



MasterClass 2007

The Porter Bell & Co. Type C

0-6-0 & 2-6-0

The Li'l Empire Builders

By David Fletcher

The locomotive builder H.K. Porter Company of Pittsburgh, Pennsylvania, is renowned for construction of light and small locomotives dedicated to the industrial railroad market. Through the various incarnations of the Porter Company beginning in 1866, over 8,000 locomotives were built, ranging from light machines of only 6 tons, to larger 100-ton units. Industrial locomotive construction became their prime business. The beginnings of the firm, however, suggest a different ambition, and their early machines reflected the promise that small locomotives held during the dawn of the narrow gauge era in the United States.

In previous articles, I've noted that the design of a successful narrow gauge locomotive presents a different array of engineering challenges than their broader gauge counterparts - not necessarily more difficult, just different. Early texts note that some of the first narrow gauge locomotives in the U.S. were little more than scaled down versions of larger designs. Be that as it may, the narrow gauge locomotives that would prove to be successful were nearly always purpose-designed, with engineering solutions dedicated to providing optimum power and flexibility on the narrow rails. One of the most vocal promoters of the narrow gauge concept in the late 1860s was Scottish Engineer Robert Francis Fairlie, who argued that only with the design of suitable locomotives could a narrow gauge line succeed. His two theses on the subject outlined the very elements important to the design of a successful narrow gauge locomotive. These design elements ultimately evolved into his mildly successful double-boilered articulated Fairlie locomotive. Porter recognized many of the same issues and began building purpose-designed narrow gauge locomotives in 1867.

Henry Kirke Porter got his start in the locomotive business after receiving a \$20,000 gift from his father. He teamed up with British engineer John Smith and the two began the firm of Smith & Porter in 1866. Devastated by fire in 1871, the firm was rejuvenated with the entry of Arthur Bell and traded as the Porter Bell Company until 1878 when Bell died. Reorganized as H.K. Porter & Company, then later as The H.K. Porter Company in 1899, the firm would go on to build its 8,275th and final locomotive in 1950. (That's right 19-50!)

The philosophy behind the Porter locomotive was simplicity, with an almost modular method of locomotive design. Porter recognized that the attributes that would make the narrow gauge locomotive a success would not be found in board gauge design. Here are Porter's own words from 1873:

“The Eight Wheeler or ‘American’ (4-4-0) pattern of locomotive is deservedly a favorite for its general use on broad-gauge roads throughout the United States, and hence has been very largely adopted by narrow gauge roads.

“We believe, however, that a narrow gauge engine should be something more than a miniature copy of a wide-gauge engine, and that the construction necessary on a large engine should be simplified on a small engine where it can be done advantageously.

“We regard the ‘Eight Wheel’ (4-4-0) pattern, especially the smaller sizes, for narrow-gauge passenger service as objectionable in the following particulars:

- The weight is not distributed to secure the maximum power, the proportions of dead to useful weight being excessive.
- The truck wheels are necessarily of smaller diameter than is advisable for high speeds; or to secure larger truck wheels the boiler is set higher and the centre of weight raised more than desirable for fast running.
- The engine does not conform to sharp curves and uneven track, so as to secure the easiest motion attainable.

“In perfecting our designs we have to as great an extent as possible overcome the objectionable features of the ‘Eight wheel’ narrow gauge design.”

In perfecting the Porter locomotive, the following features would become almost a standard in Porter designs:

- The locomotives were small, but had a high power to weight ratio.
- Most of the designs were of 0-4-0 or 0-6-0 wheel arrangement, even mainline road locos, allowing most of the locomotive's weight to contribute to the tractive effort.
- Many were designs that carried the water tank over the boiler, and the fuel on the rear of the loco, again maintaining 100% of the locomotive's weight over the driving wheels.
- The boiler proportions and drive wheel sizes were matched to enable low centre of gravity for stability, while allowing for good speed. Sometimes this would result in quite long, narrow boilers that cantilevered beyond the wheel base, particularly at the rear.
- Short wheel bases and equalized suspension enabled the locos to negotiate sharp curves, rough

trackage and light rail section.

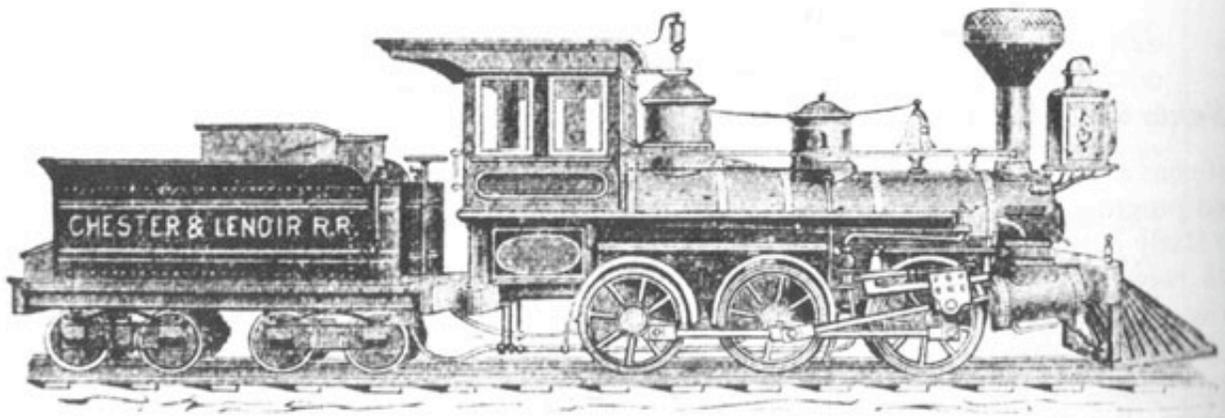
- The Porter bar frame design and catalogue of standard parts allowed for locomotives of inclined cylinder as well as horizontal cylinder design. The inclined cylinders allowed for greater bar frame strength at the front end, perfect for shifting work or a loco that was to haul loads in both directions. This design also brought the cylinder level away from the ground and away from harm where cylinder heads could be cracked against line side rocks.
- The level cylinder design aided in keeping the centre of gravity low where roughly laid rail was used, making for a more stable locomotive.

Above all, the Porter locomotives were compact, powerful, flexible, and were built from a catalogue of standard components for simplicity of repair. They were ideal for the fledgling and remote narrow gauge line. Porter marketed his type C locos as ideally suited to the extremes of physical plant that narrow gauge railroads presented.

When the narrow gauge boom hit the U.S. in 1871, Porter was already well into building narrow gauge locomotives. Consequently, some of the first locomotive orders taken out by the new lines were to be filled by Porter. These little locomotives were to haul the construction trains over the worst track, and would go on to haul the first revenue trains on many a narrow gauge line that would sometimes grow to fame and fortune. Long forgotten in the shadows of the Colorado & Southern Moguls, or the heavy 4-6-0s of the Southern Pacific, the diminutive Porter type B and type C locomotives were the power that built the early narrow gauge and supported their first years.

While Porter's philosophy in locomotive design was the central reason these tiny machines were so successful, Porter began business simply to build locomotives. That his firm would later be a primary builder of industrial machines was irrelevant at this time. There was a need for power on the narrow gauge and he provided it.

The Porter classification system was somewhat similar to that used by Baldwin. The "A" designation described locomotives with only one driven axle – the "singles." The "B" designation described locomotives of 4 coupled wheels such as 0-4-0s, and the "C" designation was assigned the 0-6-0 types. Sub-classes of these designations described additional non-powered wheels or where the water was carried: A Porter C-T was an 0-6-0 loco with tender. The C-S was an 0-6-0 saddle tank loco. The 2-C-T was a 2-6-0 loco with tender, and so on.



Light freight engine for 25 or 30 lb. rail.

Cylinders, $9\frac{1}{2}$ inches diameter 14 inch stroke.

Wheelbase, 7ft. 3 inches

Diameter of drivers, 30 or 33 "

Weight in working order, 20,000 lbs.

Water capacity of tender tank, 500 gals.

A Porter Advertisement, circa 1874

Probably the most famous Porter type C 0-6-0 locomotives would be the Porter Bell locomotives that built the Colorado Central and the 0-6-0s that built the early Californian narrow gauge Santa Cruz & Felton RR. The Colorado Central, of Georgetown Loop fame, would later be owned by the Union Pacific and become part of the giant Colorado & Southern network. The Porters that built the line to Santa Cruz were the first power of the South Pacific Coast RR, which would ultimately become a part of the large Southern Pacific Narrow Gauge RR.

Other type C 0-6-0s worked on Dr. Baker's Walla Walla & Columbia River RR, the Peach Bottom RR, a Type B on the Boston Revere Beach & Lynn RR (of Mason Bogie fame), as well as variants in the Black Hills of South Dakota. One of the earliest narrow gauge locomotives exported to Asia was the H.K. Porter 2-C-T 2-6-0 sent to Japan in 1880 (and still survives today). Some of this larger class of 2-6-0 even worked on the D&RG RY in the 1880s.



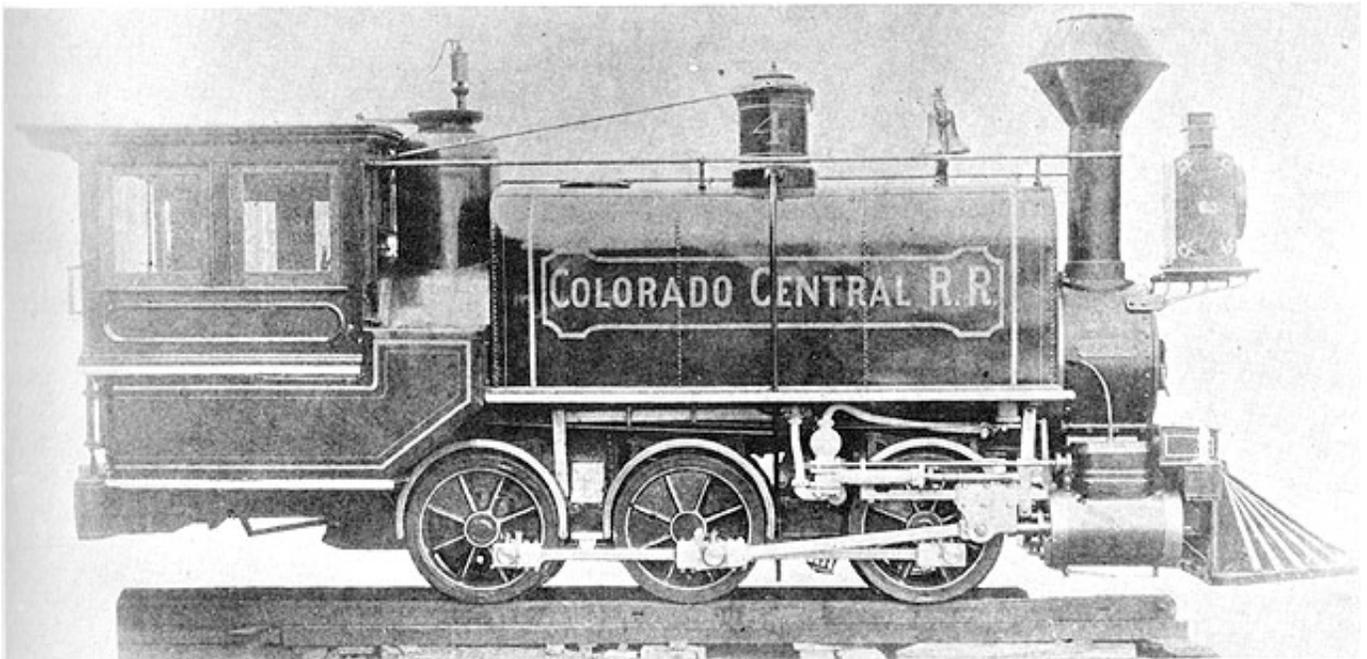
The 2-B-T from the Boston Revere Beach & Lynn RR

