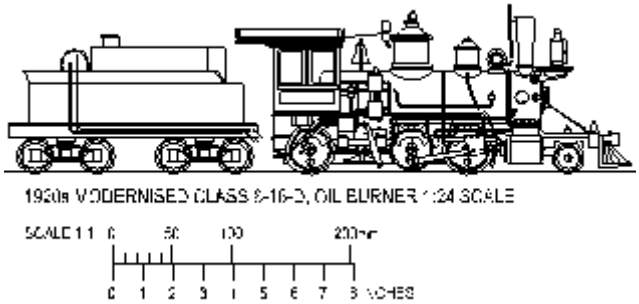
Masters-2001

Build a Baldwin 8-16-D 2-6-0

A Locomotive Adventure
By David Fletcher
Color Photography by the Author
Melbourne, Australia

Chapter 8 -The Grande Finale:

Background - Construction - Detail



Its been a Long Way...but We're Here! (Alan Shepard, Fra Mauro 1971!)
Welcome to the end of the show. Have we had fun or what?

There have been some very fine models made, and I want to thank everyone for taking part. We'll be putting up an online 'show case' of finished models soon, which will display everyone's work. This will be an open display, so that future finished works can be displayed as well.

All up, this has been a very successful series. I want to thank all of you for actually reading my overly wordy descriptions, and also thanks to all those who read the series for pure interest. I'm sure some of the ideas generated will be useful to you. Thanks also to everyone for the very kind words about the series, both from our friends here at MLS and also all the e-mail encouragement. A huge thanks to Shad Pulley too, owner of this site. He worked a lot of hours turning my rough writings into a legible on-line format. I think the process proved very clearly, that on-line co-operative efforts can work; the interactive nature of such a model building class has some real advantages, and heck there was a lot of fun, haggling and jokes played between the modelers. We've had models under construction in Florida, California, Oregon, Hawaii and Australia. I think this proves that on-line articles are a cool idea, and can be more informative, more detailed and more fun than building from magazine articles in isolation.

Here she is...Masters 2001, 8-16-D 2-6-0 in the completed 1:24 scale form.

Announcing Masters 2002

The Mason Bogie - An adventure in 20.3.

There has been considerable interest in the prospect of a 20.3 scale Mason Bogie, 2-6-6T or similar, made famous by the Denver South Park & Pacific RR. Mylargescale.com is proud to announce Masterclass 2002 -Build a Classic Mason Bogie 2-6-6T or 0-6-6T in 20.3 scale. An option is also being developed for a Standard gauge version in 1:29. Masters 2002 will be coming soon to MLS, so stay tune and look out for updates. Checkout the flyer here at MLS.

About the Author

Folks have asked, what do I do, who am I? Well folks, I'm just the same as most of you, and I only scored 50% for English and Writing when I left school! If I had gotten 51% I might have been able to write all this with less words! The important thing is that the content is there and meaningful

I'm a registered Architect in the State of Victoria, Australia and a Principal of a large Australian based Architectural company called 'Castles, Stephenson & Turner" or CS+T for short. This is an old firm, founded 1920 in Melbourne. My work is mostly in research and health care design. I'm involved in laboratory and hospital design for both Australian and overseas projects. Through our overseas identity as "The Australian Hospital Design Group", our company has a significant involvement in helping South East Asia, the near and Middle Eastern countries develop new, world class hospitals.

You can check the web sites for our firm:

Castles Stephenson & Turner (CS+T):
http://www.csandt.com.au/

Australian Hospital Design Group(AHDG):
http://www.healthcare-21.com/ahdg/

About 95% of the photographs used in both of those sites are my creations! I'm the firm's kinda handy-dandy 'do anything anytime' guy, who also does all the firm's photography!

Prior to Architectural work, I worked as a contract model maker, building all kinds of highly detailed models for engineering firms. I built models of sewerage plants, water treatment plants and chemical plants Lots of pipes, ponds and tanks! If you want, I could run a nice MasterClass on making a sewerage farm!!

My model making, tied with a good understanding of current AutoCAD drafting packages, meant I had the right tools to try and do a MasterClass like this. Also about 10,000 photos of locomotives taken at museums all around the world mean I had photos of most relevant items, that I could use without breaking copyright issues.

To see some more of my steam locomotive models, visit Jonathan Landon's JLS RR Web site. My pages can be found at:

http://www.trainweb.org/jlsrr/pictures/lgb/fletch/fletch1/fletch1.htm

I've always been interested in steam trains, and have spent a life time, wandering the globe seeking out the smell of steam and coal smoke...as well as visiting as many museums as I could find! My interest in NG steam would have evolved from seeing the cute Orstein & Koppell steam trains running at a 2ft gauge line south of Stockholm in Sweden, where we lived for 3 years in the early 70s. enough about me!

Visiting the National Railway Museum, York, UK. (The famous 'Sterling 8ft single', 4-2-2 seen behind).

Background

The background in this chapter is indirectly related to the development of the Steam locomotive. I think I've probably unleashed enough goofy locomotive stats on you guys to fill a life time!
I wasn't going to include a background in this chapter at all...but with the up-coming Mason Bogie MasterClass in 2002, well I thought there was something I could say that could be a sort of lead in (very vaguely) to the new Class. This is my last hurrah, self indulgent it may be, but hey, while I've got your attention, let me finish the story! Sit back and enjoy a twisted tale of Engineering.

Construction

This time we complete the 8-16-D 2-6-0. We look at issues of weighting and balancing the model. We talk about decals and making builder's plates. We also discover the mystery identity of the MasterClass 2001 'Master Modeler'.

Background

The Little Giant

To date, we've talked about the work of George and Robert Stephenson, Isaac Drips, Edward Bury, Trevithick, Campbell and so on. Great 19th century engineers all. The common phase used to describe fellas of such note is that 'They were ahead of their time'. That particular phase is used carelessly. The engineers we've talked about were collectively responsible for the steam locomotive as we know it...were they ahead of their time? Difficult question, but my response in NO. That takes nothing away from their achievements. In many cases their genius was what caused them to think of something first...had they not thought of it, someone else would have, and probably would have thought of it in the same year. This type of independent innovation, occurring simultaneously oceans apart was proven with the Stephenson valve gear as an example.

What this states very strongly is that these men were engineers whose thinking was 'reactive' rather than 'proactive'. They saw a problem, or difficulty and sought to overcome it with an engineering solution. That why I say these engineers were not ahead of their time, but were 'OF' their time. Leading edge thinkers they were. Today the role of Architects and Engineers in society is not that different. We're presented with a problem, and we solve it using a design solution. Some of us are 'leading' edge for the type of thinking used to solve the design problem.

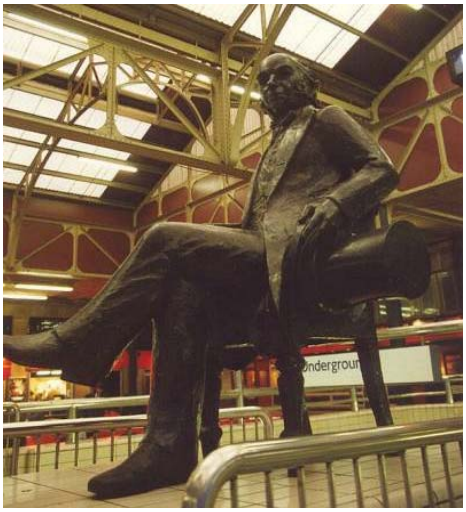
Robert Stephenson, icon of the Steam Locomotive (1803 -1859)

I have a personal hero. He's not a base ball player, a movie star, or an Astronaut. He's an engineer! Oh and its not because he has a funny name! Most folks would not have even heard of my hero, some only in passing. He didn't invent the mobile phone, in fact it is hard to figure exactly what he invented that was so grand. He's not been discussed in this MasterClass because he didn't invent anything for the steam locomotive: no his style would have been to question if we really needed steam locomotives, and then he would proceed to re-invent it from the ground up.

His contribution was more about 'what if it could be done' Many of his ideas caused financial havoc to his investors, and he had many failures. But strangely most of his ideas would prove to be very successful 50 to 100 years later, long after the same ideas had wrecked companies with disastrous failure. He was a man ahead of his time, and the term 'audacious in concept' best describes his work. He was a man with a personal vision based on 'bigger - faster - better'. He lived at the same time as Robert Stephenson, and the two of them were friends and rivals. He was the man behind the great ocean liners, long before Lusitania or Titianic. He was indirectly behind the rail gauge that we would come to know as 'Standard Gauge' because he opposed the gauge so venomously! He hated Narrow Gauge, and expressed his dissatisfaction with the construction of the world's first steam narrow gauge railway in Wales UK. He was never wrong. He was affectionately known in his time as 'The Little Giant'. He was a small man with huge ideas. He was a man of outstanding imagination and had the capacity to turn broad visions into reality through hard work and incredible attention to detail. Above all he loved the attention that greatness bestowed. The greatness that he strove for would ultimately drive him to an early grave...he who shone so bright, burned only half as long.

