mills followed a roller-coaster route through the early decades of the nineteenth-century and through the next few years Mason saw several employers fail. In 1842, now in Taunton, Massachusetts, Mason saw another employer go bankrupt. This time, however, with the aid of a Boston dry goods agent, Mason took over the business and launched the Mason Machine Works.

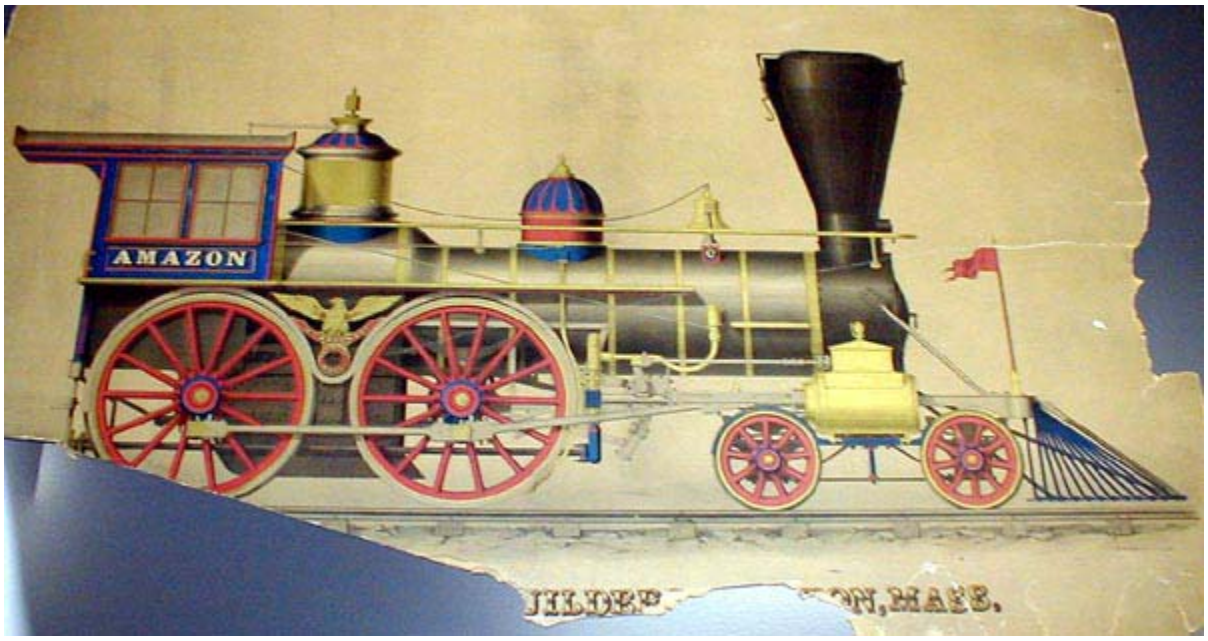
T he Mason Machine Works

Under his direction the factory produced cotton and wool machinery, machinist's tools, blowers and furnaces, gearing, shafting, spoked car wheels, and finally, beginning in 1852, locomotives. Though an excellent businessman, Mason couldn't always beat the larger economy and he too suffered a bankruptcy in 1857 but was able to reopen shortly thereafter.

In 1852 Mason decided to start building locomotives and during that year he built erecting and boiler shops, expanded his foundry, and acquired the machine tools to equip these shops. The first locomotive, the James Guthrie, actually was finished in 1853. The Mason works had built 100 locomotives by 1860. The demands of the Civil War allowed the company to equal that number again by the war's end in 1865. That locomotive production was accomplished even as the plant was also turning out 600 Springfield rifles a week for the Union Army during much of that period.

Art Wallace cites William Mason's background in textiles as a direct contributor to the level of finish he brought to locomotive manufacture. Because the nature of textile processing is that the equipment has to be very cleanly finished so that there are no protrusions to snag anything, Mason had to produce castings that were very high quality to begin with and which were then carefully filled as needed before machining, final polishing, and a multi-stage painting process produced an impeccable finish.

However, it should be emphasized that Mason's approach was not simply a matter of glossy paint. Indeed, in the sources cited by John Lozier, the emphasis is not high polish but excellent machining. Lozier cites Alexander Holley's *Railroad Advocate* of 1856 describing the *Amazon*: "There is not a homely place on the engine. And there is no 'deep scratch and high polish' work. Everything that is smoothed at all is smoothed on the planer and not the buff wheel." Photos certainly attest to the fact that Mason must have made use of a buffer, but clearly what impressed those in the business was the quality of machining, not the finish per se.



Early Locomotives

Much of the credit for Mason's early engines belongs to Charles F. Thomas, whom Mason hired away from Amoskeag, another early New England locomotive works. Prior to his development of the bogie design, Mason's engines were almost entirely of the 4-4-0 arrangement. Indeed Mason is often credited (and credited himself) with the "modern" 4-4-0, including the use of a wagon-top boiler, spreading the axles of the pilot truck so the cylinders could drop down to the center of the driving wheels and sit parallel to the rail, the use of a bar frame with cast cylinder saddle, and putting the cylinders, stack and smokebox on a common center line.

In fact all of these changes in design had appeared prior to Mason's first use and most had been used even on a single engine. Nevertheless, Mason brought them altogether in a particularly refined form that gained instant notice for its balance and symmetry. One design feature that became a hallmark of Mason locomotives was introduced on his fifth engine in 1854. For this engine Mason developed driving wheels with hollow spokes, which allowed him to eliminate the counterbalances bolted between the spokes of standard designs. Typical of Mason, he found these counterbalances unsightly and his innovative design allowed his drivers to retain the purity of their spoked design.

Mason's changes were not merely aesthetic, they made for a better locomotive as well. Nor were his innovations confined to structural design. Mason was a machinist himself and his innovations extended to the manufacture of his locomotives. One of his most significant design changes was modifying the cylinder saddle casting, so that the front and rear faces of the cylinder bores could be planed without remounting the casting. This guaranteed they were square with one another. He also built all his machines "to pattern", meaning that machined gauges were made and all parts were machined and tested against those gauges to ensure a general interchangeability of parts.