For me, the 1874 Porter Bell 0-6-0 built for the Martha's Vineyard RR of Massachusetts has always been a favorite along with the many and varied Porter Bell type Cs built for the Colorado Central between 1873 and 1877.

The Colorado Central Type C

Construction of the Colorado Central Railroad began in 1872, running out from Golden, Colorado. Initial construction work was carried out by three 2nd hand 0-4-0 locomotives.

The first type C 0-6-0 locomotive delivered by Porter Bell to the Colorado Central RR in 1873 was also the very 2nd type C, 6-wheeled locomotive to be built by Porter. The first 0-6-0 had been built in 1872 for the American Coal Company. Colorado Central #4, built March 1883, Porter's 149th registered locomotive, was delivered as a 16-ton square saddle tank locomotive with 33" drivers. She was the first new locomotive to be built for the line. As a standard Porter design of the day, she was fitted with a crosshead water pump on the engineer's side and an early lifting injector on the fireman's side, representing the best technology of the day. Costing \$8,500, she was reported by her crew to be able to pull more than twice as much as the older 0-4-0 locomotives on the grade up to Black Hawk.

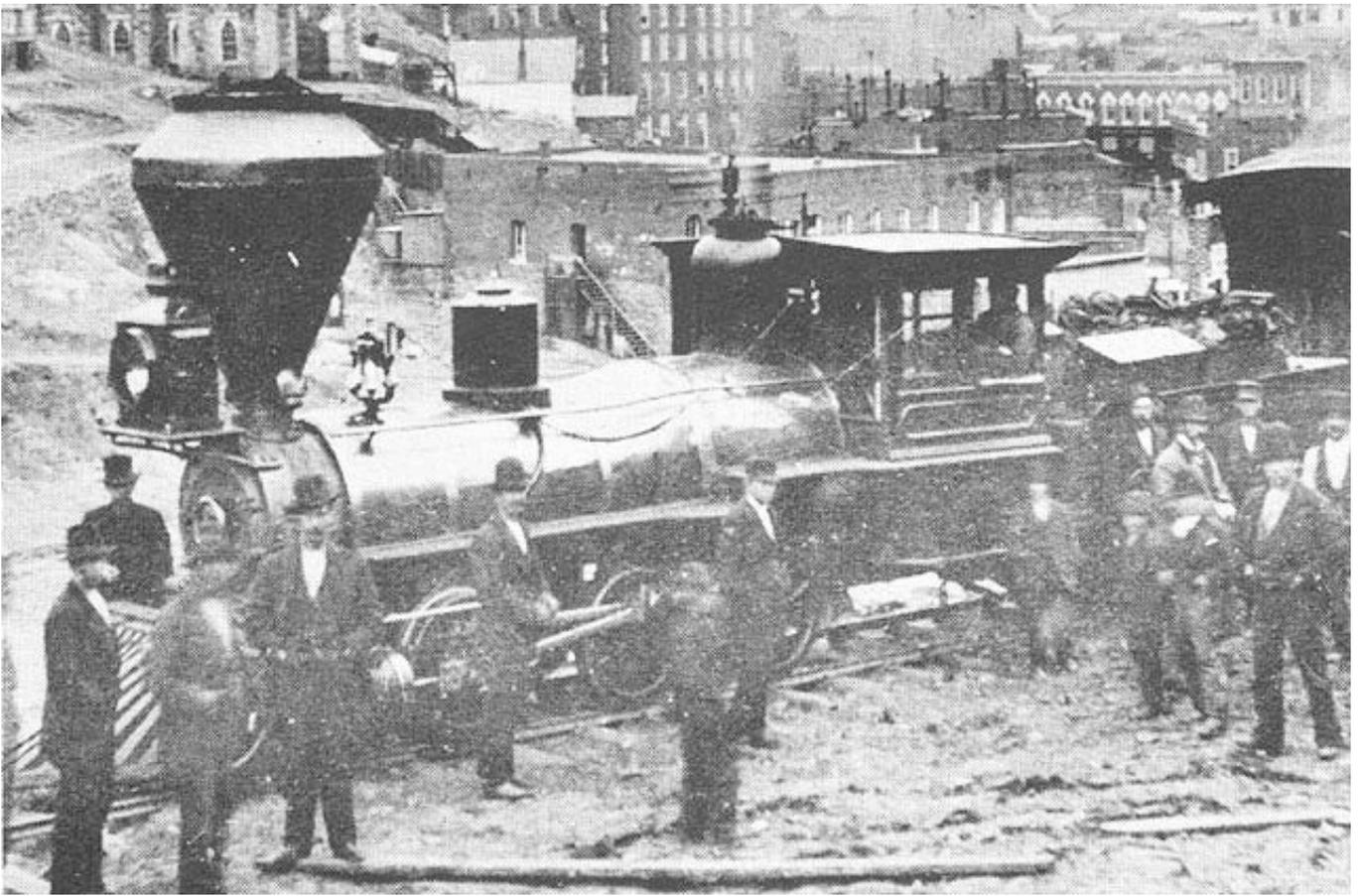


The First Type C delivered to the Colorado Central

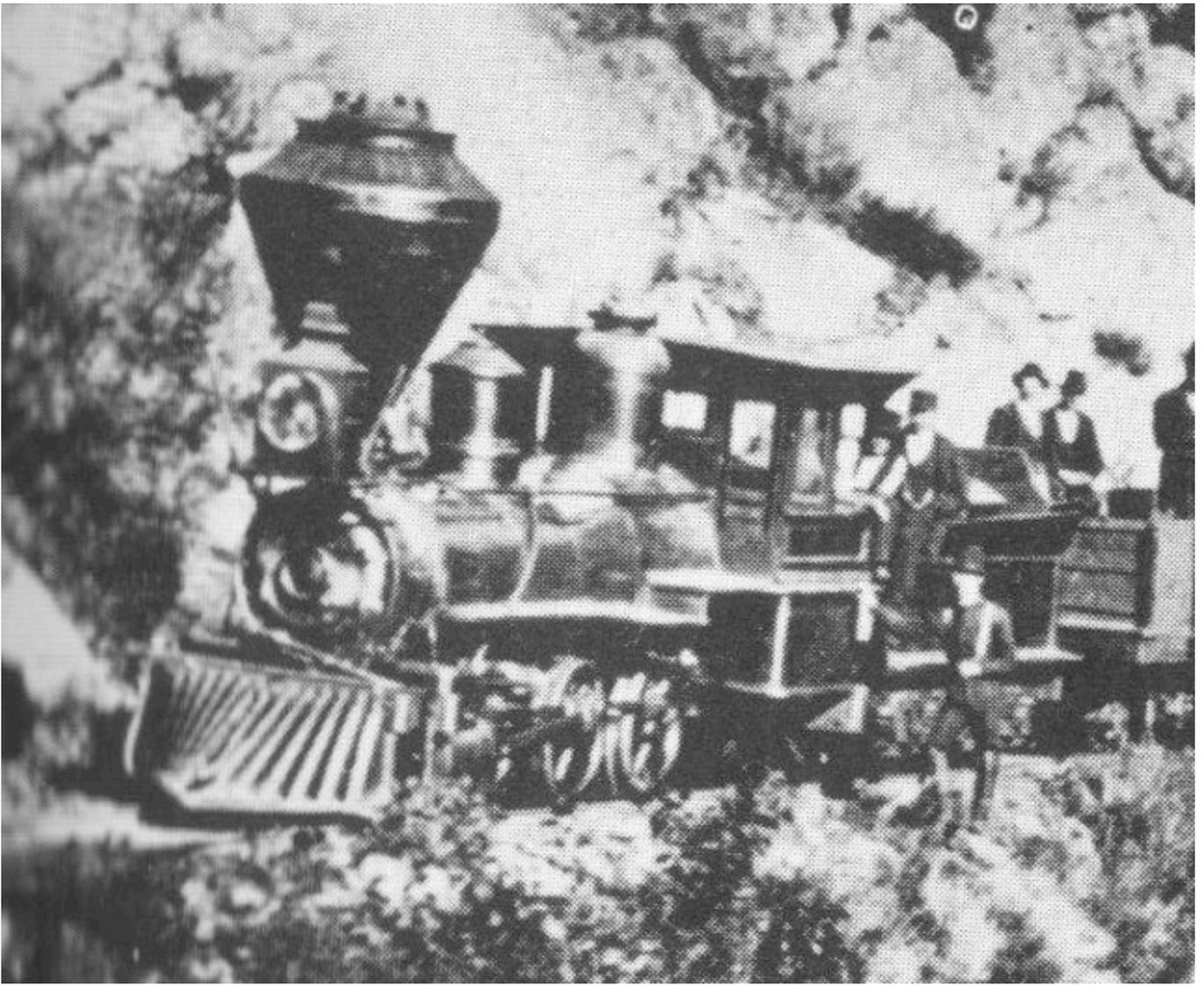
Whether due to weight concerns, or to increase the locomotive's range, she was quickly rebuilt into an 0-6-0 tender loco, sporting a short 4-wheeled tender possibly built by Porter, or built at the road's own repair shops, in November 1873.