The Little Giant

Go onto a platform of the modern day West End London station of Paddington, and you might notice a statue of a small man sitting comfortably in a chair, very large top hat in one hand and a distant gaze in his eyes. He is the 'little Giant', and few remember his significance as they mill about to catch their daily trains. The 'Little Giant' is Isambard Kingdom Brunel. The trains departing from this station extend out into the west country of England, reaching as far as Bristol, a distance of some 200 miles. It is said that Brunel walked every mile of the railway while he was appointed chief engineer, and surveyed the best route for the line to take in 1833. At age 30, the 'Great Western Railway' was the turning point in Brunel's career...great things were to come.... Let's go back to the origins of a boy Genius.



Brunel's statue at Paddington Station - London's West End

Isambard Kingdom Brunel 1806 - 1859

Isambard Kingdom Brunel was born the son of noted British engineer, Sir Marc Brunel. Like George Stephenson, Sir Marc's greatest invention was to have his son! Sir Marc had a solid reputation in large projects, involving docks, and harbors. Brunel was born just 3 years after Robert Stephenson, and they both died in the same year. At an early age Brunel Jr was a master at drawing, and at age 6 had a solid understanding of Geometry. At 14 he was sent to Paris for specialized training in Mathematics. Two years later he returned to England and resumed his studies in Engineering, while working at his Father's practice.

The Thames Tunnel

There had been many plans to build an underwater tunnel under the Thames in London. No one had ever built an underwater tunnel, and the prize was high. The 'Thames Archway Company' was formed in 1805 with the task of building the world's first underwater passage. After some mishaps and lack of progress, the engineering of the tunnel was handed over the Richard Trevithick (our ol' friend!..refer chapter 4). Richard drove the tunnel 1200 ft in just 6 months...and then in 1808, an abnormally high tide flooded the tunnel, washing away most of the construction while Richard and his contractors were lucky to escape with their lives. The project was abandoned.

15 years later Sir Marc Brunel was up to the challenge. Having examined the extensive damage done to wooden ships by the 'ship worm', Brunel Snr devised a self strengthening tunneling device based on the way the worms ate and shored up the tunnel behind them. With every foot of progress in a tunnel, the tunnel behind would be safely fully shored up and finished. It was safe and the length of tunnel was unimportant. In 1825 tunnel work under the Thames began. The site was just up river from Trevithick's attempt, running under the Thames from Rotherhithe to Wapping. Two large vertical air shafts were built at both ends of the tunnel, with steam pumping houses stationed on top. The tunnel device worked, and good progress was made. The center section of the river bed proved to be mush, instead of the solid clay the surveyor had advised. The tunnel suffered constant leaks and washouts and work was reduced to a crawl. The resident engineer suffered a break down and left the workings. Brunel Sr, proud of his son's early achievements, appointed Isambard as site engineer of the works..he was barely 20 at the time. Progress was made, with the young Brunel, eating, sleeping and working inside the tunnel. They suffered numerous washouts and collapses, but very few workers were lost. The tunnel would take several years before it was finally completed...Isambard had moved onto greater things by then, but had set the standard of work and safety within the tunnel.

Today you can visit Rotherhithe and see the old pump house above the shaft. The tunnel was indeed a grand vision. It was a double bore tunnel with two lanes and large enough to run trains through. Today the tunnel is still used as part of London's underground railway net work. The Tunneling device became the standard method of tunneling for many years. Most of London's deeper rail tunnels were built using that system. Once or twice a year, in the early hours of the morning, after the last trains are put to bed, enthusiasts run a flash light tour through the antique tunnel...it is something to behold. The craftsmanship and size is astonishing...if you ever find yourself in London, checkout the Brunel Thames tunnel. Ride the train through, and press your face against the glass, you can see all the arched construction and brick work. Go to the surviving Rotherhithe pump house and check for any advertised tour times. If you're really ambitious, you

might like to walk about 200ft along the river edge from the Rotherhithe pump house, and find an old pub from the 1500's. It was at this exact spot that in 1620, a group of puritans, in fear of their life, charted a ship to take them to the new world. The ship was called the Mayflower.

The Brunels' surviving tunnel pump house, Rotherhithe, London

Sometime in the early 1830s, during a period where the Thames tunnel works were suspended, an agitated young Brunel looked for other challenges that would make him rich and famous. He came up with the idea of a 'Gaz Engine'. This was a concept he'd hoped would replace the steam engine. It was an engine powered by gas, generated by the reaction of carbonate ammonia and sulphuric acid. The endeavor failed and his backers lost their investment. Strangely it was one of the earliest forms of the Internal combustion engine.

The Clifton Bridge

Other than the Thames tunnel, Brunel found work hard to get. Then in 1830 a great competition was held in Bristol for the design of a bridge to span the Avon river...the bridge would have to span some 630 ft. Brunel entered 4 designs, all single span suspension bridges. Due to a judging debacle where the senior judge rejected all entries in favor of awarding the contract to himself, Brunel's designs went unnoticed until a 2nd judging was held. Brunel won the prize. His bridge, to be called the 'Clifton Bridge', would be the longest single span in the world. The two pylons at the ends of the bridge (called follies) were based on the ancient Egyptian architecture found at Edfu. Egypt. The span would be 630ft long and weigh 700 tons. As a result of contractor strikes, and city unrest, the bridge would not be completed until after Brunel's death. Brunel was in the game!

The Clifton Suspension Bridge constructed 1830 - 1864.

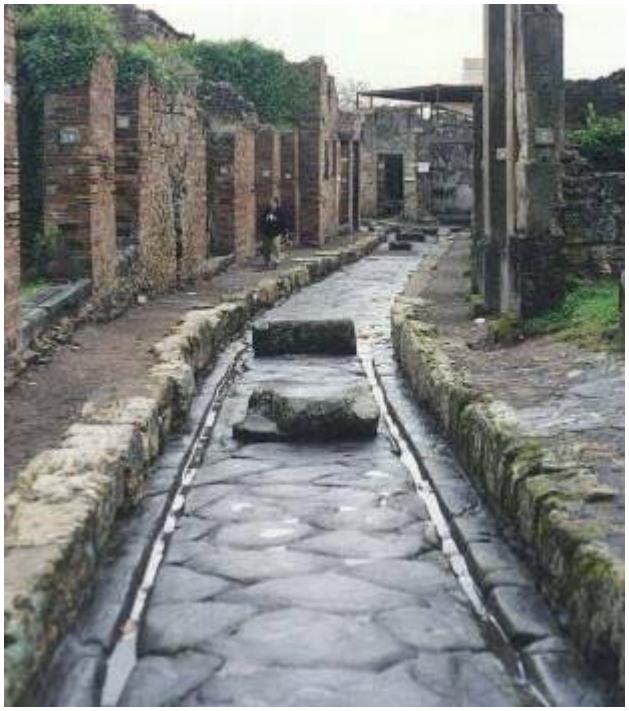
The Great Western Railway

Shortly after the bridge competition was won, Brunel won the contract to build the Great Western Railway between Bristol and London. Opposition to the line from other competitors found Brunel eloquently arguing at the house of Commons for the rights of the GWR. His sound reasoning and solid design work that traced the most perfect alignment, won the day and the GWR became a reality in 1834. Work began shortly after.

The GWR was surveying perfection. It was not the cheapest route, but the route selected had the least grades and widest curves. Brunel's vision was for the fastest and smoothest ride in history. The engineering was not without its challenges. Where the line left London, Brunel designed and built a bridge over the Thames that is still today the largest brick arch in the UK. The line would also sport the longest tunnel in the world at that time, a staggering 2 miles long. Bigger, faster, better....that was the GWR, that was Brunel.

The Gauge Wars

Brunel, never to accept anything without due consideration, or redesign, reviewed the rail gauge being used by the Stephensons in northern England. The unusual gauge of 4' 8 1/2" had been adopted by the Stephensons on the Liverpool and Manchester Railway, based on the track gauge used by the colliery wagons of the day. The wagons had been based on typical road wagons...which had been based on the spacing of the wheels of Roman Chariots! That kind of haphazard acceptance of the status quo was not Brunel. He sat down to calculate the perfect railway gauge from first principles. The formula considered many aspects, such as speed, method of construction, cost of laying etc. Brunel finally came to his conclusion. The most efficient rail gauge would be 7' 1/2 "...a really broad gauge. The gauge was adopted by the GWR at considerable cost.



Roman Standard Gauge! Wheel Ruts ground into the streets of Pompeii by the passing of thousands of chariots prior to the city being Buried by a Volcanic eruption in AD79. Pompeii, Italy. The 'proof was in the pudding' as they say...for on average the trains on the GWR's broad gauge line could pull trains 10 tons heavier, at 10 MPH faster than the trains on the Stephenson's narrow gauge! Typically the speeds attained were in the order of 60mph.