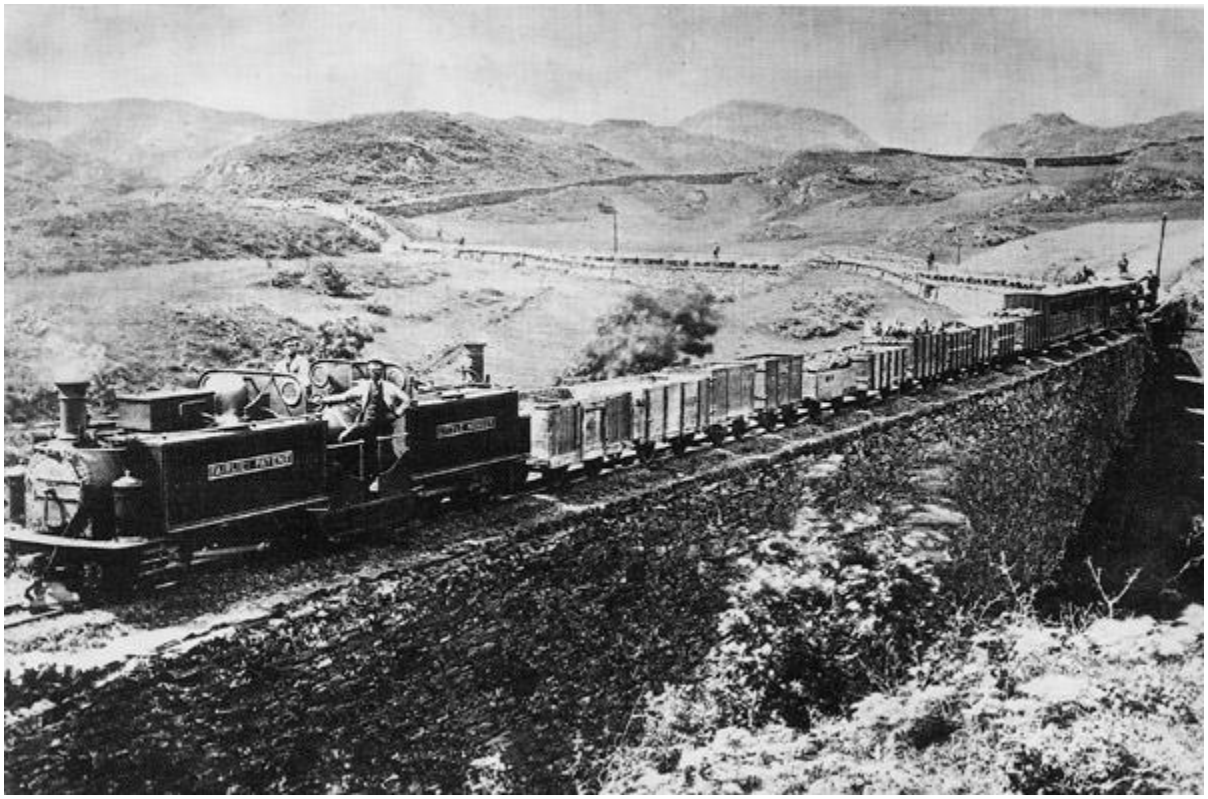
William Mason's 'Highland Light' 4-4-0.

At first, Mason found his most ready market among the new railroads in the Midwest. These lines were apparently more willing to embrace his new designs than the staid New England lines that had already been around ten years or more! The Amazon of 1856 and the Phantom of 1857 (which have been well preserved in lithographs) gained such admiration that other builders quickly copied most of the design innovations Mason had made. Though sometimes difficult to recognize through the austerity of modern aesthetics, Mason's designs were viewed as exceptionally clean and free of excessive ornamentation. As John Lozier notes, Mason's elimination of ornamentation is best understood as an elimination of ornamentation unrelated to a locomotive, such as extraneous brass filigree pieces. Steam and sand domes may have been ribbed with double-curved upper portions and trimmed in brass, but they were and are functional elements of a steam locomotive. Moreover, Mason made the domes a matching pair and spaced them evenly across the top of the boiler.

As he had done with cotton machinery, Mason worked to simplify the elements of his machines, often by designing a single casting to serve dual functions. His combined bell yoke and handrail bracket being an excellent example that is even further "multi-tasked" on the Bogies by using it as the hanger for the valve gear operating rods.

The Bogies

Having achieved good success building standard engines for almost 20 years, Mason's decision in 1871 to champion the Fairlie design is perhaps more a testament to his obsessions with symmetry and simplification than sound business judgment. According to Art Wallace, Mason met Robert Fairlie and saw his engines in action (presumably in Wales) while on a vacation to England shortly after the Civil War. He was very much taken with the design and decided to bring it to the United States. Contributing to Mason's interest in these engines was the simultaneous rise of interest in narrow-gauge railroads in the United States.



'Little Wonder', a Fairlie 0-4-4-0 in service on the Ffestiniog in the early 1870s.

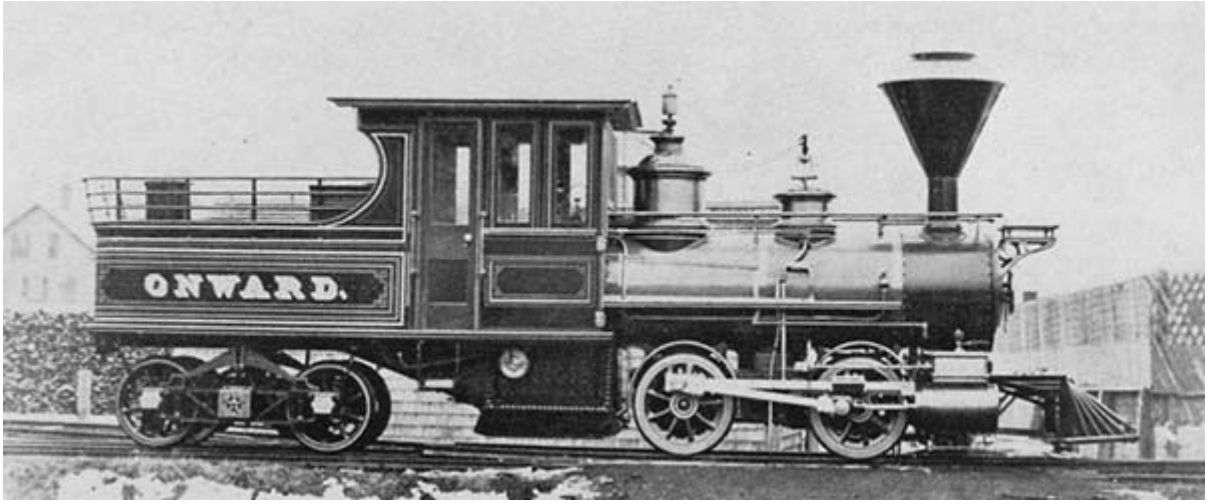
After the Civil War and despite the de facto standardization of gauge resulting from the decision to build the transcontinental railroad to 4'-81/2", interest in narrow gauge railroads surged as every community that aspired to grow wanted a railroad. Narrow gauge promised (and often delivered) a lower initial cost than standard gauge lines.