Under Union Pacific ownership in 1884, she was again rebuilt, sporting the 1882 Westinghouse Automatic Air brake system and a neat 6-wheeled tender. As Historian Jim Wilke notes:

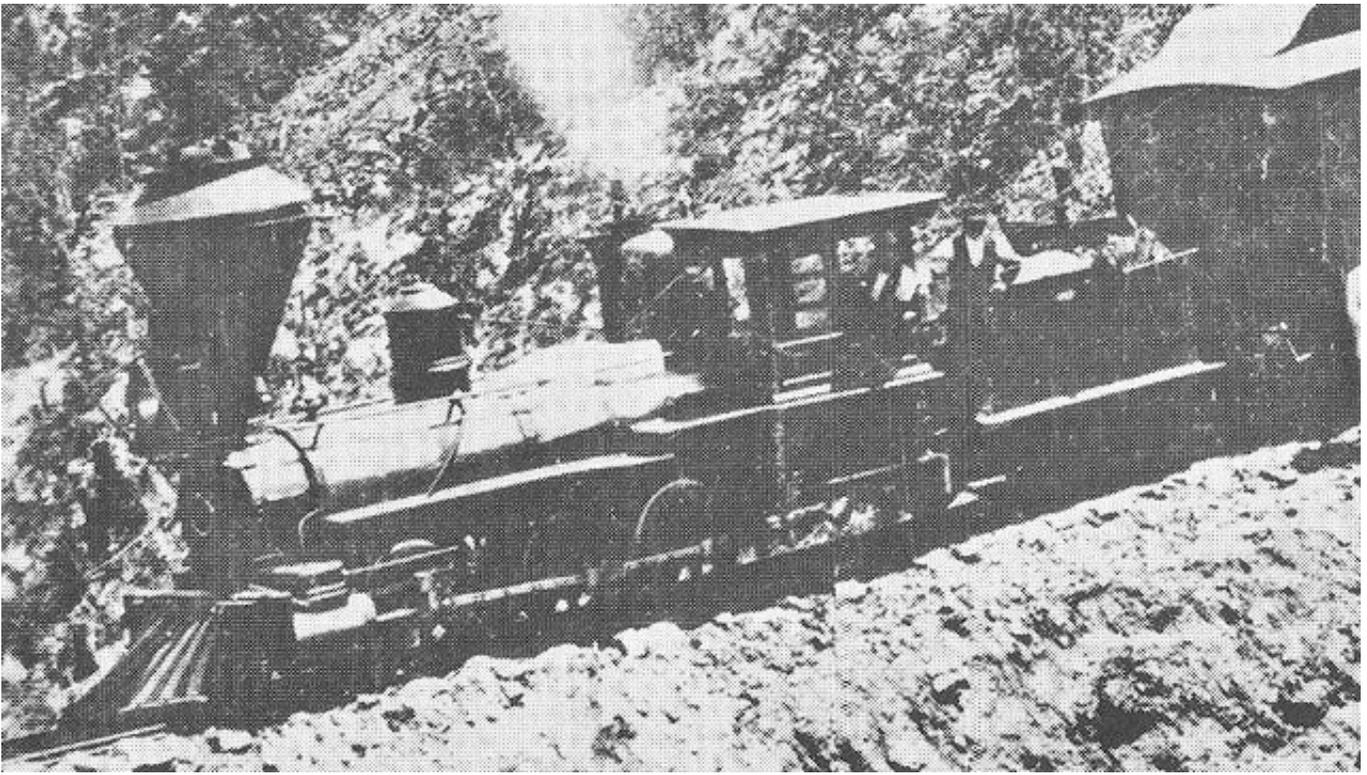
“Two things intrigue me about these engines -- first, I wonder if they bought the tenders from Porter, since early photos show Porter style striping, and second, I wonder if the Rogers style sandbox came from a standard gauge UP engine, since they ran many Rogers engines and might have had a spare sandbox somewhere. Basically, I wonder if the sandbox is a clue to the CC's operating/rebuilding practices.”



CC RR #4 in rebuilt form, with 4-wheeled tender

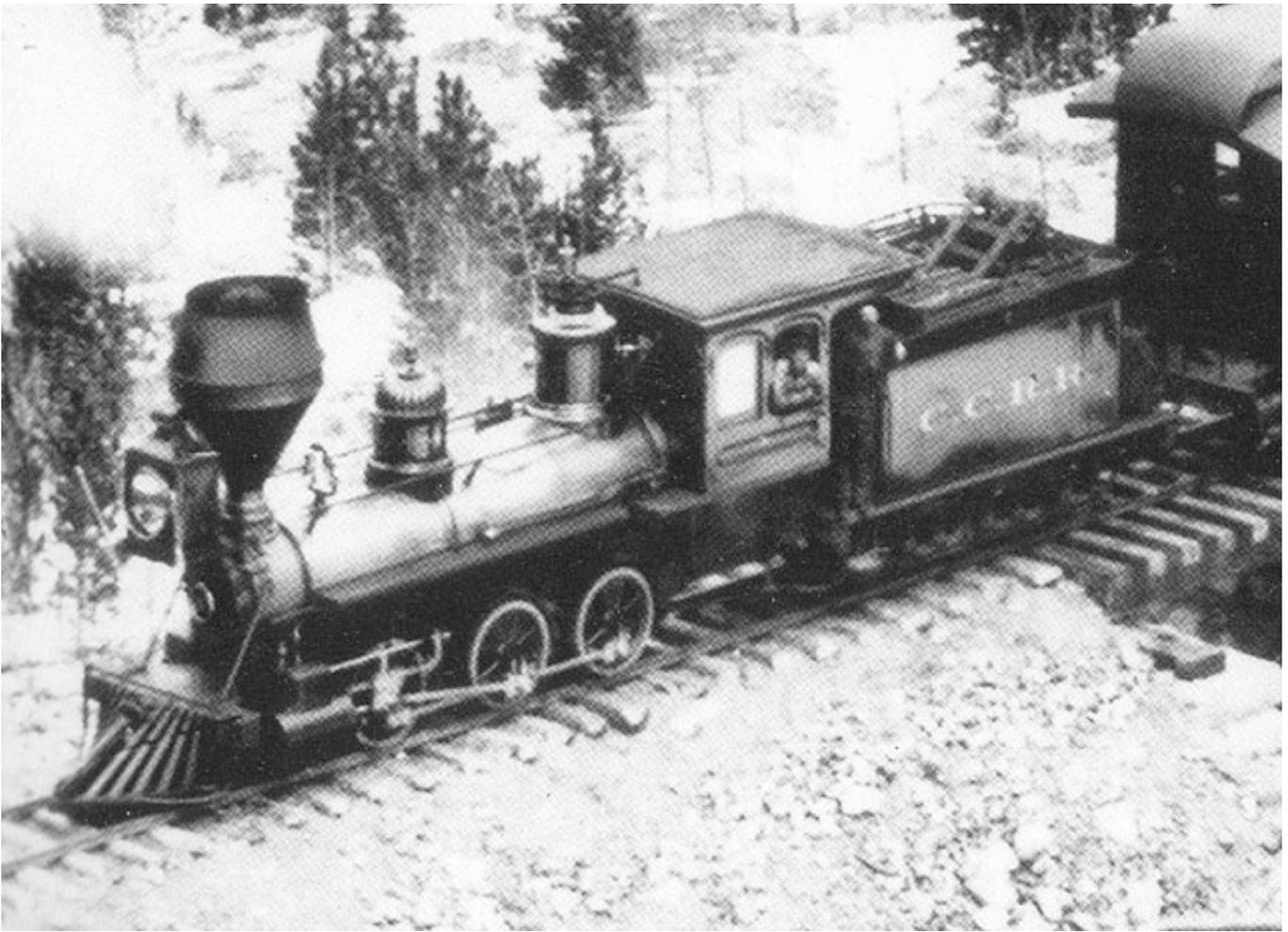


Porter #5 with 4-wheeled tender



Good side view of #5

The color schemes of the first two Porters (#4 & #5) “as-built” are unknown, but were probably a wine color base with vermilion wheels, and with gilded linework: very much a contemporary scheme of the day. When #4 was rebuilt again by the UP sometime in 1884, the locomotive may have been repainted a muted dark green, representative of the design of that day, and consistent with the new heavy Brooks Moguls delivered to the line from 1880 onward. The #4 featured prominently in the photograph by Henry Jackson with the recently built Georgetown Loop Bridge in the background. At that time the #4 sported a very non-Porter style sand dome, probably scavenged by the UP from a Rogers locomotive. The photo clearly shows the gilding on the sand dome and headlight, and the linework on the tender, with CC RR gilded drop shadow letters on the tender: a very neat and up-to-date scheme.