The inevitable would occur...the two rail gauges would meet causing the utmost chaos. In 1845 the government acted...the country would only have one rail gauge. Trials were done. The GWR's older fleet of Broad Gauge locomotives, designed by Daniel Gooch, went up against Stephenson's latest locomotives on the Narrow Gauge. With every trial, the broad gauge won the day...faster, bigger, better.....one time a Stephenson loco pulling trains at speeds in excess of safe limits overturned on a curve...something that 'would never happen on my Broad Gauge' reported Brunel! But the Stephensons won the battle. The narrow gauge was cheaper to build and already 1900 miles of Narrow gauge had been laid, as opposed to the GWR's mere 274 miles of track. Brunel tried everything to save his perfect gauge...he even invented mechanized ways of transferring goods from one train to the other in little time. The order came from high up..the GWR would have to change its gauge. It wasn't until the 1890s that the GWR finally fully adopted the Stephenson gauge. The Stephenson Narrow Gauge would become known as 'Standard gauge'.

The 7" 0.5" gauge Iron Duke, typical Gooch type locomotive of 1840s GWR. Working Replica - National Railway Museum, York, UK.

Brunel was actually right. Stability of speed, load limits that could be pulled, and the size and power of the locos were all substantially better with the broad gauge. This same argument would be proven correct by the demise of most NG lines around the world by the turn of the century. Cheaper is not always better.

The Atmospheric Railway

Bitter with the loss of his Broad Gauge concept, and eager to prove that true power on the rails was restricted by the size of the locomotive that could actually be made to run with stability on the rails, Brunel experimented with other forms of locomotion. He'd heard about an experiment using air pressure to drive trains. Robert Stephenson dismissed the 'atmospheric railway' concept as "A great Humbug!" But Brunel saw logic. If one cannot built a locomotive large enough to ride the rails, then build an even bigger engine as a stationary unit on the ground next to the railway and have that unit pull the trains.

In 1848 Brunel talked some financiers into the concept of a high speed atmospheric railway. The concept was simple enough. He set up a number of steam powered air pumping plants along the new railway line, and fitted a specially designed air pipe along the middle of the trackwork. Light weight trains, with no locomotive ran freely on the rails, with the lead car running a 'piston' down into the central air pipe. Using a simple telegraph communication system, the engineers at the various pump houses would simultaneously pump air into the pipe behind the train, and extract the air out of the pipe from in front of the train. During trials, Brunel was recording speeds up to 70mph. Folks came far and wide to ride the silent, smokeless wonder of transport. Within a couple of months, the leather seal to the air pipes were rotten, and breaking up. Another of Brunel's technologically brilliant, economically disastrous endeavors! The cost to replace the seals was more than the railway was worth, and the financiers sold up for what they could get. The line was later restored to normal steam power. Brunel's designs called for perfection in manufacturing, and also required materials to exceed their typical performance. Usually the designs were sound, but their implementation with contemporary materials and manufacture usually fell short of the mark...with the development of materials years later, many of Brunel's ideas were to flourish.

The PS Great Western

The Great Western Railway was looking to expand its service overseas. The Great Western Navigation Company was formed, and Brunel was appointed chief engineer. The concept was that the GWR would run from London to Bristol. The shipping company would connect and then make the run across the Atlantic to New York.

Steam ships had been around for a while...especially freighters. However, a fully steam powered ship had never been considered for Ocean travel. It was generally considered that a steam ship could never hold enough fuel to make the full journey. Most steam ships were sail powered, with only a supplementary engine to help out when needed. Brunel knew the answer to most problems could be found in mathematics.

A ship of a given size, contains a certain volume, enclosed by a hull of given surface area. It follows that if the ship were to double in size, the surface area would be increased by the power of 2...while the volume increased by the power of 3. The answer to a steam powered ocean liner was size. The bigger the ship became, the proportionally larger the volume became, while the engine and fuel requirement only increased by a smaller amount.

Brunel set about designing the world's largest ship, a vast ship of 1320 gross tons. Big enough to take payload, passengers, and ample fuel for an Atlantic crossing entirely powered by steam. The ship would have paddle wheels (the only known form of steam propulsion on the sea), and was entirely made of oak in the traditional manner. In 1837 the 'Great Western' was born.

When the ship was ready for sea trials, and the first steam powered crossing was imminent, another company, dreaming of winning the prize of being first, chartered the largest steam ship they could find, a paddle wheeler called Sirius. In 1838, they filled the holds of Sirius with as much coal as she could carry. In fact coal was about all the cargo she could carry. 19 days later she limped into New York, with barely a scoop of coal left. She had made the entire journey by steam power and made it into the history books. A few days later Brunel's 'Great Western' steamed into New York, brimming with passengers, freight and a cool 200 tons of unused coal in her bunkers. She made the trip in 15 days. Some stories report the Sirius as having made the journey only after burning every ounce of coal, every piece of furniture, deck houses, and anything that could burn...but those stories are untrue, Sirius did arrive intact!

The Great Western would make 67 Ocean crossings before being broken up in 1856.

Model of the PS Great Western, 1837. (cool Airfix Kitl!)

The SS Great Britain

The Great Western had barely completed her 2nd Atlantic crossing when Brunel set about designing an even bigger ship. Initially the ship was designed as a larger version of the Great Western, timber construction, with paddle wheels...then one night Brunel just couldn't sleep. He'd seen an iron ship a few days before, a tiny little river barge of a ship...but made from IRON? Could that be used to make an even bigger ship? Not only that, he'd heard about experiments involving the use of a steam powered propeller, instead of paddle wheels. Brunel did some experiments with the propeller, and realized it had efficiencies way above paddle wheels. He'd made the decision. He completely redesigned, and re-documented the great ship to be built from iron and be powered by the first ocean propeller.

In 1843, Brunel's 2nd great Ocean Liner was born...the Great Britain. She was over 1/3 larger then the Great Western, at 320ft long, entirely made from Iron, including the first double bottomed Hull. Her enormous steam engine powered a single screw propeller. The propeller was a six bladed unit, of Brunel's design. The blade angles had been carefully calculated to meet the optimum power output for minimum torque input. She had the first 'clipper bow', designed for speed. The steam engine was so vast, it occupied the full width and height of the hull. In order for the long stoke of the pistons to fit within the confined space, the engine had oscillating cylinders. Concerned about the crew's ability to steer the ship, because of the prop wash holding the rudder immovable, Brunel devised the 'Balanced Rudder'. Instead of the rudder hinged at the leading edge as per traditional methods, the Brunel rudder, was pivoted at the top and bottom along a center line. Regardless of the prop wash, the rudder could be turned with no extra effort. The same type of rudder is used on today's ships.

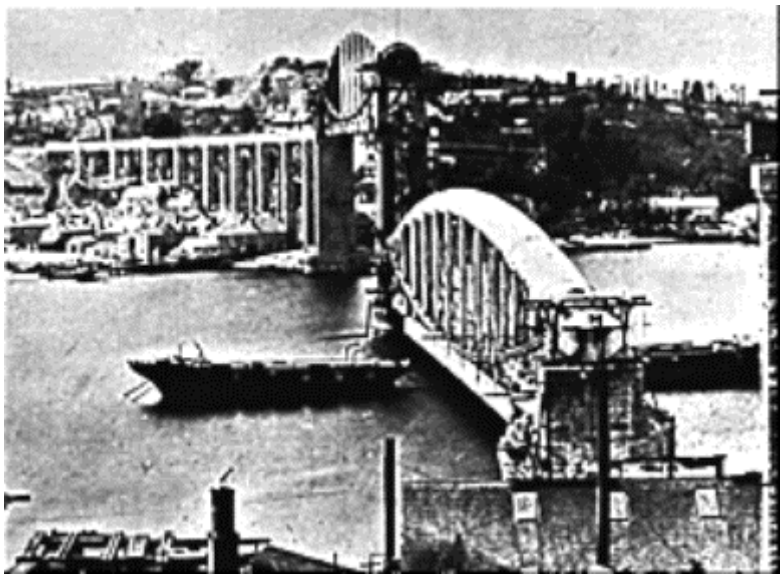
The Author stands beside the first ocean propeller and balanced rudder on the Great Britain, 1843. Bristol, UK.