In the mid-nineteenth century, standard practice was to place the firebox between the driving wheels. This was constraint enough in standard gauge, but on narrower gauges it so restricted steaming capacity that it made one of the strongest arguments against narrow-gauge railroads. The Fairlie/Mason design, which suspended the firebox between driver and tender bogies, allowed for very efficient steaming—a quality repeatedly remarked upon by all users of Mason Bogies.

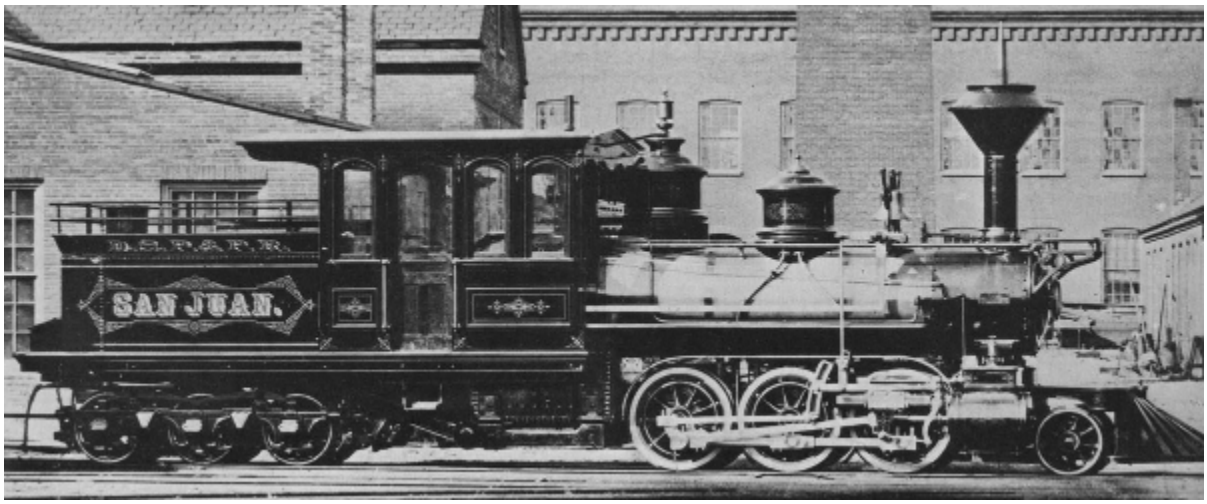
Regardless of gauge, the Fairlie design of putting the entire engine on a single platform would, of course, have appealed to a man who liked to combine machine elements to simplify the overall design. Mason's sense of symmetry seemed to find its fulfillment in the Bogie design.

As with his other machines, though Mason patented a number of refinements, the basic design of the Mason Bogie had already been developed by Robert Fairlie in England. Mason's most important contributions (and they were critically important to the design's viability) were the design of the pivot and the routing of the steam pipe forward to the smokebox, down, back along the bottom of the boiler, through the main bogie pivot (the only flexible joint required) and thence to the cylinder chests.

Early Mason Bogies had no lead truck. Since the driving wheels pivoted it was assumed a lead truck would be unnecessary. It has been asserted that Mason originally intended his Bogies to run tender first, just as Forney had intended for the two-foot gauge *Ariel*, and that this is why there was no lead truck. However, the builder's photo of the 0-4-4T *Onward*, the first Bogie, shows it equipped with a headlight bracket on the smokebox and a cab that seems clearly designed for the engineer to look forward across the boiler as per standard practice. Similarly the 0-6-4T *Torch Lake*, built only a year later, also has its headlight bracket firmly in place on the smokebox front. More to the point, running in reverse would not have altered the issue of flange wear on the drive wheels as there was no connection between the two bogies that would lead the drivers into a curve—the function of a pilot truck.



According to the roster in Rowland Abbots' *The Fairlie Locomotive*, at least two 2-4-4Ts were built in 1874, well before the South Park engines. It's possible, however, that this reflects a later conversion. In any case Art Wallace notes that the *Centennial* of 1876 suffered a lot of flange wear working on the very tight curves of the exposition grounds and that Mason had already begun work on a pilot truck design before any engines were shipped to the South Park. Nevertheless, the *Oro City* went to Colorado as an 0-6-6T and when the South Park reported "excessive" flange wear and requested pilot trucks on future deliveries Mason was ready. Indeed, the *San Juan*, the South Park's second Bogie arrived not only with its own pilot truck but with a retrofit kit for the *Oro City*.