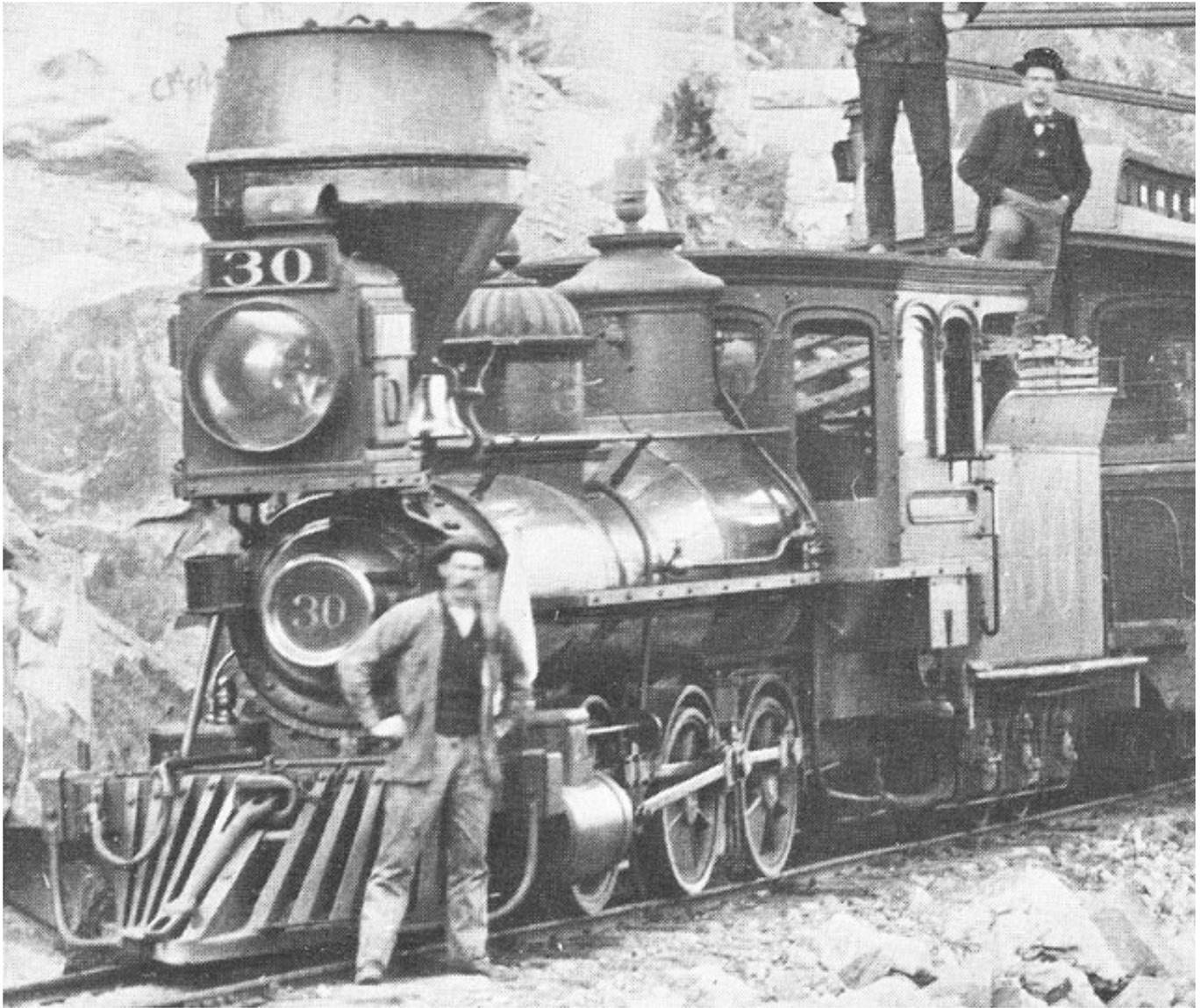
CC RR #4 rebuilt sometime in 1884, photographed by Jackson at the Georgetown Loop Bridge. The locomotive shown with some color and ornamentation prior to the Union Pacific painting the locomotive black.

By 1885 however the Union Pacific had published new paint standards for all locomotives under their control:

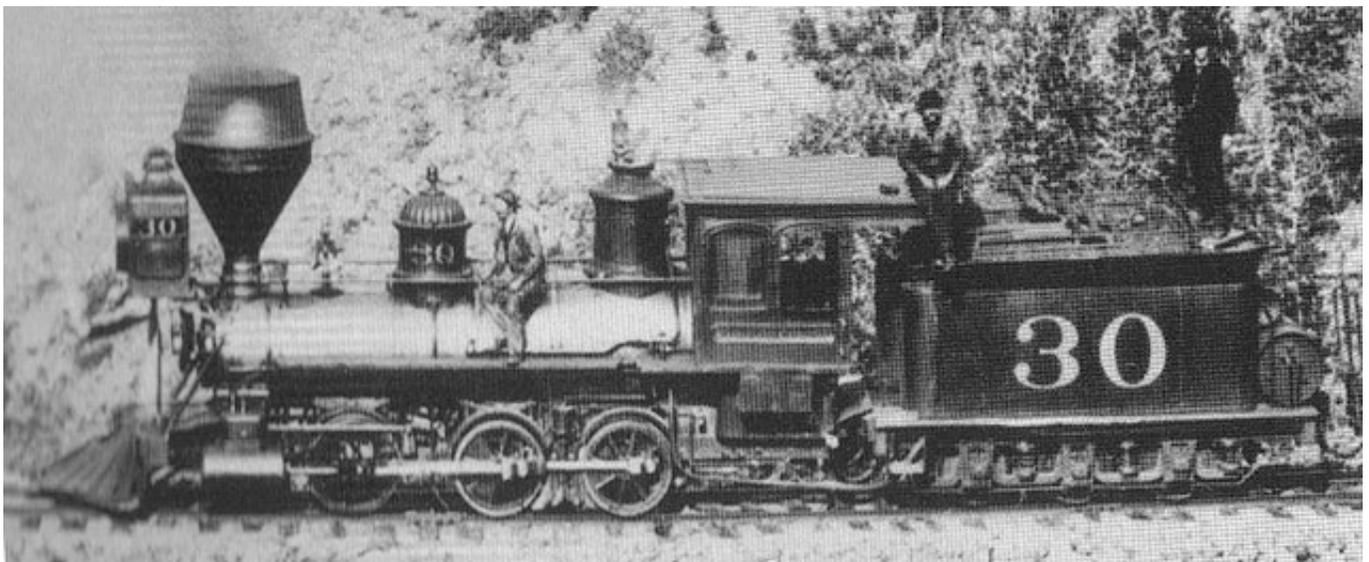
- Drop black (black with blue mixed into to look like deep black)
- Painted cab sashes imitating wood
- Cabs painted green inside
- Russia or American iron boiler jackets, brass or planished iron bands
- Black or graphite smokebox, stack and firebox
- Mineral brown running boards and cab roof
- Imitation gold or dark yellow lettering, no striping

The #4 was renumbered #30 in 1885, with the then usual imitation gold lettering. Oversize digits were applied to the tender body. The numbers were visibly large as the same font and size was used by the UP on all their equipment, narrow gauge as well as standard. On a locomotive as tiny as the Porter Bell type C, the

numbers on the tender were as large as the tender!

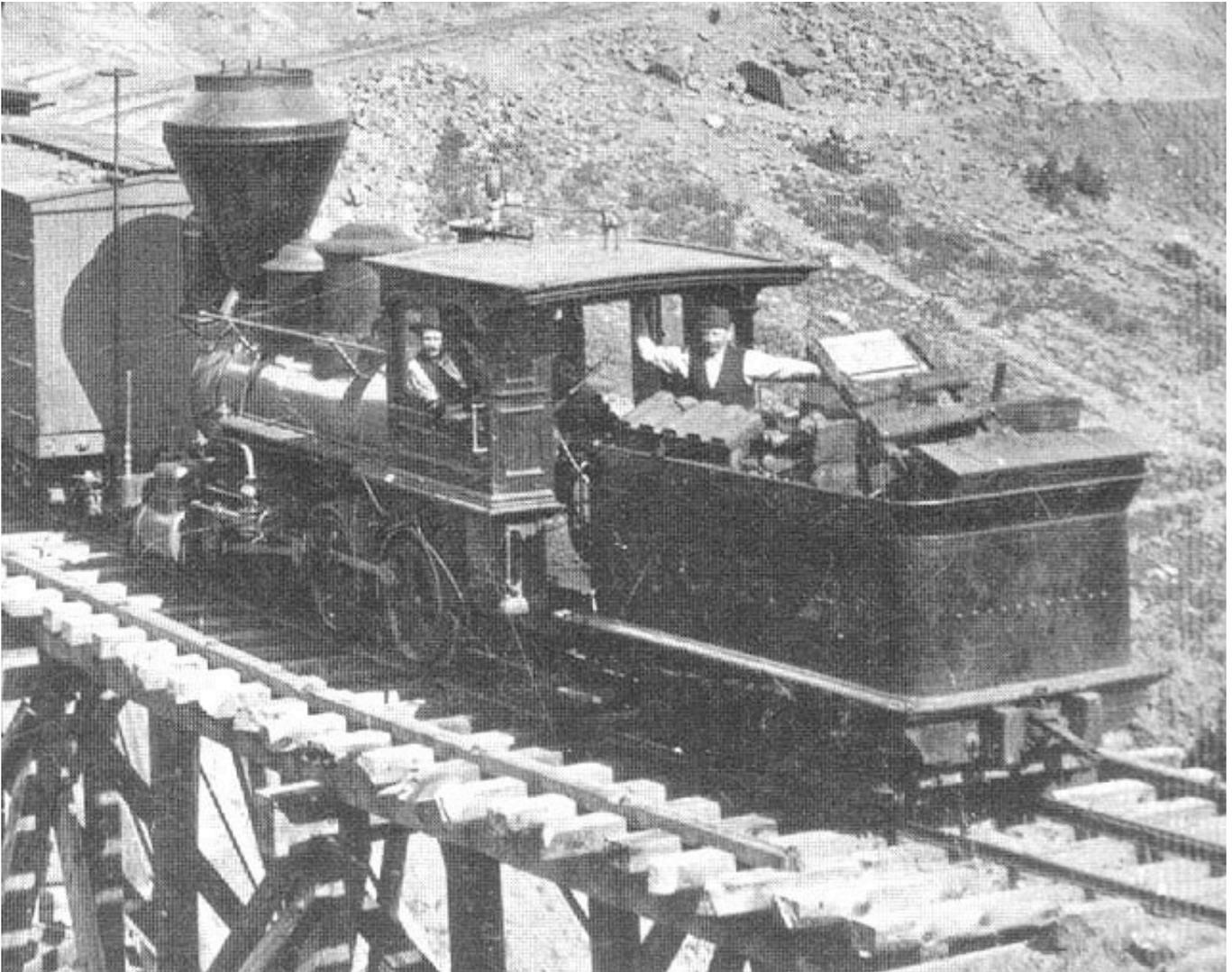


A Shot of #30 (formerly #4) directly below the pylons of the Georgetown Loop Bridge