The Great Britain had a long and successful career before being abandoned at the Falkland Islands in 1886, during a storm. In 1970, the rusting hulk of the Great Britain was returned to England, and in fact returned to the same dock in Bristol where she'd been built over a century before. Today, with 2/3 of her hull thickness rusted away, she's undergoing restoration, and is well worth visiting. She is without doubt, the absolute first of the Great Liners. Just think about what followed...Lusitania, Titanic, Mauretainia, Queen Mary (we know that one eh??) Queen Elizabeth and the QEII. Read more about the Great Britain at: http://www.ss-great-britain.com/

Brunel's Great Britain of 1843, The world's first Great Liner

The Tamar Bridge

Probably Brunel's greatest triumph was to occur in 1857, with the building of the Tamar Bridge near Cornwall for the GWR. The railway had proposed a 1200ft long bridge in many small spans..Brunel had bigger ideas (he always did)...two massive iron bow truss spans, each 465ft long, prefabricated at an iron works up river. When the 3 brick piers, and the two massive iron spans were ready, the spans were floated to the site on barges. Then using a system of jacks, Brunel set about lifting the two spans into place. This was the day of his crowning glory, and he basked in the glare of his own brilliance that day! He stood high on a platform above the workings, like a conductor on the podium above the Orchestra. And like conducting engineering music, he waved semaphore flags to and fro, instructing, and directing the lifting of the spans into place. The spans just slid into place, with perfection, not 1/8" to spare. The whole operation was done in complete silence, something Brunel had insisted on. The crowed that gathered to watch stood awe struck as they saw engineering at its finest when those huge bow trusses just slid into place. Brunel stood on the platform a moment longer, savoring the victory, then stood down to acknowledge the ovation of the crowds.



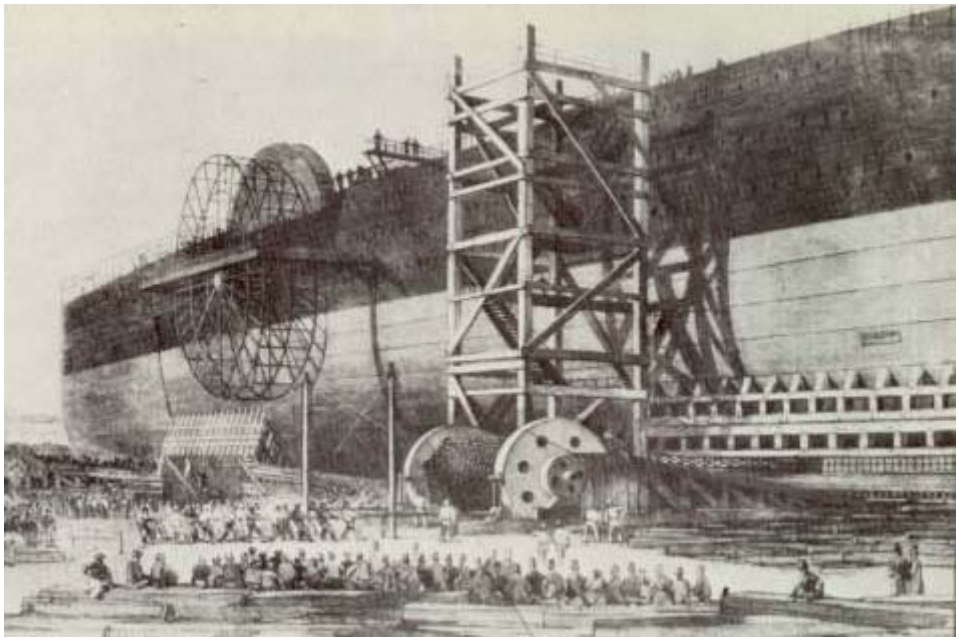
Moving the 2nd giant bow truss into place

The Tamar Bridge photographed on opening day in 1859. This railway bridge is still in use today.

The last laugh - The Great Eastern

Faster, Bigger, Better - Brunel not satisfied with the size of Great Britain; believing the value of iron as a construction material had not been fully realized, he set about designing a stupendous ship. The ship would be called the 'Great Eastern', and this indeed was a big ship at near 700ft long. In 1853, at over twice the size of the Great Britain, she was the century's largest ship, only eclipsed in 1906 with the construction of Cunard's 4-funnelled Lusitania. The ship was indeed to be grand, and set up the tradition of excellence in ocean travel. She had two enormous steam engines that powered both Paddle wheels and a propeller. Many large ball rooms and dining rooms, private bathrooms with hot and cold water were planned. The enormous size of the ship allowed spatial luxuries not seen on the sea before. She was to be the palace of the ocean. In a joint effort with noted naval architect and ship builder, Scott Russell, the keel of the Great Eastern was laid in Russell's shipyard at the very southern tip of the Isle of Dogs, right across the Thames from the Royal Navel headquarters at Greenwich. The ship was so large, she had to be launched sideways. Her length was wider than the Thames. The side slip method of launching, first used on the Great Eastern in 1857, is still used today when launching larger ships.

Thousands of workers were contracted to the ship, and the ship yard took on the appearance of the Egyptians building a modern day Pyramid. The day for launching the hull approached, and people came from far and wide to see the extraordinary ship hit the waves. Brunel climbed up to his conductor's podium atop the ship and began the flag waving....The silence he asked for from the crowd fell on deaf ears, there was a right party going on down below, with souvenirs being sold along with front row seats to the show! Distracted, the workmen were not coordinated, and the ship suddenly lurched down the slipway. Arresting the fall, the great Eastern was brought to a screeching halt...and remained jammed on the slipway for a year. Brunel worked feverishly to devise ways to lift the enormous whale into the water. Hydraulic jacks, cranks, ropes and men could all but move her an inch at a time. Finally in 1858, she touched the waters of the Thames, and upon high tide, floated off the ramp.



Lithograph of the vast bulk of the Great Eastern shown during the sideways launch operation, 1857.

The events of the last two years had taken their toll on Brunel. He and Scott Russell had fallen out for some time, but only stayed at work to see the great ship float. Two shipping companies

had faced financial ruin just trying to see the great ship into the water. A third company took over the floating shell and set about fitting her out. Once again Brunel and Russell could not agree on the fitting out of the vessel, and finally on the 5th September 1859, while Brunel was preparing the ship for sea trials, he collapsed on her decks, suffering a stroke. He was carried away from his great ship for the last time. While attempting to recover in the hospital bed, Brunel continued to give site instructions, preparing the ship for sea.

Finally the Great Eastern steamed out of the Thames to open sea. The size of the ship on the waves was remarkable. She just glided past the many small boats straining to keep up. The rolling motion of the seas were barely evident on her stable decks....then Booooom! One of her 5 large boilers blew up, throwing the whole front decking into the sky, and utterly destroying the forward ball room. No one was in the room at the time and no one was killed. The ship's hull and most of her interior was undamaged. News of the accident was the final blow to Brunel, suffering a 2nd stroke, he died on the 15th September 1859.

The Great Eastern under way

The ship was not the success Brunel had hoped for. From an engineering stand point the ship was incredible. Brilliant in design, and brilliant in the many smaller feats used to make her possible, from the launching technique to the engines themselves. The world just wasn't ready for such a large ship. Few ports could handle her size, there was no where in the world she could be dry docked or repaired. She wrought financial havoc on all who owned her, and very quickly she just wasn't financially strong enough to make luxury ocean trips.

From 1865, an ageing Peter Cooper, famous for the B&O's locomotive trials with Tom Thumb all those years before (see chapter 4) and inventor of Jello (that great kid's desert!), took up with a group of investors to lay the first telecommunication cables across the Atlantic, linking the US with Europe. There was only one ship large enough to carry the thousands of miles of cables required for the task....the Great Eastern. She was refitted for the task. Her many ball rooms, saloons and cabins were removed and converted into giant cable drum rooms. She set sail for New York, dragging the telecommunication cables out the stern. Half way across, in rough weather, the cable snapped, with the cable end dropping to the ocean floor. Defeated Cooper and the Great Eastern returned to port. The 2nd venture was successful and the first transatlantic cable was laid. Instant communication between the two continents was at last possible. On the return journey, the Great Eastern stopped at the site where the first cable had been lost, they fished up the broken end, spliced it, and returned to the US, with the 2nd completed transatlantic cable. She would ultimately lay 5 cables between the nations. This was the only real glory the Great

Eastern would earn. Her task finished, she was sold to an amusement park, where she served as a floating circus. With her huge paddle engines long since rusted solid, her last good boiler and screw engine were fired up for a last journey, to the scrappers yard in 1889. When she was broken up, the body of a rivet contractor was found sealed between the twin iron hulls of the Great Eastern. Some have said the ghost of this poor trapped soul the reason for the Great Eastern's many misfortunes.