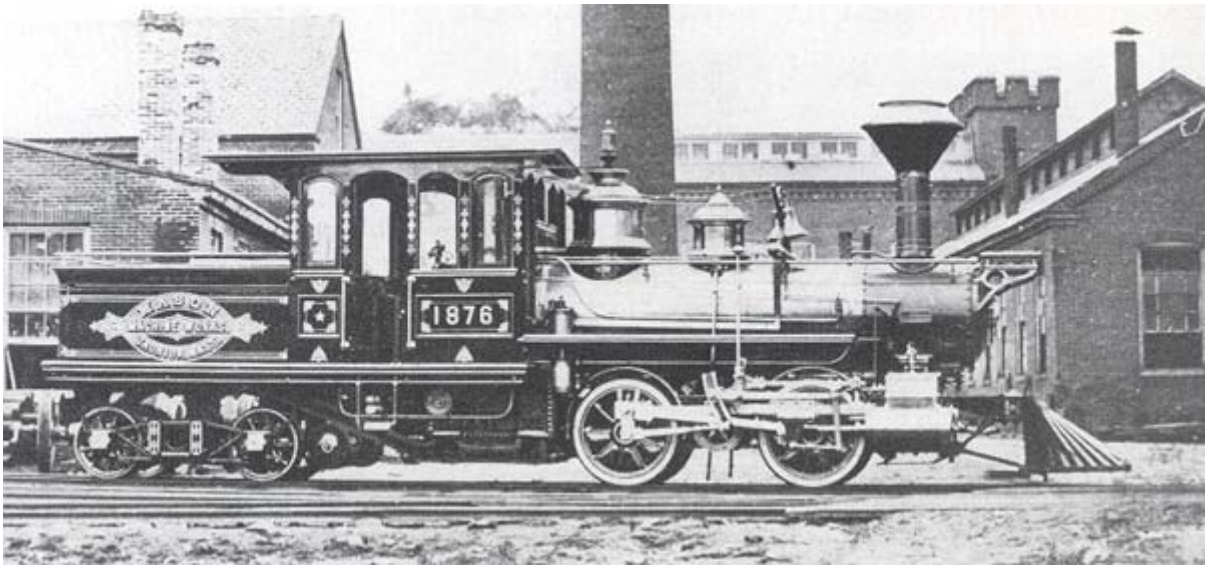


The '*San Juan*' of 1878 was the first full 2-6-6T delivered to the South Park, complete with pilot truck. The first South Park Mason, '*Oro City*' was delivered as an 0-6-6T, and later retrofitted with a pilot truck.

The development of the lead truck did not mean that all subsequent Bogies would be so equipped. Many engines were built after 1879 without a pilot truck. Most of these appear destined for railroads where presumably the curves were less severe, such as the 16 engines delivered to the standard-gauge Wheeling and Lake Erie in 1881 and 1882.

Early Bogies used Stephenson valve gear. Even in the relatively wide-open spaces of a standard gauge 4-4-0, Stephenson linkage can be difficult to get at and maintain. In between narrow-gauge frames and buried beneath the steam pipes and pivot casting of a Mason Bogie, it is accessible only from a pit. Nevertheless, Mason had built 21 Bogies by the end of 1875 all with Stephenson's gear. He produced another dozen in 1876 probably at least some of them with Stephenson as well. Presumably all later engines were equipped with Walschaerts valve gear, but it’s clear that the Stephenson gear was perfectly successful on the Bogies.

Thus, efficient steam management, not space constraints, was the most likely reason Mason adopted the Walschaerts valve gear for his 0-4-4T Centennial, which would haul fair goers at the Centennial Exposition in Philadelphia. Mason had been an early adopter of the Stephenson linkage because of its efficiency over other designs of the time. Moreover, the Centennial Exposition was the place to show off the latest developments in industry, so what better time and place to introduce a new valve gear.

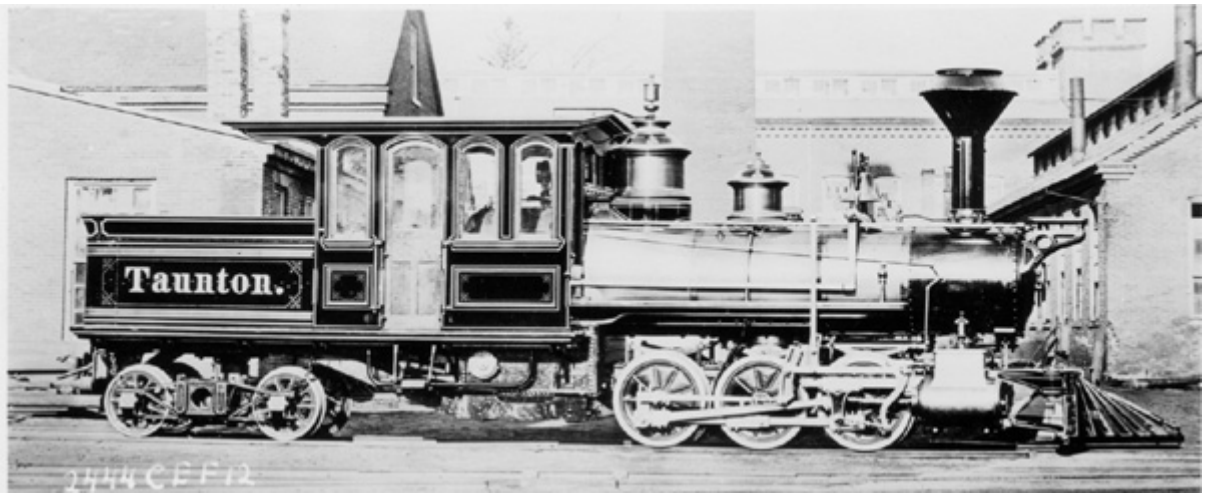


Mason's 'Centennial' of 1876, built for the 1876 Exposition.

The shift to Walschaerts valve gear provided what would be the Bogie's most singular bit of engineering. In order to not change the valve setting as the bogie swung back and forth under the boiler, Mason placed the reverse lever (crank) on an arm incorporated into his combined bell yoke and handrail bracket. In a standard installation this crank forms an “L” but the Mason design inverted this so the “L” was upside down with the short arm facing the cab. From this arm, very long reverse links reached down to the radius rods. The great length of the lifting links almost eliminated the difference between their length hanging dead vertical and the hypotenuse of the triangle they would form from the vertical as the truck pivoted, thus not changing the valve setting.

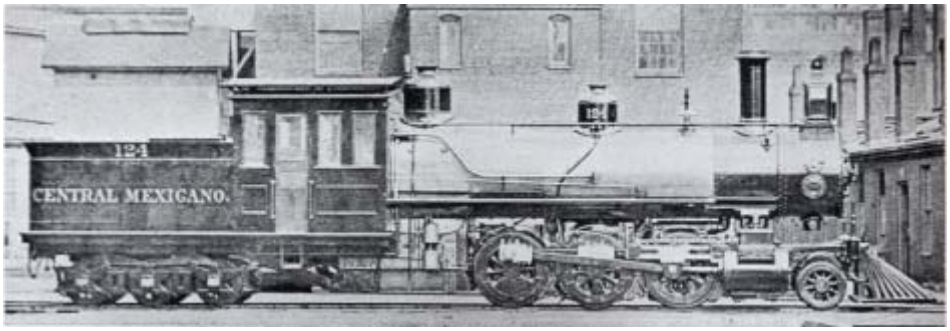
Although the Fairlie design was conceived for the particular conditions of heavy grades, sharp curves, and narrow gauge, neither Fairlies nor Mason Bogies were ever confined to such operation—though arguably both found their greatest success there. Mason built some 148 Bogies between 1871 and his death in 1889. At least 29 were built to standard gauge and that many again to gauges greater than three-feet but less than standard gauge, and a number which operated on railroads that were later standard gauge but may have been narrow gauge at the time the engines were purchased. Bogies were actually relatively easy to re-gauge. Since Mason built them to all gauges, it was a relatively inexpensive matter to order new cylinder castings and frame spacers and rebuild the bogies to a wider gauge.