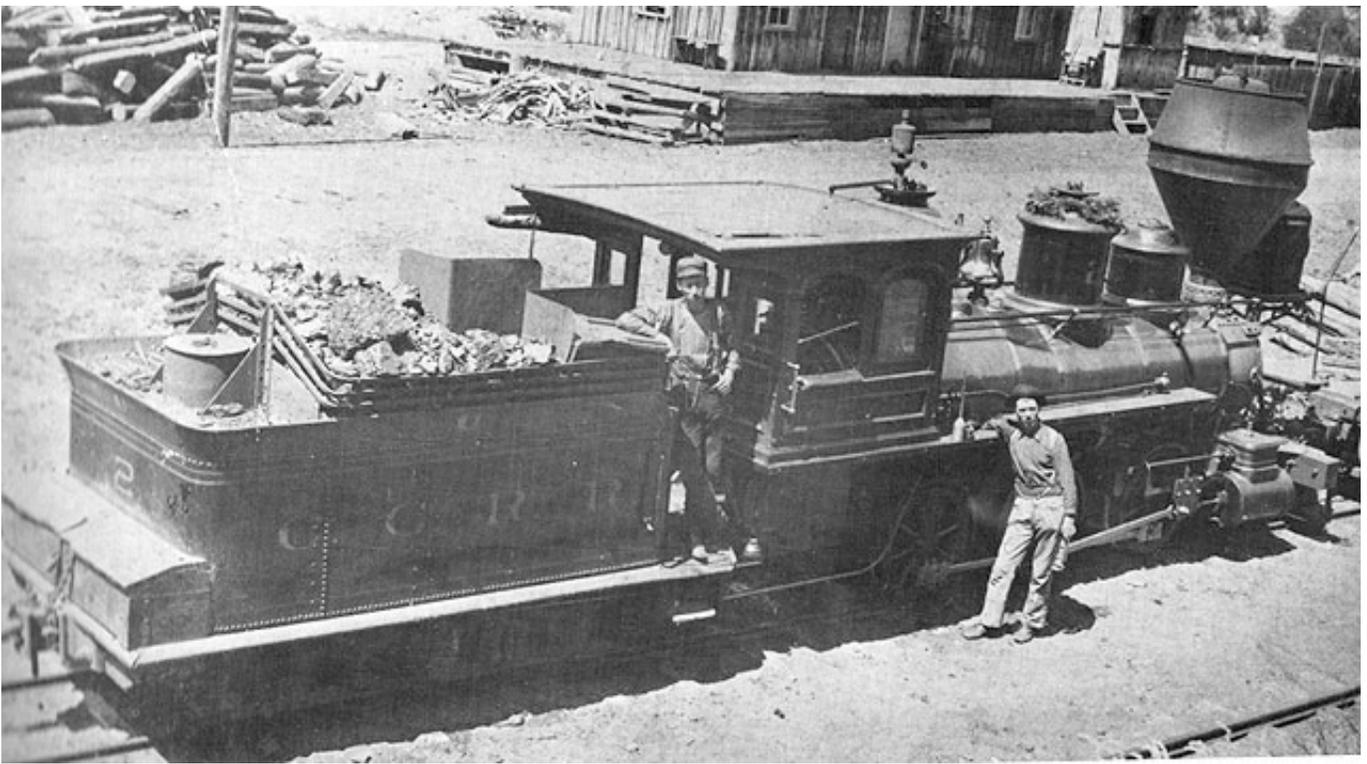


The best photo of the CC RR locos yet is this digitally enhanced photo of #30 in the recent Mal Hope Ferrell book, Narrow Gauge Country, 1870-1970. I highly recommend the pictures in this book!

Colorado Central #5 was built in April of 1873 to the identical design of #4, and was also converted into a tender loco in late 1873. So pleased was the CC with the performance of these locomotives on the steep grades and light rails that two more 16-ton type Cs were ordered from Porter Bell & Co. in 1875. These locomotives, to become CC's 2nd #2 and 2nd #3, came from the factory as tender locomotives. CC #2 was rebuilt into a 2-6-0 configuration by the CC in 1877. The final order of locomotives from Porter Bell came in 1877 with the delivery of two more type C tender locos to become CC's #6 and #7. The #7 was delivered to the road as a 2-6-0, 17-ton machine.



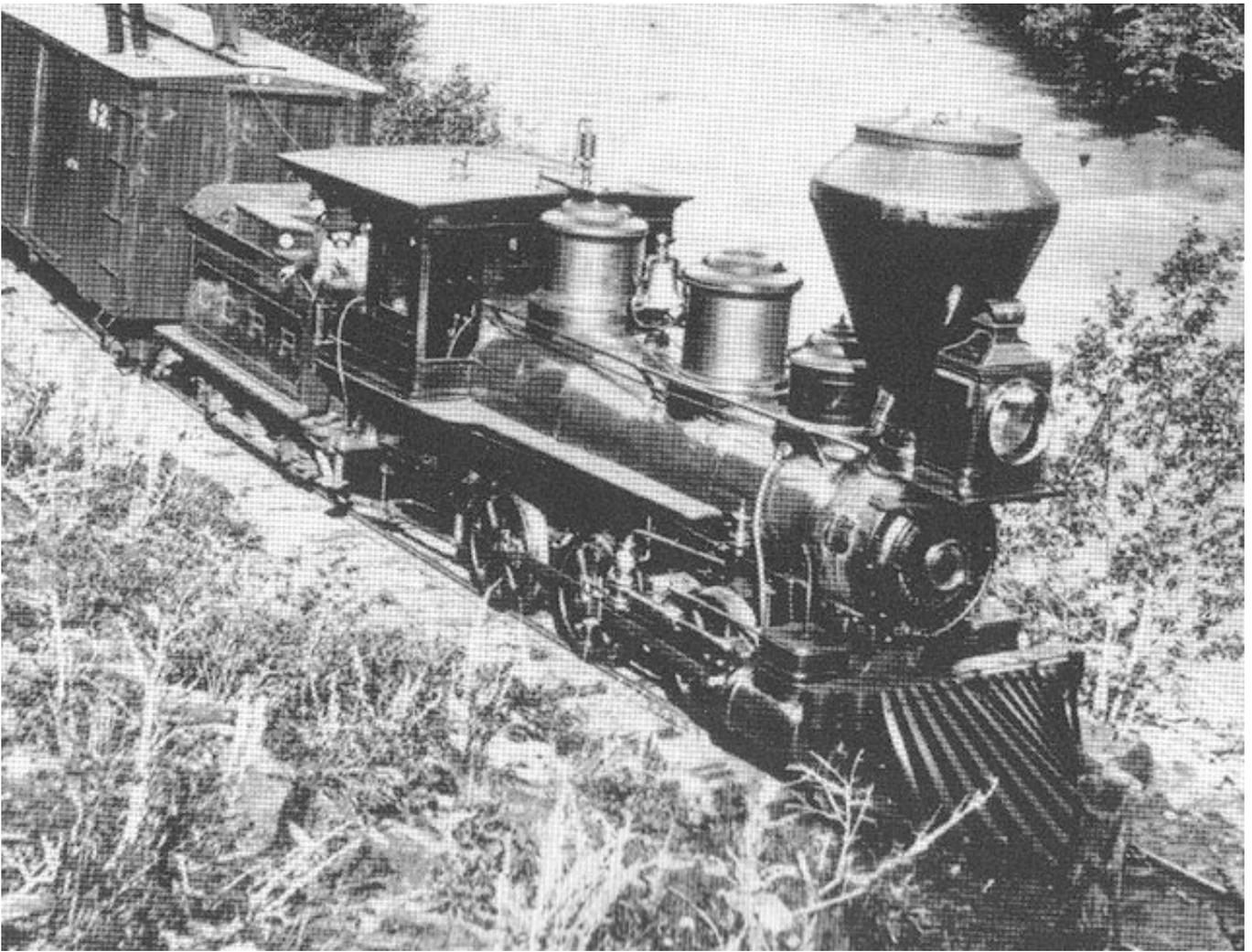
CC RR #2 in "as built" configuration



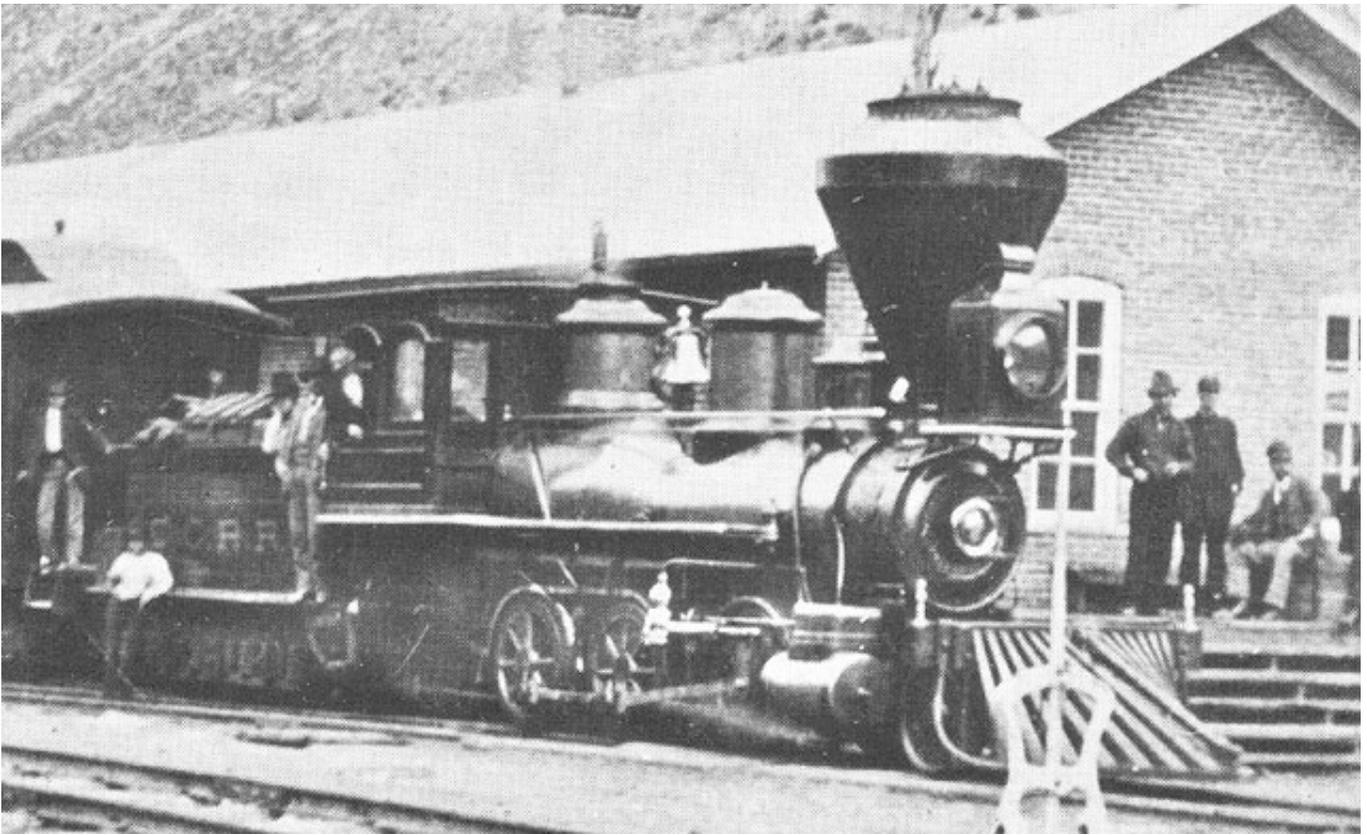
Colorado Central #2 circa 1880, with Congdon stack



CC RR #3 already in rebuilt form as a 2-6-0. The short coach on this train will be available as a kit from Bronson Tate Architectural models, developed by MLS members!