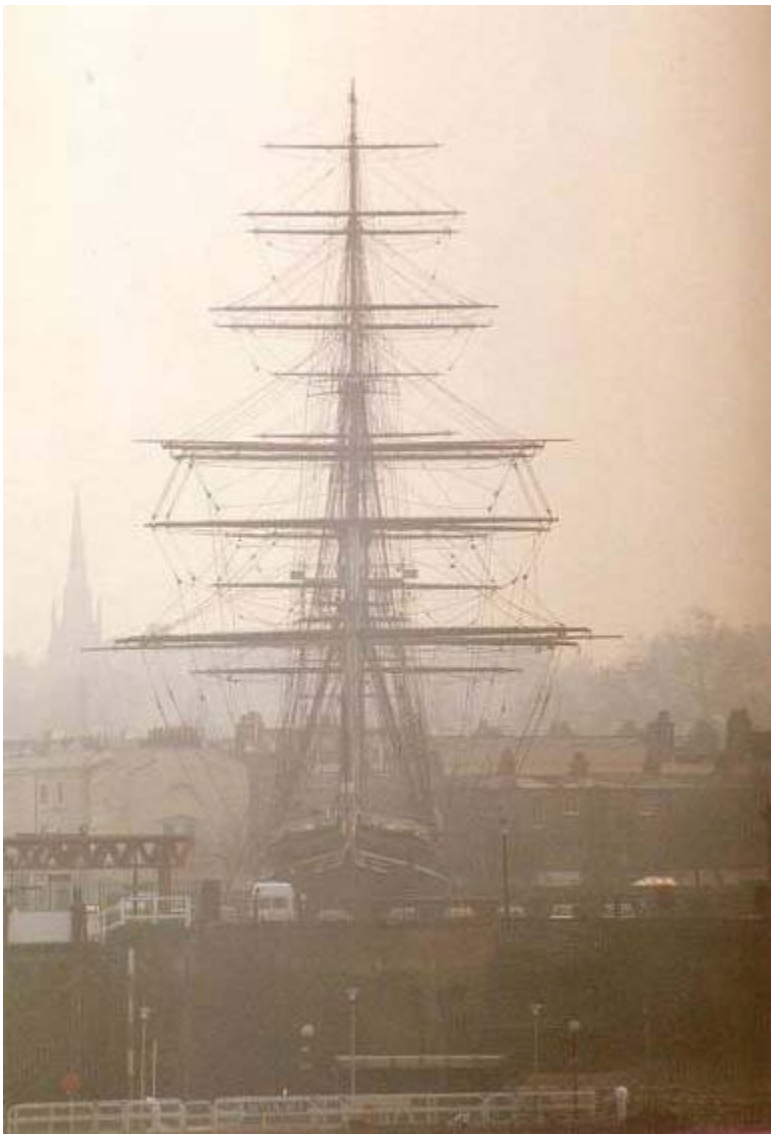
I'm told some those communication lines are still serviceable even today.

Cunard's Lusitania keel was laid only 15 years after the Great Eastern was broken up, and she succeeded where the Great Eastern failed. The world was now ready for the era of the great liner. If you want to read a little more about the Great Eastern's life, links etc, visit:

http://sol.brunel.ac.uk/~jarvis/brunelstory/greateastern.html

It is a very little known fact, but today it is possible to reach the very southern tip of the Isle of Dogs, and walk to the location where the Great Eastern was built. Looking across the water, you can see the masts of the famous Clipper 'Cutty Sark' at Greenwich. Wait for the very low tide...and then climb down the vertical galvanized ladder, down some 20ft-30ft of sea wall. Step off the ladder, and onto the Thames' muddy bottom, like stepping onto the moon. All around you can see the straight lengths of oak slips and rails of the Russell ship yard. Rusty cables are strewn about along with rusting pulleys and trunks. This is all that remains of the Great Eastern. Her birth place. The rails and ropes remain untouched since the day she floated off. Its worth the trip to pay your respects, but take gum boots along.

The surviving launch rails of the Great Eastern, seen in the muddy bottom of the Thames at low tide, at the Southern Tip of the Isle of Dogs (London Docklands).



Looking across the Thames, from the Launch site of Great Eastern, you can see the masts of the great Clipper, Cutty Sark, at Greenwich.

Of Brunel's death, Danial Gooch, his closest friend and locomotive designer for the GWR, said this:

> "By his death the greatest of England's engineers was lost, the man with the greatest originality of thought and power of execution, bold in his plans but right. The commercial world thought him extravagant; but although he was so, things are not done by those who sit down and count the loss of every thought and act."

Isambard Kingdom Brunel - The Little Giant, 1806 -1859

Note the size of the chain links behind...this was one of the winches used to launch the Great Eastern. Photo taken in his last years.

A little about his ways:

When he worked for the GWR, he had his own private car, which could be towed around the line to where ever he wanted. It was a drawing office and bedroom in one. Complete with dining facility and a case of 50 cigars. Brunel didn't suffer fools and was quick to judge. On one occasion he wrote to a draftsman working for the GWR:

> "Plain, gentlemanly language seems to have no effect upon you. I must try stronger language and stronger measures. You are a cursed, lazy, inattentive, apathetic vagabond, and if you continue to neglect my instructions, and to show such infernal laziness, I shall

> send you about your business. I have frequently told you, amongst other absurd untidy habits, that that of making drawings on the back of others was inconvenient; by your cursed neglect of that you have again wasted more of my time than your whole life is worth, in looking for the altered drawings you were to make of the station -THEY WONT DO!"

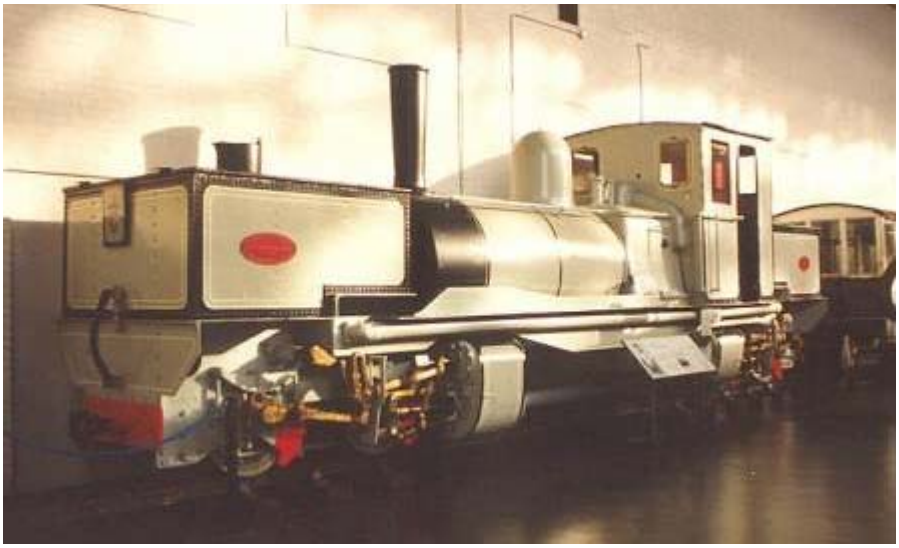
OUCH!!

Building things 'big' doesn't naturally mean Brunel's thinking was ahead of his time. No the size and grandness of the vision was only half the story. Thinking things on a grand scale might make him a 'visionary', but often that kind of thinking just borders on the Arrogant. What makes Brunel so advanced was the many thousands of smaller inventions and ideas that he dreamed up, just to ensure his vision could even work. One cannot build a big ship, by simply enlarging the plans of a small ship, and build it using traditional methods. Virtually every detail, construction method and concept had to be invented from the ground up in order for his vision to come to life. It's the many thousands of un-named innovations that made Brunel special.

Steam and the Narrow Gauge

Brunel was always right! He had no patience for the Stephensons' ill conceived rail gauge, and was even more upset to hear of a new steam railway to be built in Wales connecting to a branch of his broad gauge GWR. As early as 1850, the Ffestiniog railway was setting up a public steam railway. To save costs they were thinking of building to a narrower gauge than even the Stephenson's 'standard gauge'. They were proposing a gauge of only 1ft 11 inch or just under 2ft. Brunel said 'What madness is this?' of what he believed was a terribly short-sighted venture.

The line did prevail and still runs a tourist operation today. Was Brunel wrong? YES and NO. The line was indeed short-sighted and inefficient. The size of locos and rolling stock so restrictive as to be almost impractical. The railway tackled their problem head on and sought an engineering solution to their problems. The solutions that came forth for this narrow gauge line, and for most other narrow gauge lines around the world, are the innovations that make the Narrow Gauge so endearing. A whole technology devoted to make the impossible, possible - a new breed of engineering. It proves that engineering can overcome when needed. For NG locomotives alone, we've seen the success of outside framing, Mallet articulated, we've even seen Garratts...and then there is the famous Double Fairlie of the Ffestiniog railway...the precursor to the Mason Bogie of North America...ahh but that's another story.....



The World's first Garratt Locomotive, built for a Tasmanian industrial railway in 1909, 0-4-0+0-4-0. Photograph taken at the York Railway Museum, UK...I believe the locomotive is fully restored to operable condition and is running in Wales today.

One of the Famous 'Double Fairlie' articulated locomotives of 1869,0-4-4-0, built for the Ffestiniog Railway, Wales.