The vast majority of Mason Bogies were four or six-coupled engines, usually with a matching number of wheels on the tender truck (x-4-4Ts or x-6-6Ts). However, many early six-coupled engines, like the *Torch Lake*, had four-wheel tender trucks and the Erie RR received an 0-4-6T in 1874 and the Long Island RR bought five 2-4-6Ts in 1883 and the Providence Warren & Bristol received a single such engine in 1885. While the early six-coupled engines with four-wheel tenders can be seen as works in progress whose design gets fulfilled with Mason's development of the six-wheel trailing truck, the later x-4-6T designs seem to fight against Mason's sense of symmetry. However, my own aesthetic sense agrees with Mason's choice. Indeed even on four-coupled engines, the four-wheel trailing truck always looks out of place to me, as if it's a temporary fill-in for a photo session rather than the finished piece.



The Taunton is a classic Mason 0-6-4T. The 'Torch Lake' probably looked similar to this when built in 1873, but with Stephenson Valve gear.

The Bogie design reached its maximum wheel arrangement in six 2-8-6Ts all destined for Colorado: four for the South Park and two for the Denver Utah and Pacific. Combined, they are perhaps the most unphotographed of all locomotives that ever served in Colorado. With 55,340 pounds of weight on the drivers, these were large engines, but by no means the largest Mason Bogies. That distinction goes to a pair of 2-6-6Ts built for the standard-gauge Mexican Central (F. C. Central de Mexico) that put 93,250 pounds on the rail through six 54" drivers.



The Heaviest Mason Bogies to be built were these huge 2-6-6Ts for the Mexican Central, built after William Mason's passing.

Although, the South Park would retain the title of the railroad with the most Mason Bogies, by far the longest lasting fleet was that of the Boston, Revere Beach, and Lynn. With the exception of one 4-4-0 that it quickly sold off, the BRB&L used Bogies exclusively from 1875 until its electrification in the 1930s. After Mason Machine Works stopped building locomotives in 1890, the BRB&L ordered replicas, first from the Taunton Locomotive Works, then the Manchester Locomotives Works, which was absorbed into the American Locomotive Co. (ALCO) from whom the BRB&L ordered its last Bogie in 1914 (built in the Schenectady plant). The only significant change from earlier engines was ALCO's use of counterweighted drivers.

As a final thought and looking forward to my discussion next time of the evolution of the South Park Bogies it seems worth noting that by the time the South Park placed its order, the Mason Bogie could justifiably be considered an established design. Though hardly a huge number, Mason had already delivered 35 Bogies and was contracted for at least another dozen besides the South Park's order. Thus the South Park's choice of the Mason Bogie shouldn't be seen as quite the mistaken extravagance it has sometimes been portrayed. Indeed, although it would be wrong to say the Bogies were an unqualified success, it is equally incorrect to consider them failures.

Bibliography

The following were my primary references for this article.

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Lozier, John. *Taunton and Mason: Cotton Machinery and Locomotive Manufacture in Taunton, Massachusetts, 1811-1861*, dissertation for Ohio State University 1978

Wallace, Art. "Mason's Marvelous Machines" *The Bear Trap* Summer 1996 and Fall 1996

Construction

In the Beginning….

It is desirable to read the entire construction chapter first before commencing work, sometimes an understanding of what is coming helps to determine the best way to carry out earlier work. So get reading, and you can get cutting styrene later.

Check Your Scales!!

I've said it before and I'll say it again...with every PDF page of Mason Bogie templates you print off, CHECK YOUR SCALE BARS! Check that the scale bar along the bottom and side of the page scale out to be 1:1...300mm shall equal 300mm etc. Some printers will not print these perfectly to scale. If you've tried everything and they still print undersized. Take the file to a printing place and have them try it. Another option is to take the printed page to the photocopy joint and blow up the drawings by a percentage point.

Download the PDF Templates for this Chapter.

Masterclass Options 1 to 6 2-6-6Ts (All Masterclassers to use this set)

DSP&P Heavy 2-6-6T (special drawings for larger 2-6-6T, with 45" straight boiler)

DSP&P Big 2-8-6T

Store the template pages away in a binder, and refer to them as I call for them through the chapter.

Making the Boiler

(Refer PDF Pages entitled "Boiler Profiles" and "Wimp's Way Boiler Profile" for this section.)

Step 1

Go out into the world and find yourself a 51mm outside diameter plastic pipe. ABS, PVC, Styrene, or acrylic should be fine. Those of you building in Brass can go and find a 51mm brass or copper pipe.

The Mason Bogie we're focusing on in this class, namely the light South Park 2-6-6T and the NPC Bully Boy 0-6-6T both had what was scheduled by Mr. Mason in the late 1870s as a 38" diameter boiler. The 38" diameter boiler was then lagged with timber, and clad over with a gorgeous Russia Iron (blued metal) boiler jacket, bringing the boiler diameter up to 41". At 1:20.3 scale 41" is 51.3mm.

Also note that the smokebox diameter on these Mason Bogies was made wider than the boiler shell, such that the smokebox diameter was EQUAL to the fully lagged and finished boiler…thus the Smokebox diameter was also 41". Unlike Baldwin, Rogers or most of the locomotive builder's of the day, the Mason locomotives had no visible step at the interface between boiler and smokebox. I emphasise this point, because I know many of you are already thinking about how to achieve this non existent step at the smokebox -- forget it! From a model making viewpoint, this makes things easy, we're only needing to find one pipe size that is good for the boiler and smokebox in one!

Find that 51mm pipe! It might be a Plastruct ABS pipe, it could be a plastic beer flute, it could even be a toilet cistern pipe, because that is what the boiler of my Mason is made from...a toilet pipe! Reasonably, allowing for some difficulty in finding that pipe size, I ask you to find a pipe that is 50mm diameter minimum, and no more than 52mm in diameter. Also (assuming you've read ahead and been through this entire article in advance), you have the option of cladding over your boiler pipe with a treated brass/metal wrapper. With this in mind, you might like to find a pipe that is approx. 50.8mm in diameter, this will then pack out to 51.3mm when fully lagged.