CC RR #6 in "as built" condition



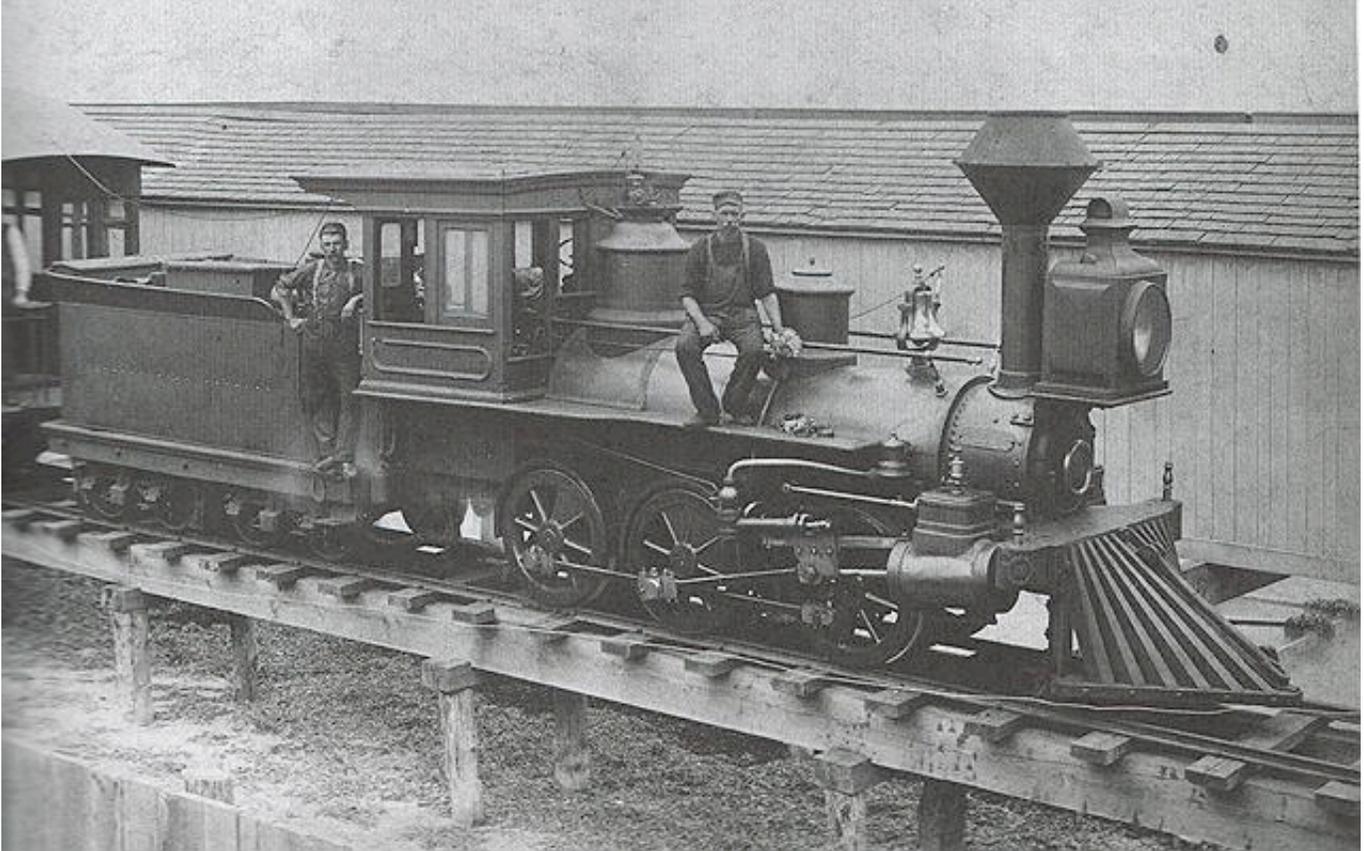
The gorgeous CC RR #7 built new as a 2-6-0. This is probably the look of the locomotive as delivered from the Porter factory.

All of the Colorado Central Porter Bell Locomotives were superseded by the delivery of the first heavy moguls from the Brooks works in 1880. By comparison, over one third heavier, the Brooks locomotives were massive. The Porter Bell type Cs of the Colorado Central were all removed from the roster and scrapped between 1887 and 1889.



Martha's li'l loco

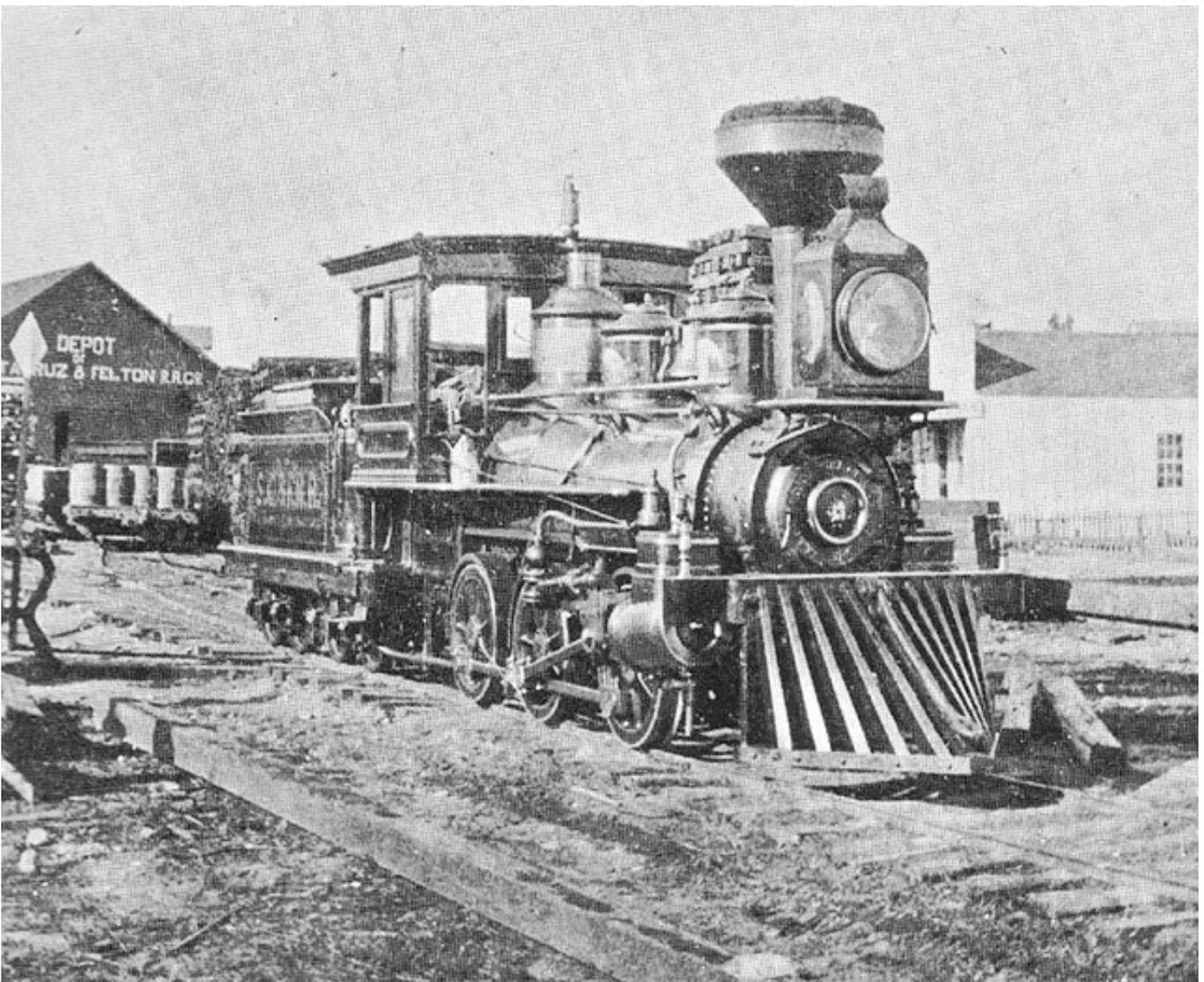
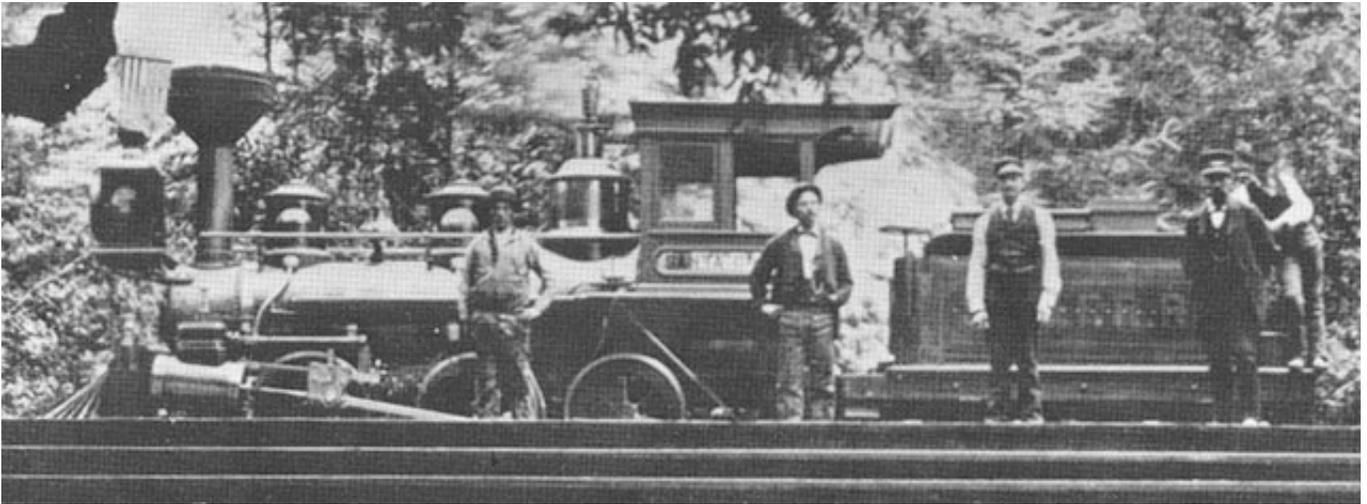
The type C-T built for the Martha's Vineyard RR was a tiny unit of only 11 tons, built in 1874 as Porter Bell's 201st locomotive. She had 33" drivers slung under a tiny, low level boiler. Originally named *Active*, the line later renamed her *Edgarton*. Primarily used for passenger traffic, she was to replace a less than satisfactory steam rail car that was found to be unsuitable to the road's tight curves. The line was only of 8.5 miles long, running between the steam boat landing at Oak Buffs and the resort town of Katama. While the locomotive's light stature was perfectly suited to the line's curves and silty road bed, the passenger line was never successful, and was sold to the Old Colony Steam Boat Co. in 1892, and finally abandoned in 1896.