Hope you enjoyed a just a little about Brunel. Naturally these are only his greatest works, visit the UK, and you'll find a treasure trove of Brunel artifacts, right down to segments of his atmospheric railway pipeline!

Construction

The Finishing Touches

Well, your loco looks finished, and runs. But it isn't quite done yet. There are some last minor items to look at. Not all of these last items will be of interest to many, but it's probably best to at least reveal them to you.

Locomotive Balancing

Balancing was an issue more relevant to smaller scales, but the theory is sound and should have some impact in large scale too.

Balancing is this:

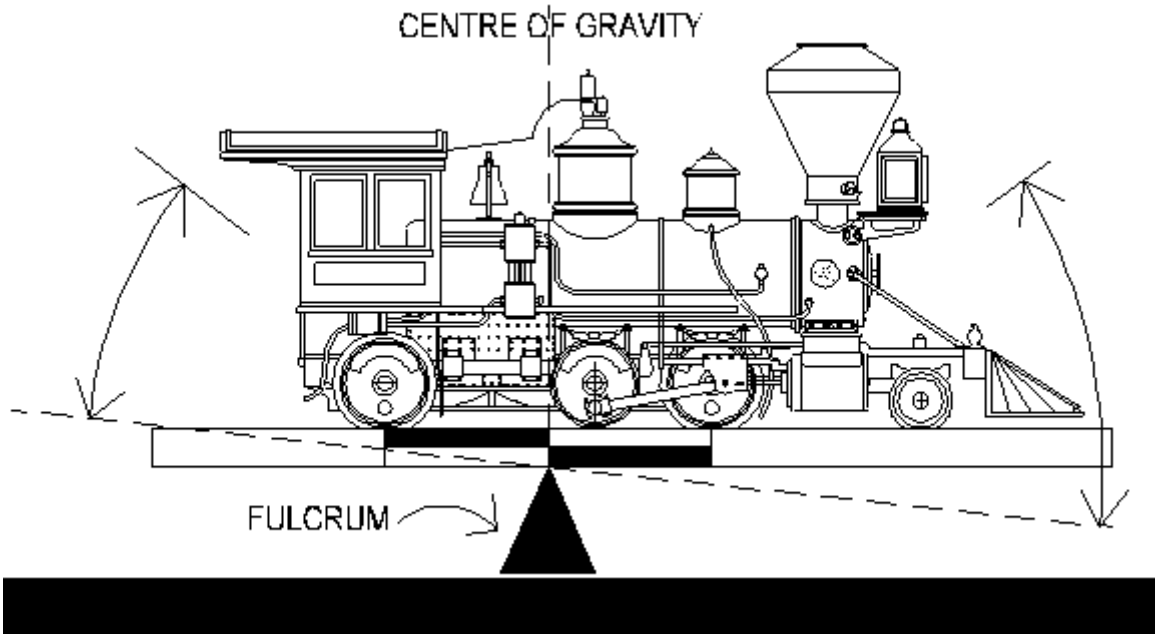
For the optimum tractive effort to be obtained from the model, the weight distribution should be such that the center of gravity is close to the center point over the drive wheel/chassis length. For a given model weight, the weight to power ratio of the model is at its maximum when this is achieved. Now in smaller scales, this technique was one way to maximize the power of the tiny models, given the restricted size of the model for weight addition. In the meager number of years I've been working in large scale, I've come to a new truth about weight distribution. The best tractive effort obtainable, to run on garden grades, slippery rails, squished ants and dead leaves, is simply to pack the model with as much weight as she can carry! On smaller prototypes such as our 8-16-D, there isn't much room for weight, so pack it in where ever there is space! We're lucky in a way that the Aristo block was made as a weight in the first place. Many of you may see no need to add extra weight at all.

My advice: add weight if possible. Try to get the weight center of gravity about right, it can't hurt. If you still can't pull a zillion cars up the 7% grade, then just pack the weight in where ever it can fit. The Aristo drive is robust enough for the added weight to have little effect. I should point out that there are models out there, where added weight is not good for the long term survival of the drive.

The center of gravity and weight distribution can be done by placing the loco without tender on a short length of track. Place the track on a tube, or pencil or such to make a kind of see-saw, fulcrum point. Move the pencil to the exact center point between the 1st and 3rd drivers. This is

the desired center of gravity for the model. Without added weight, your model will be cab heavy, and the back end will tip downward over the fulcrum. Add weight to the empty boiler in the section forward of the firebox...in the area above the springs, within the boiler. Keep adding until the loco tips to level...that's the optimum weight distribution. Try the model out on grades, with cars behind. If good, then you're done with weight addition. If the model is still too light, then just add as much weight in the boiler as can be made to fit.

I use flat lead sheeting for weight. The lead can be purchased in hardware stores, and plumbing supplies. Originally used for roof flashing etc, the lead sheet is easily bent and cut with scissors. I usually cut a strip of lead the width of the boiler area I intend to fill. Then roll the strip into a cylinder. Roll tightly, and use a hammer to bash the lead into a tight pack. Dob some blobs of 5 min epoxy inside the boiler where the lead is to rest, then slide the lead weight into position and allow the epoxy to dry. That's it. (take care that the dobs of 5 min epoxy don't dribble out the holes in the bottom of the boiler and ooze on the chassis top). Take care to wear gloved while handling lead for it is generally poisonous to our well being.



Balancing a model locomotive

Decals

I don't have much to say about decals, other than there are several good brands of decals out there. My favorites type, for a long time, were the dry transfers offered by Larry Larson, until he went into film decals like everyone else. I don't like film decals period. The difficulty is hiding the film such that the letters show and no film. This is especially difficult on flat or matt painted models. Decals can be a total mess on Matt models. Some folks will paint the whole model gloss first, so the decals will bed down properly, then spray a flat dull coat over the lot to get the desired matt effect on the model. Others use a bedding agent, available at model shops to bed the decals down onto matt painted surfaces. There is a danger with Bedding agents, they can screw up the decals and can even screw up the paint. Testing is important before trying it out on your model.

Ask around for practical advice if you're new to this.

There are some other makers of decals, that will provide customized decals. These are pretty cool. Jeff Damerst of the Shawmut Car Shops has done all kinds of custom decals for me in the past very successfully.

Prototypical Cars to Pull

This is in response to concerns about the small size of the 8-16-D not looking right with available rolling stock. There is a host of good equipment out there that is perfect with the smaller locos of this type, both in 1:24 and 1:20.3.

By far my favorite freight cars for this prototype are the Bachmann 20.3 20ft cars. A flat, gondola and box car are currently available which are 100% perfect for this model. Best part is that these cars are adaptable. They are indeed perfect 20.3 20ft cars, for the 20.3 version 2-6-0s...but they also make excellent 24ft cars in 1:24 scale! I've yet to find a car to more closely resemble the classic 24' cars used on all NG lines during the 1870s and 1880s. The big 30' cars, which we're all so used to seeing, came later. For good 1:24 scale 30' cars, you can't go past the Aristocraft/Delton Classics. These are the original Delton cars, produced in the late 1980s and are highly detailed. Available is a box, reefer, gondola flat and long caboose. From H-L-W, you can obtain the original 1:24 scale Delton Passenger cars...These are still my favorite on the market.

Other good options for smaller equipment for both 1:20.3 and 1:24 versions can be found in the H-L-W catalogue. There are the cute lil 4 wheel cars offered as the 'Hartland Value Line'...check MLS for some of the terrific conversions done to these lil cars. Hartland are also in the process of upgrading their 24' box cars, gons and a possible new stock car. All will have detail on the level found on the original Delton cars. This range make for great 20ft cars in 1:20.3, or 24ft cars at 1:24 scale.

The Prototype 8-16-D 2-6-0 pulling a string of Bachmann 20' freight cars

Breaking out the Champagne

Ok chaps we've come to the end...time to make the builder's plates. The installation of the builder's plates on the smokebox sides represents the 'christening' of the loco, or the smashing of the Champagne bottle across the bow of the ship...it signifies that the loco is finished and ready for the rails.

Lets first have a quick look at some of the stylish builder's plates used on some of the more notable locomotives.

Real Builder Plates

The builder's plates, in reality, were brass castings. The castings were painted black, or sometimes other colors such as red or green. The lettering relief on the castings were then polished which made the brass lettering stand out against the dark painted background. Lets look at some real builder's plates.