Boiler tubing - A source

2" ABS tubing can be ordered directly from Plastruct's web site. An 18" length is US$8.25 + $6 postage. This is exactly 50.8mm diameter. 1.5" nominal PCV plumbing pipe is 1.900" actual o.d.. You can probably beg a 3 foot piece free from a plumbing supply, but you'll have to wrap it with a 1mm layer to get it up to the right diameter. (Vance Bass).

The Big 2-8-6T and Heavy 2-6-6T (Breckenridge et al).

(Refer to the PDF boiler pages dedicated to these specific locos.)

Builders following our class, and doing options 1 through to 6 can ignore this section...you're still looking for a 51mm pipe OK!!

Notes for the Builder's of the Big 2-8-6T Mason Bogie, and anyone thinking of building the heavy South Park 2-6-6T locos. These locos had generally straight boilers, somewhat larger than the small wagon top type boiler we're building in this class. the pipe sizes you need are as follows:

Big South Park 2-8-6T Boiler - 48" fully lagged - at 1:20.3, you're after a 60mm pipe.

Heavy South Park 2-6-6T types - 45" fully lagged - at 1:20.3, you're after a 56mm pipe.

Step 2 - Cutting the Boiler Pipe.

Rightee-oh, let's begin! The finished boiler length of your model will be **193**mm long from cab wall to the boiler front, but not including the boiler front itself. There will be two ways of achieving this length...the prototypical way, which includes the construction of a wagon top boiler (a boiler with a conical taper near the firebox), and the Wimp's Way which is the easy way, involving the making of a straight boiler. Some Masons, such as Torch Lake and AA Denny had straight boilers anyway, making the Wimp's Way straight boiler the way to go.

The Prototypical Way - 2-6-6T and Bully Boy.

Cut your 51mm pipe to a length of **189**mm, as shown in the PDF template sheet, entitled "Boiler Profiles". You will note this boiler/pipe length seems 'short' compared to the 193mm length of the locomotive drawings from Chapter 1. This is correct. There is to be a 4mm section to be packed to the rear of this pipe, bringing the boiler to a 193mm length. A thickness is also added at the front end in the smokebox front. You will also note we are cutting the boiler off at the cab front wall, and not running the boiler right into the cab in once piece. We've designed the boiler this way so it will be possible to remove the boiler from the BBT chassis to access the motor, without having to remove the cab. Also the Mason boiler we're building is a 'Wagon top' type. That is a boiler that tapers from a smaller section to a larger pipe, very much like the classic American 4-4-0s. The taper on the Mason Bogie occurs right in front of the cab front wall, thus the larger boiler pipe occurs separately inside the cab only. It proved to be easier to break the boiler in two, with the smaller diameter and taper outside the cab in one unit, and the larger boiler pipe inside the cab as a separate unit.

The Wimp's Way Boiler.

There is a 'Wimp's Way' boiler PDF template -- use this only in an emergency! The Wimp's Way boiler does not have a taper. What we do is make a straight boiler of 51mm diameter right to the cab wall. Then inside the cab we install the larger boiler pipe (in a coming chapter). We simply leave out the taper in front of the cab wall. Once the steam dome, air compressor and pipework is installed, it is actually pretty difficult to see that a taper is there anyway. The Wimp's Way boiler will be cut to a length of 193mm. ..that is slightly longer than the wagon top 'tapered' boiler above. Any one building AA Denny 0-6-4T of Puget Sound will be following the Wimp's Way boiler, as the AA Denny did not have a wagon top boiler anyway! The AA Denny boiler is also longer at 198mm. Use the PDF to set out your boiler length.

Cutting the Pipe.

Cut the pipe using the masking tape method outlined in the last chapter. Wrap the tape around the pipe such that that the tape meets up perfectly once it is wrapped all the way around...this will ensure you cut the pipe perfectly perpendicular to the pipe...not crooked.

Step 3 - Finding the Upper and Lower Datum Lines on the Boiler

The datum lines are drawn lines we apply along the very top of the boiler and along the very bottom. Attaching appliances to the pipe, such as domes and running boards etc, is more difficult than you might think. The pipe tends to mess with one's eyes, and only after you have finished a model will you notice, to your dismay, that the domes are not in line, and worse, the stack is pointing to the right, while the domes appear to have been applied to the boiler side, and are pointing to the left! YUCK! So we take the time at this step to work out the lines on which all object will be mounted, so everything points in the same general direction.

There are several ways to establish the datum lines:

The totally cool Vance Bass Method -

Have you seen the trick using L-section angle? If it's well-made so the edges are parallel, like a piece of K&S brass or Plastruct ABS, then the edges MUST lie along the cylinder parallel to the centerline. So, just drop a piece of K&S tubing on the pipe and mark along one edge -- you're done!

The tedious Fletch Method

I list this method simple because it allows for other checks to double check your datum lines and checks if the ends of your boiler are cut square:

Place the boiler pipe on a nice smooth flat horizontal surface. Using tape or blu-tack or some kind of putty, fix the pipe to the bench so it won't roll. Next look close at the point where the pipe end touches the flat surface....mark a pencil line on the pipe end at the exact point where the pipe touches the bench...without moving the pipe, look at the other end of the pipe and mark the point where it touches the bench as well....theoretically both these marks are at the same position at opposite ends of the pipe and a line drawn between them will provide you with a datum line that is exactly parallel with the pipe itself (this can be achieved using Vance's brass angle idea). Draw a pencil line between the marked pipe ends. This is your upper Datum line. If you tried to draw this line by sight, you'll probably have a line that looks parallel with the pipe, but actually veers off to one side. Your domes and stack would all be pointing in different directions!!

Testing the Upper Datum Line

Now we test the datum line. Place the pipe on end, at the edge of a table. Get a 3 ft length of cotton thread and tie a weight onto one end...use one of your brass loco parts if you like. Something small and heavy is needed as a 'plum bob'. Hold the end of the cotton onto the top end of the pipe right on the top of the datum line. Use your thumb to hold the cotton in place. Let the cotton hang taught with the plum-bob weight at the bottom hanging down near the floor. Now we let gravity tell us if the datum line we drew was accurate. Watch where the cotton aligns with the drawn datum line. Make sure the plumb bob is not swinging!! If the cotton line aligns with

the drawn datum line, your datum is A-O-K. If the drawn line veers off to one side relative to the cotton line, you gotz a problem!! This whole test depends on the cut boiler end being 'square' in the first place or the boiler will not be standing vertical for the test!! If you're not sure of the accuracy of the cut end, try the plum bob test standing the pipe on the other end instead and double check it.