The Type C Locomotives of Santa Cruz

The Santa Cruz & Felton RR was an early California short line connecting two towns south of San Francisco. The line was noted to have some of the most extreme railroad conditions, featuring 25 pound rail and 118' radius curves as the line worked its way up the canyon to Felton. Someone described the line as little more than some fence posts laid in the mud with bail wire for rail! Despite that, the Porter Bell catalogue noted that their 10-ton type C 0-6-0 could be run on as little as 16 pound rail and 80' radius curves! On the SC&F RR, the little Porter type C was right at home. The first of two Porters delivered to the line was the 10-ton *Santa Cruz*, built in May 1875. Her design was almost identical to the Martha's Vineyard locomotive, except she sported a 2nd sand dome for operation in both directions and had 31" drive wheels. She was probably one of the most decorative and ornamented locomotives in the state, painted a deep wine color, with vermilion red wheels and gilded linework as standard. However, she also sported a number of landscape murals painted on the dome sides and headlight. The color scheme and decoration was consistent with the highly publicized Porter Bell locomotive entry at the great Centennial Exposition of 1876

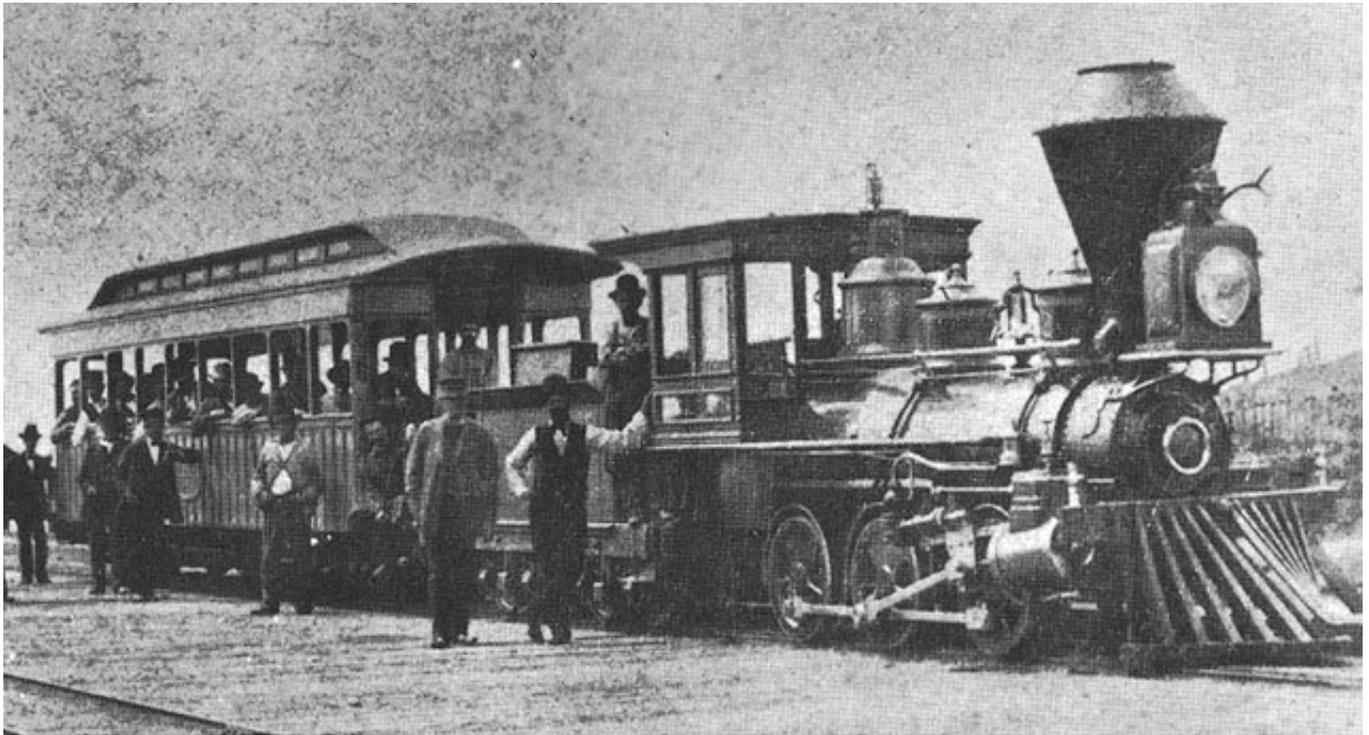
where the wine color scheme with red wheels was featured.



Side view of Santa Cruz in "as built" condition

A 2nd locomotive was built by Porter Bell in July 1876, named *Felton*. The two locomotives operated on the

short line until it was taken over by the South Pacific Coast RR in the late 1870s. Under SPC management, the two locomotives were pressed into construction service for the line until replaced by the road's standard Baldwin 8-18-C 4-4-0s of twice the weight. Of interest also is that the Porter Bell's 10-ton type C wheel base was no larger than the drive wheel spacing of the new 4-4-0s.