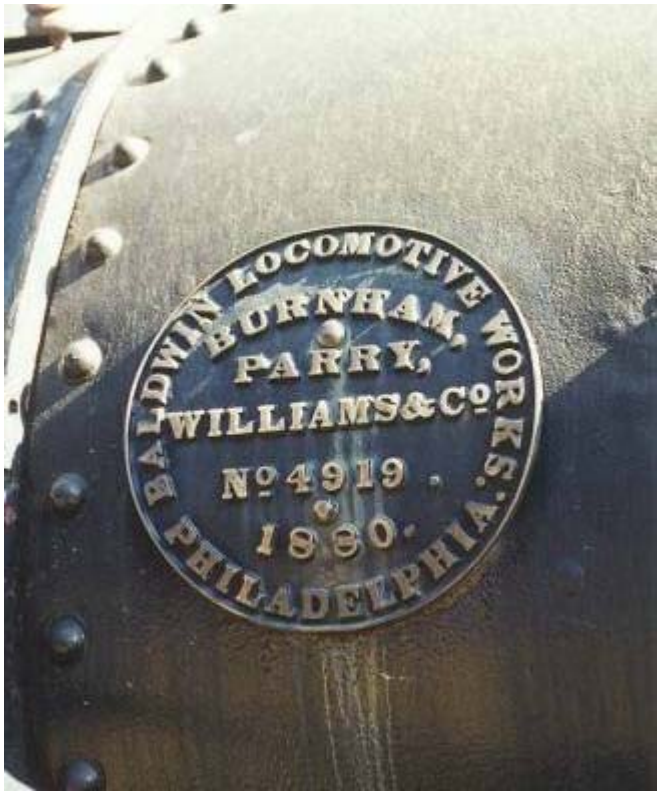
Baldwin Plates

We'll start with what the Baldwin Plates looked like the in the early 1870s.

Prior to 1870, I don't know the names that featured on the BLW plates, but up until late 1874, Baldwin Locomotive plates, featured M Baird as the general Superintendent of the works.

Here is an example of an 1873 M. Baird BLW builder's plate found on the V&T #13, 'Empire'. Genoa has an almost identical plate.

By 1875, the classic Baldwin names appeared on the Plates... that of Mr Burnham, Parry, Williams and Co. This type of plate is found on most Baldwin locos from 1875 through to around 1900. Here is an early example, on the 1875 4-4-0, Eureka.



The same plate design is seen on this 1880 South Park 2-8-0

By 1903, Mr Parry had been deleted from the B-L-W plates, with only Burnham, Williams and Co. depicted. This plate is mounted on the 1903, D&RG K-27, #463.

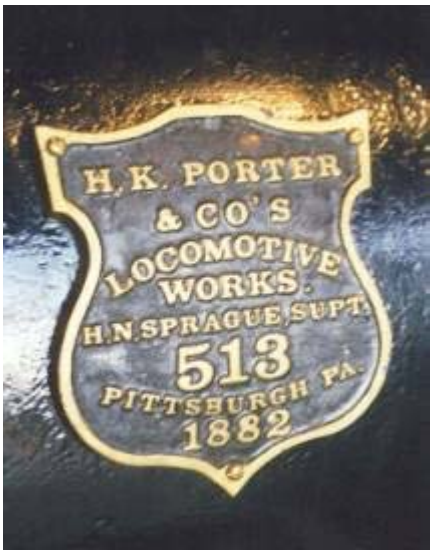
ALCO Plates (American Locomotive Co.)

There were a host of smaller engineering firms that combined to form ALCO in the early 1900s. Such companies, among others, were Cooke, Danforth, Rogers..and Schenectady.

This is the original Schenectady plate of 1899, as used on the Cripple Creek 4-6-0, later RGS #20. These were the heavy T-19 4-6-0s used in Colorado. The Schenectady plant in NY would become one of the prime builders for ALCO.

Here ALCO's Schenectady plant built the Famous D&RGW K-28s in 1923. The plate is somewhat plain, and slightly damaged, worn by K-28 #473.

....And H.K. Porter



This is a typical 1870s-1880s plate from the H.K. Porter Locomotive Works. Like the plates shown above, this plate would also evolve, and become somewhat plain, but the classic Porter shield would remain a constant.

Naturally there were heaps of other plates, but to put them all on-line here would make this file unbearable! I've chosen the types that are more relevant to the Class.

Making Your Own Builder's Plates

I make my own builders plates using CAD. Basically I make a small drawing file consistent with the era style of the prototype I've built. If my model is based on a specific prototype, I draw the plates to have the actual construction number and date, matching the prototype.
Because most of you wont be able to make your own CAD drawing of the plate you want, I've generated the plates for general use for the Masterclass. All these plates are based on the correct styling for locos of the 1870s and 1880s.

The CAD plates are as follows:

- The NCNG plate for the #2 'Nevada', including the correct builders number and date.
- The D&RG #15 plate, Class 40 'Raton' including the correct Builder's number and date.
- A generic H.K. Porter & Co. plate, based on the correct design for the 1880s.

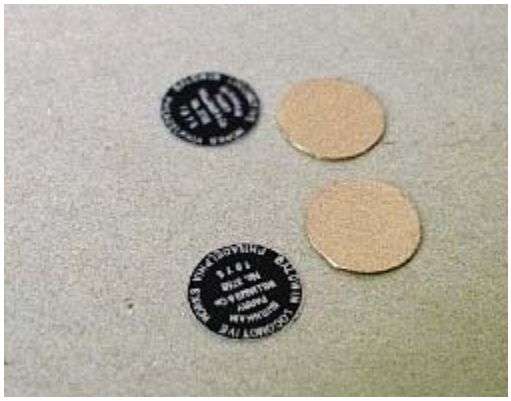
Pint out this page from the Internet, and photocopy/reduce the drawings to the desired plates size. The plate diameter you're looking for is as follows:

- 12mm diameter for the Baldwin Plates,
- 10mm wide for the Porter Plates.

Photocopy the drawing onto clear acetate sheet or overhead transparency film. You will have plates with clear lettering and black surround.

If you have no access to a photocopier to print the transparency, or even reduce the copy size to the correct size, then go to a commercial copy place, they can do anything, and the cost is little.

Cut out a circular (of what ever the plate shape is) plate of 0.5mm styrene sheet as the plate backing. Paint the styrene backing a gold/brass color.



Note the BLW plates, printed on Transparency. The gold painted backing plates have been prepared.

Cut out the plate transparency and using 5 min araldite, bond the film over the gold styrene plate. The gold then shows through the clear letters, while the black printing on the film hides the gold plate. Make sure you have an even film of glue over the gold plate, from edge to edge, keep the glue low profile. You don't want it oozing out the edges when you press the plate film down over the gold backing.

When the glue is dry, bend the plate slightly to the curvature of the smokebox. Using a small dob of araldite, in the rear center of the plate, press the plate onto the smokebox side. Avoid sliding the plate around or you will grease glue over the exposed painted surface of the smokebox.

The builders plates installed.

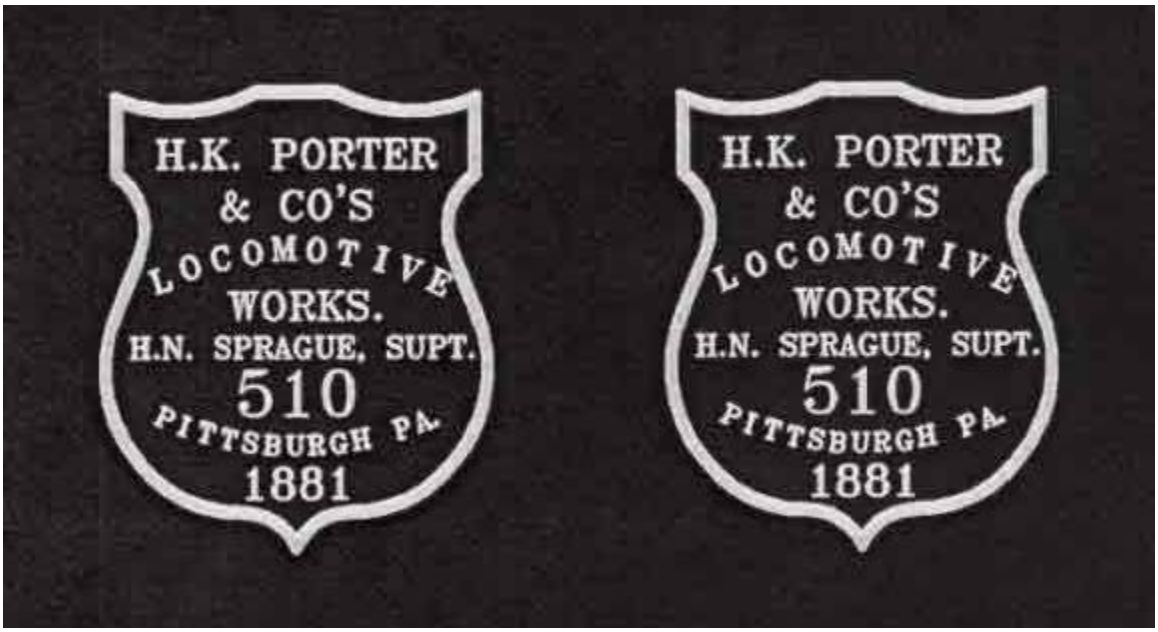
There are also commercial builder's plates makers who will etch plates to requirements. Check GR and other mags for details. They are not cheap, but are excellent, and even have raised lettering, something my home made plates do not have.