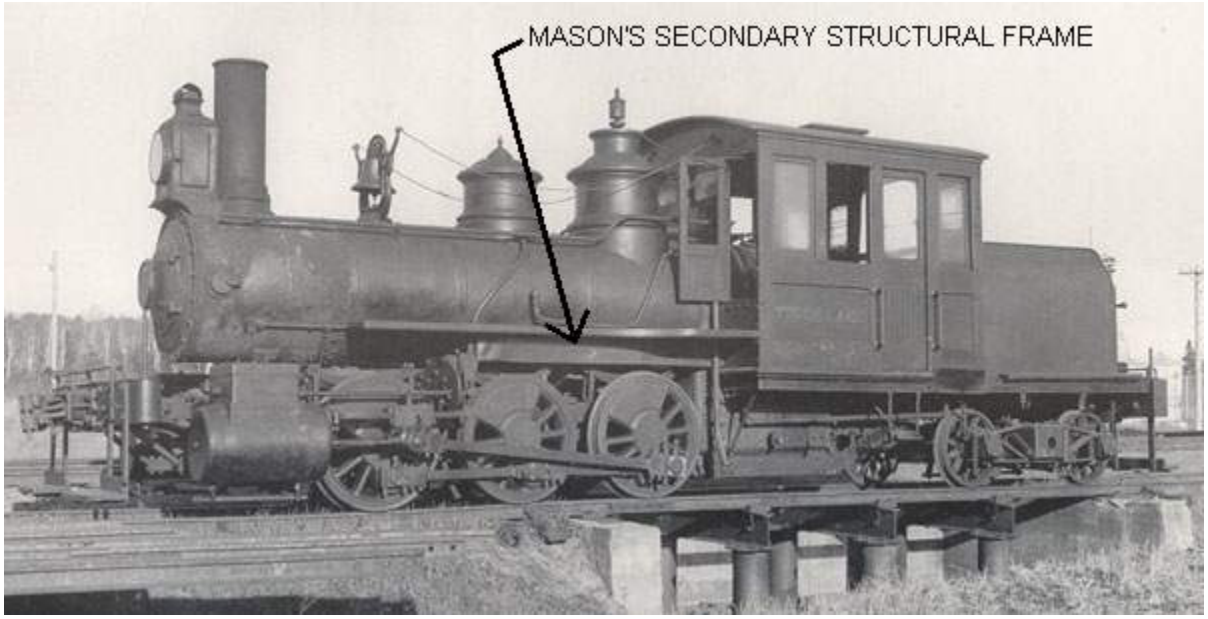
Step 4 - the Lower Datum Line

Next we need to measure the diameter of the pipe exactly. A 51mm pipe should have a circumference of 160.2mm, that's based on the 2-pie-r formula. That's: 2 x 3.1415926(pi) x 25.5(Radius) You will need to confirm your exact diameter, radius and circumference. My pipe might be slightly different to yours. To make measurements around the pipe you need a reeeeeeal thin ruler....the thicker the ruler, the larger the circumference measurement becomes! To make your own reeeal thin ruler, cut a 10mm wide strip of paper, 200mm long. Place a mark every 5mm along the edge of this length of paper. If the circumference is 160mm, then the half circumference is 80mm. Lay the paper ruler out flat and place a mark at the 80mm point. Place a bit of tape on the end of the paper ruler and stick it to the upper datum line on the boiler, wrap the paper ruler around the boiler till you reach the 80mm (half circumference) point and mark the boiler at that point. Next wrap the paper around the boiler in the opposite direction and see if the 80mm mark comes to the exact same spot. We're talking real accuracy here. If your boiler is slightly wider or narrower, the circumference will be slightly different. Do this same procedure near both ends of the boiler. Thus using the upper datum line, we're marking an accurate lower datum line exactly 180 degrees from the top of the boiler. Draw another pencil line connecting the two marks and you have the lower datum line. Again check this line is parallel with the pipe by using the plumb bob.

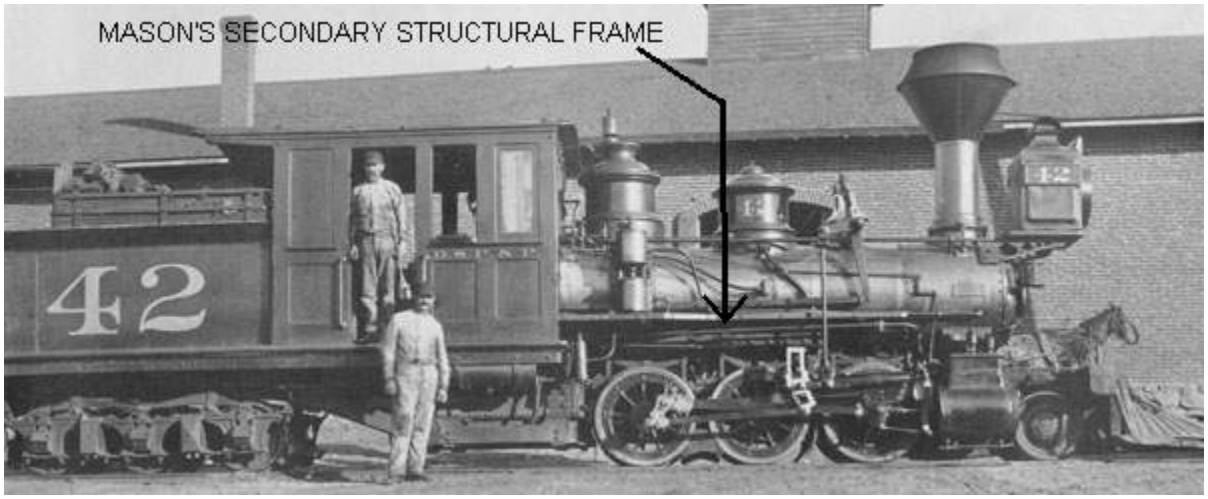
Note the upper datum line and the paper ruler taped to the datum used to mark out the lower datum under the boiler.

Step 5

Something you should know about Mason Bogie locomotives is that there was a secondary iron framework structure located under the boiler that supported the boiler independently from the chassis. Since the chassis was pivoting, the boiler was not adequately supported by the chassis frame in the traditional manner. Mason's secondary frame is visible directly below the running boards, and is seen as a vertical flat iron face that conceals the curvature of the boiler below the running boards. The BBT frame supports our model boiler to the same design.