Here are the Builder's plates. Choose the plates you want, print this page and reduce onto transparency film and go to it. By reduce photocopying, you will find the text becomes crisper.

Baldwin 1875 - Actual Plate from NCNG #2 "Nevada"

Baldwin 1878 - Actual Plate from D&RG #15 "Raton"

And Finally, for those enjoying a Porter style 2-6-0 in 20.3 scale, here is a typical plate from H.K. Porter.



The Master of MasterClass 2001

There has to be someone who earns the undisputed crown and title of 'The Master' of MasterClass 2001. Few would dispute that title should go to Chris Walas.

Not only did he foolishly embark on two MasterClass locomotives at the same time, representing two very different versions, but in the face of adversity, Chris came though with outstanding style, and model making prowess. To say that Chris is a 'natural' in a locomotive modeling endeavor is an understatement. Above all it proves the value of the online MasterClass principle, and also proves that with but a push, some can discover abilities they never knew existed.

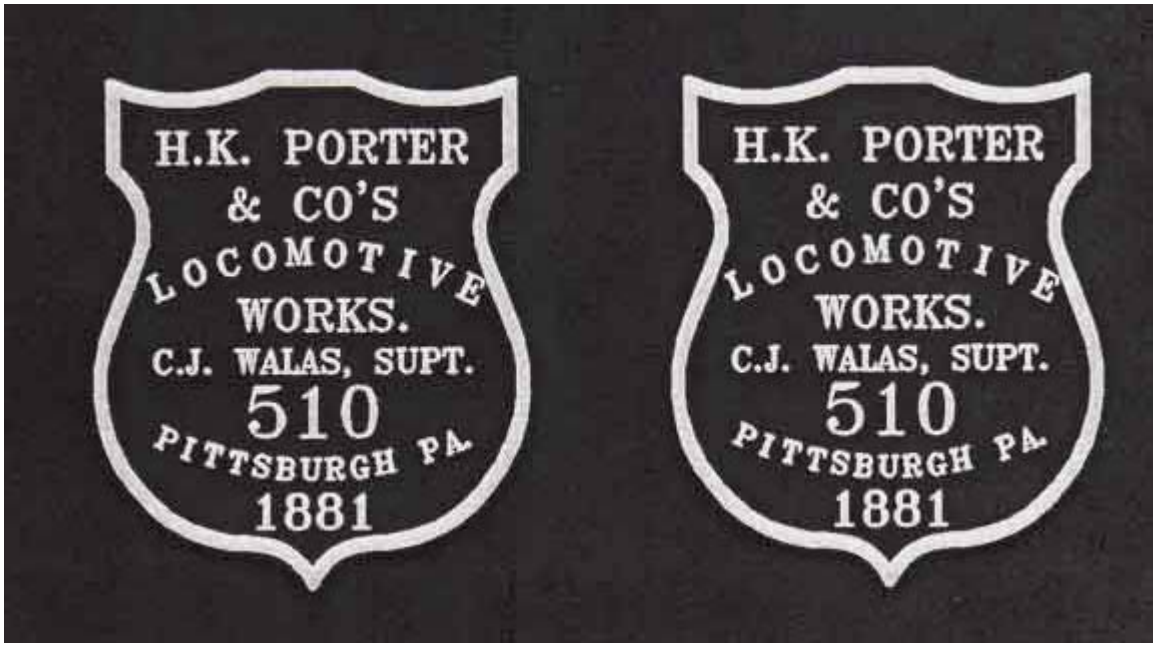
Here is just a token look at Chris's MasterClass 2-6-0s, as seen at the end of Chapter 5, masterpieces both.

The 1875 Baldwin 2-6-0 with Radley Hunter stack. Everything, including the headlight, domes and cab is scratch made.

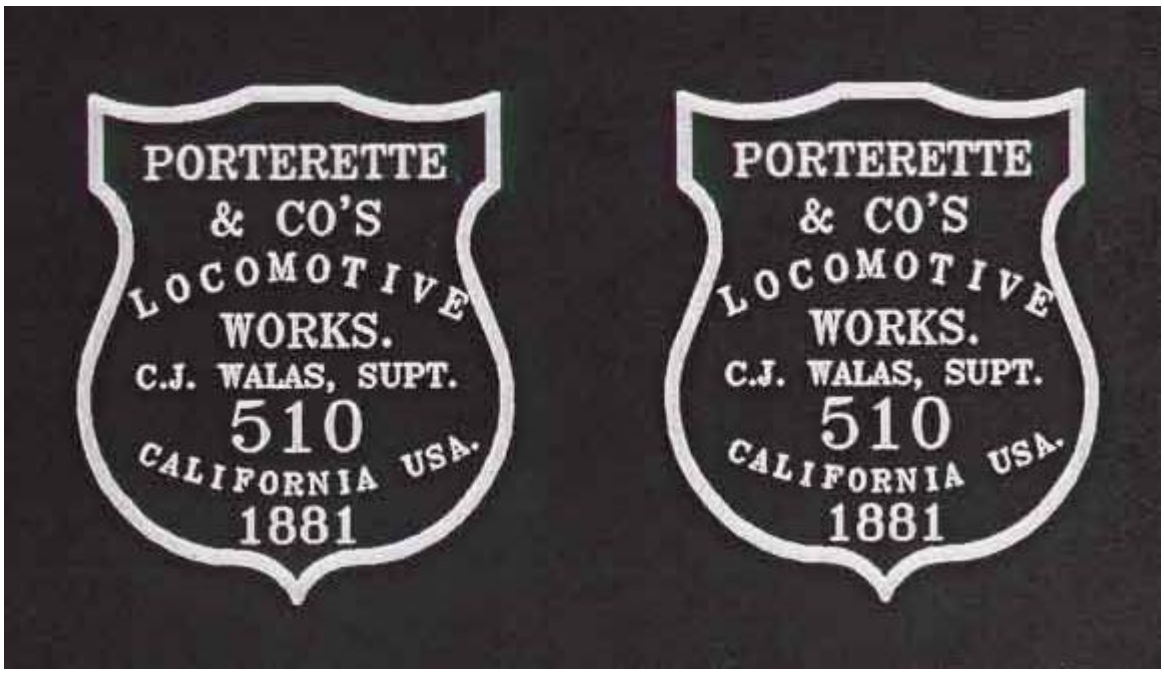
The 'Porterette', as this loco has affectionately become known, was based on the MasterClass instructions to a degree, but was greatly enhanced by detailing and ideas generated through the 'Background' sections. Loosely based on Porter 2-6-0 designs at 20.3 scale, including inclined cylinders and twin sand domes, this is probably the most outstanding model produced during the MasterClass. Excellent work Chris, really excellent.

As a token of our appreciation for Chris's efforts in this class, providing a constant source for inspiration to us all, we have provided a set of special MasterClass builder's plates for his Porterette locomotive. He has two different types to choose from, both based on H.K. Porter builder's plate designs of the 1870s-1880s. The first is the standard H.K. Porter plate, which lists Chris Walas as the Superintendent of the works in 1881! The second plate represents Chris's Fictitious Porterette company, again with Chris as Superintendent of the works. Enjoy Chris, and thank you...you earned it!

H.K. Porter -Chris Walas Superintendent....



Fictitious Porterette Company - Chris Walas Superintendent!!



The locomotive is Aliiiiiiiive!

Now head out into the yard, and set your loco free.

Enjoy the following photo series, as the Masters prototype loco stretched its wheels for the very first time on the Possum Pass & Frog Mouth Gulch RR. You will also note how she can double head with the 1870s NPC 2-6-0 built all those months ago...that was the loco that started this whole MasterClass concept!

The double headed consist heads across Crazy Horse Bridge, after departing the depot.

They head into the mountains

...and onto the high bridge....

The view looking out of the canyon as the train rumbles over.

The consist is then split…

Well I hope you enjoyed the Show...as with all good things, the end must come.
With that, MasterClass 2001 is finally complete.

We'll put a showcase of finished models on-line as soon as the models are ready, so keep a look out for the Masters 2001 Showcase.

A very special thank you to those who took part in the MasterClass construction, who's efforts made the whole thing worth while; Chris Walas, Jeff Livingston, Robert Durall and Norm (just starting out). And a really big thank you to Steve J from Florida who asked that this MasterClass be done in the first place. Thank you Steve, I hope you got a lot out of it.

Coming soon to MLS:
MasterClass 2002- The Mason Bogie in 20.3. Stay tuned for updates.

As always..good luck... Its been a thrill and a pleasure.

David Fletcher
December 2001