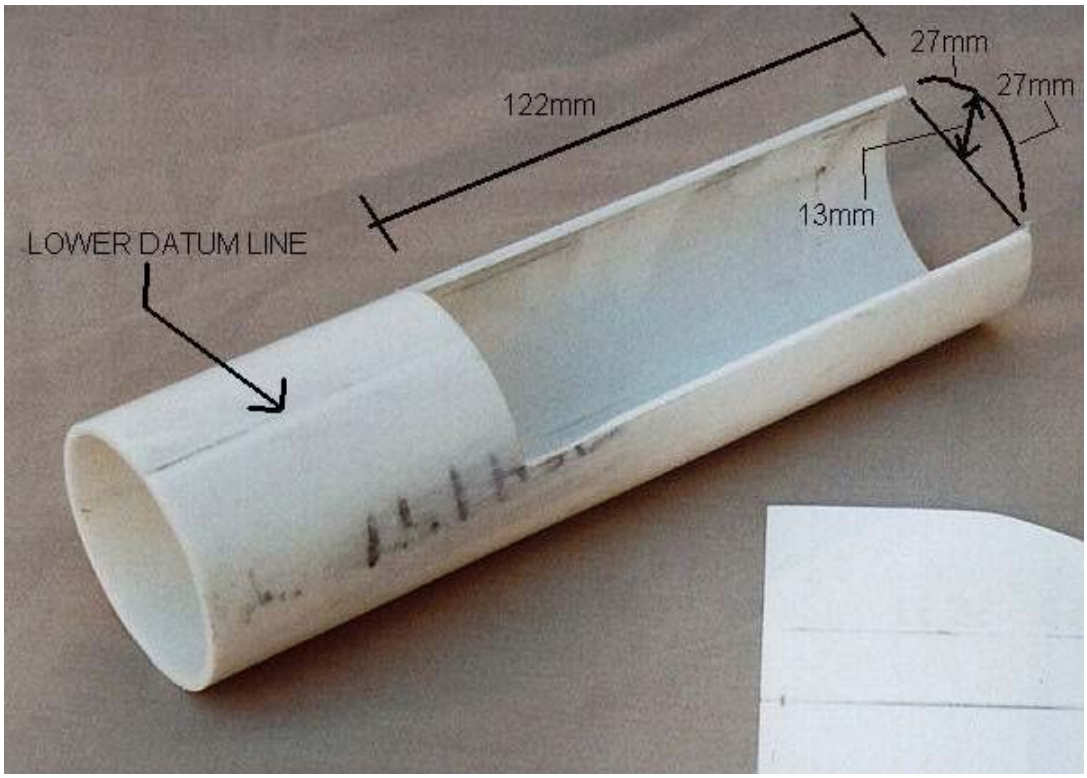


A great side view of the last Mason Bogie survivor, the 'Torch Lake', of upper Michigan. The Mason secondary framing is clearly visible.



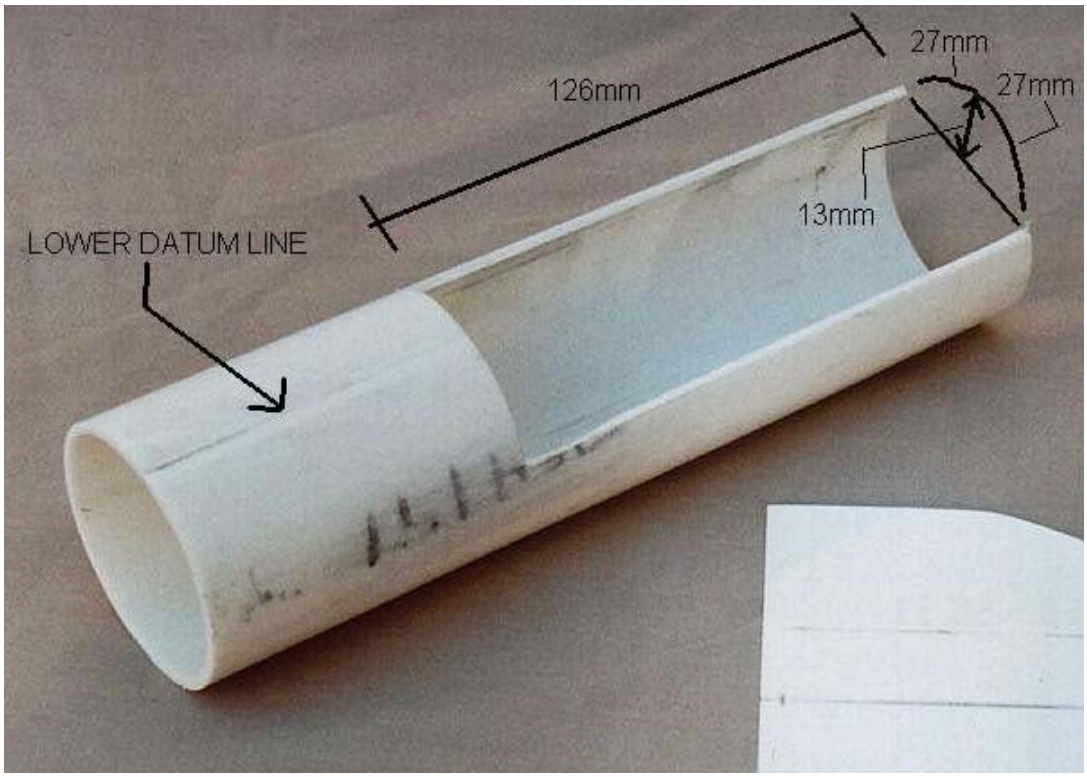
..and as seen on our famous DSP&P 2-6-6Ts!

We now need to cut out the rear bottom of the boiler pipe where it runs over Mason framing. Following the PDF template "Boiler Profiles". Remove a 122mm long section of pipe away from the bottom of the boiler. The section is to be 13mm deep...that equates to a line marked at 27mm either side of the lower datum. Cut across the boiler at the 122mm mark using a razor saw, then cut along the boiler to the extent of the area to be removed using a knife, score a deep line, then snap the section away. The cut boiler will look like this:



Cutting the Wimp's Way Boiler.

The Wimp's Way Boiler and AA Denny uses a longer boiler(193mm), and as such the cut out areas is to be 126mm long. The AA Denny boiler will also have 126mm removed. The Wimp's Way cut boiler should look like this:



The Cut boiler as seen from below.