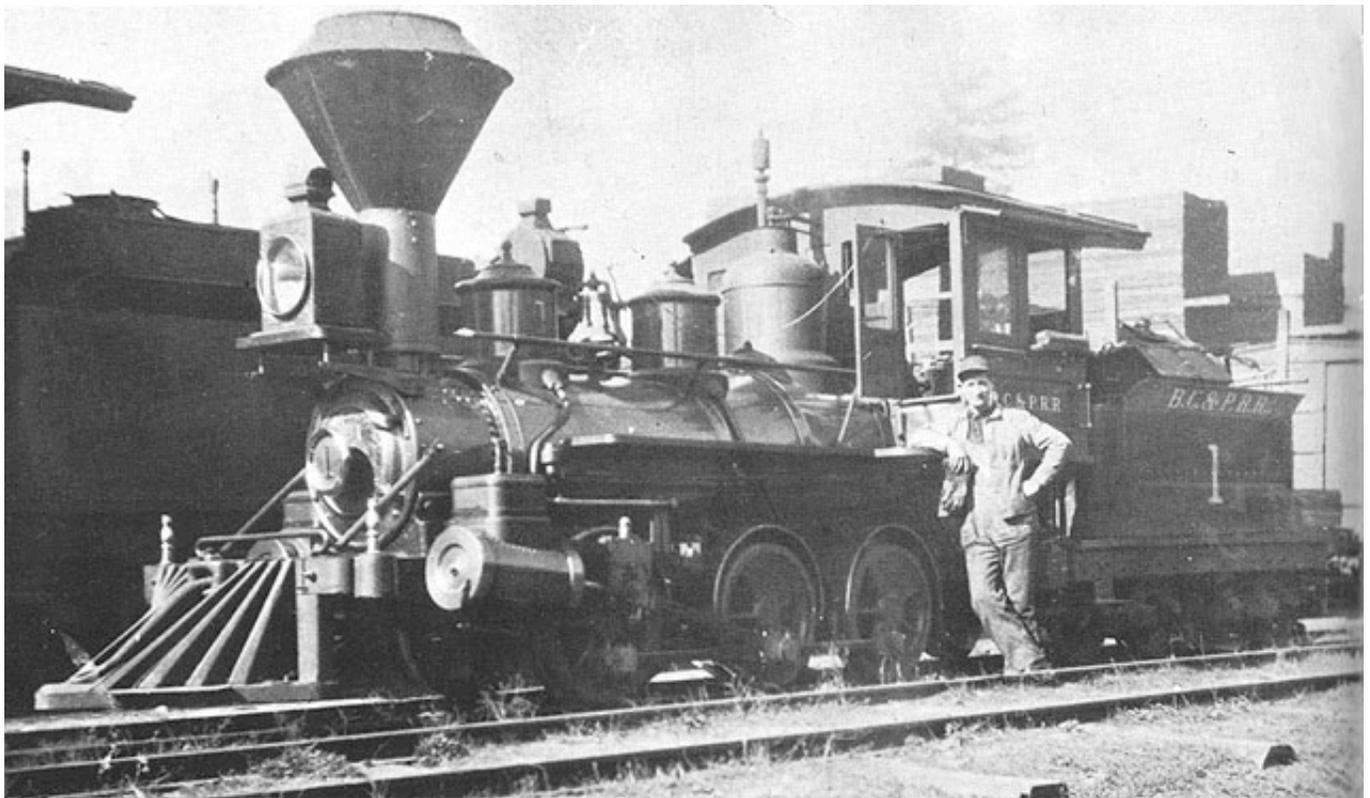
The Li'l Felton

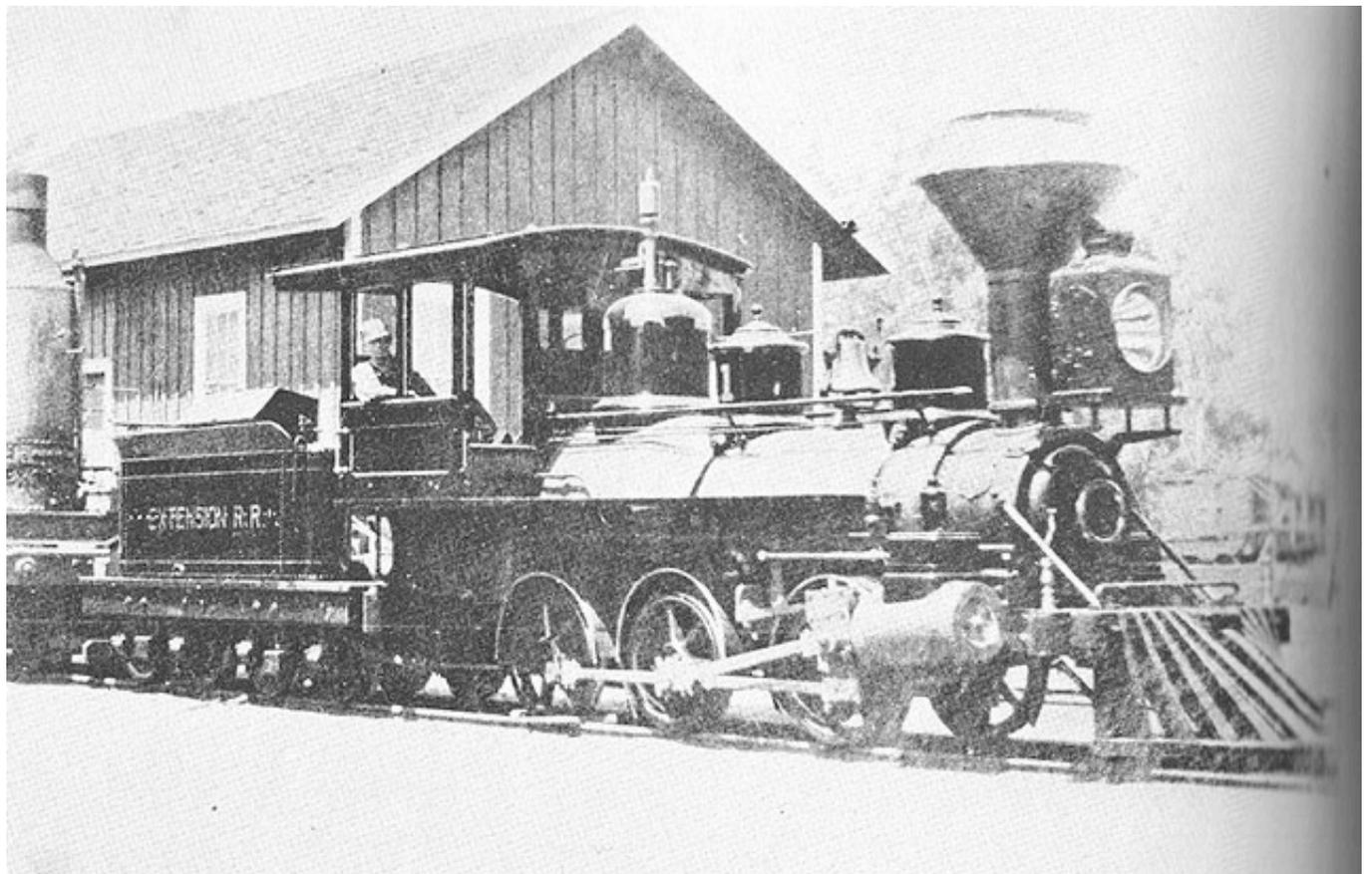
The two baby locomotives went on to long and successful careers. *Santa Cruz* was sold in 1881 to the Nevada & Oregon RR as their #1, then to the Lake Valley RR in 1885 as their #4, to the Sierra Wood & Lumber Co in 1890, and then in June 1899 to the Nevada County Narrow Gauge RR, where the tiny type C would serve through to 1916. Her boiler was then sold to a saw mill in Colfax. The little locomotive, often overshadowed by the larger machines, served in construction and maintenance service on lines that would go on to fame.

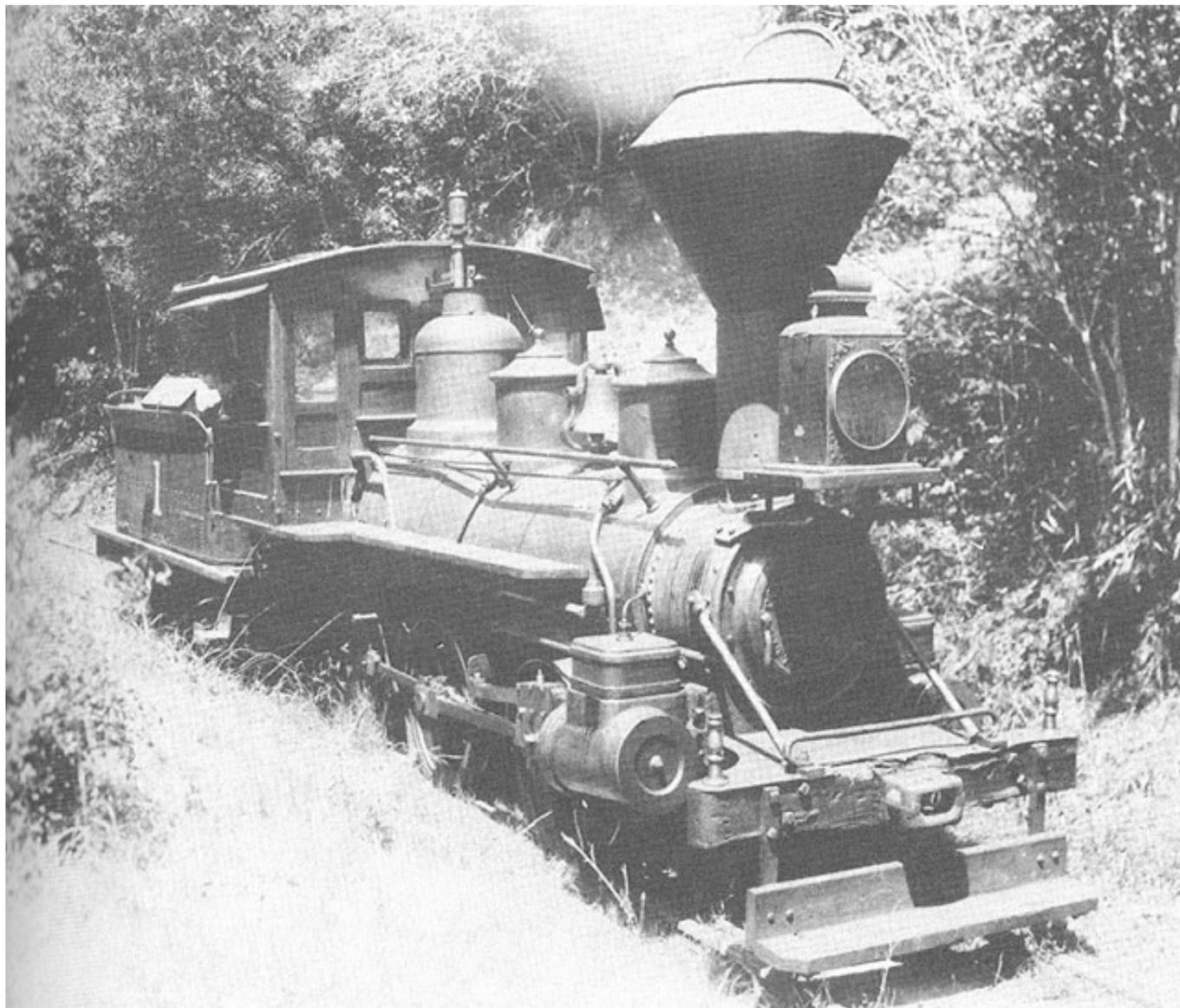
As for the 10-ton *Felton*, she was sold by the SPC in 1884 to the Santa Clara Mill as their #1, renamed *Dinky*. She was sold to the Dougherty Lumber Co. in 1888, and then in 1904 became #1 on the Californian Timber Co. line, operating until 1914. She saw over 40 years of service in Santa Cruz County.

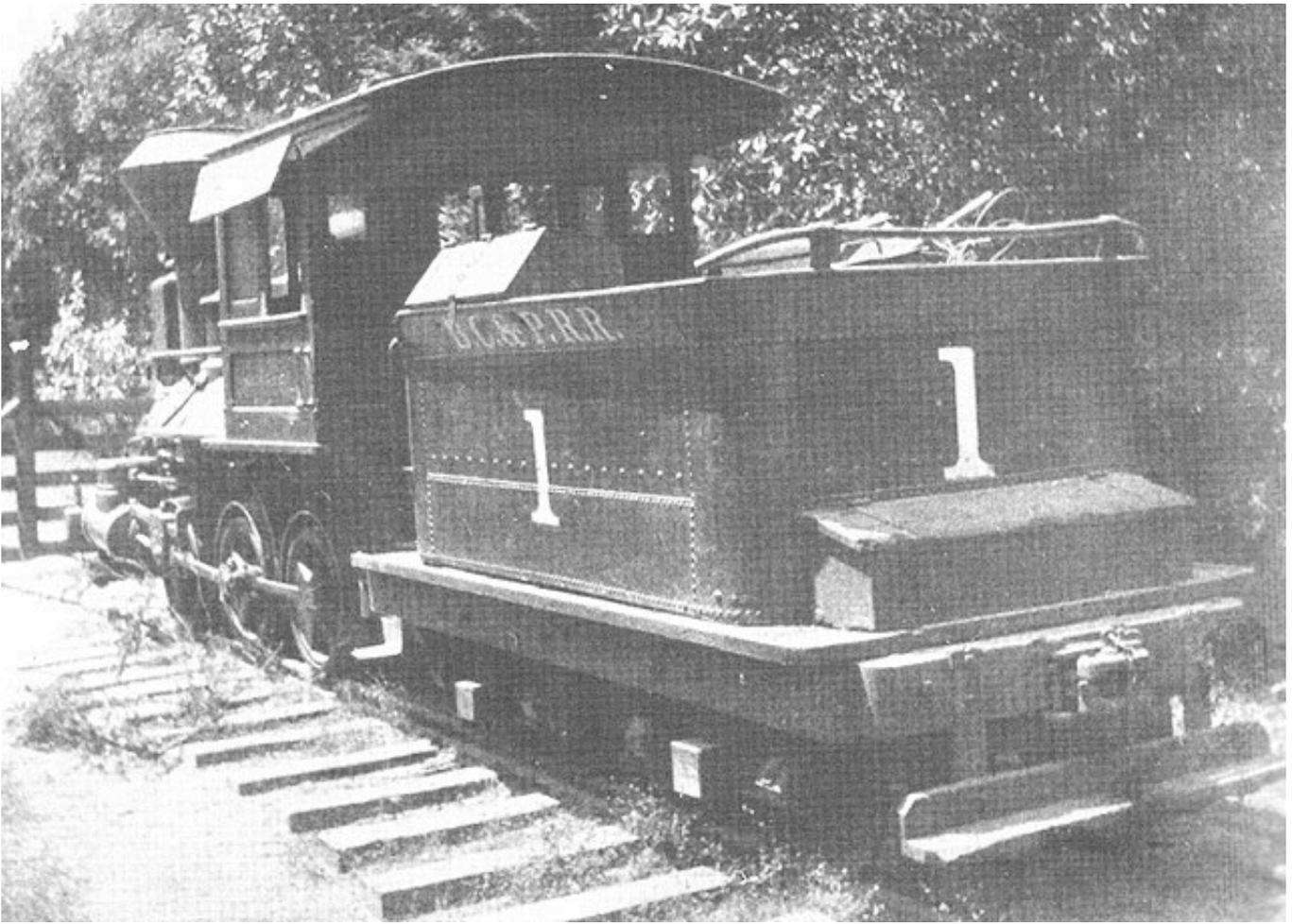


The Dinky circa 1892







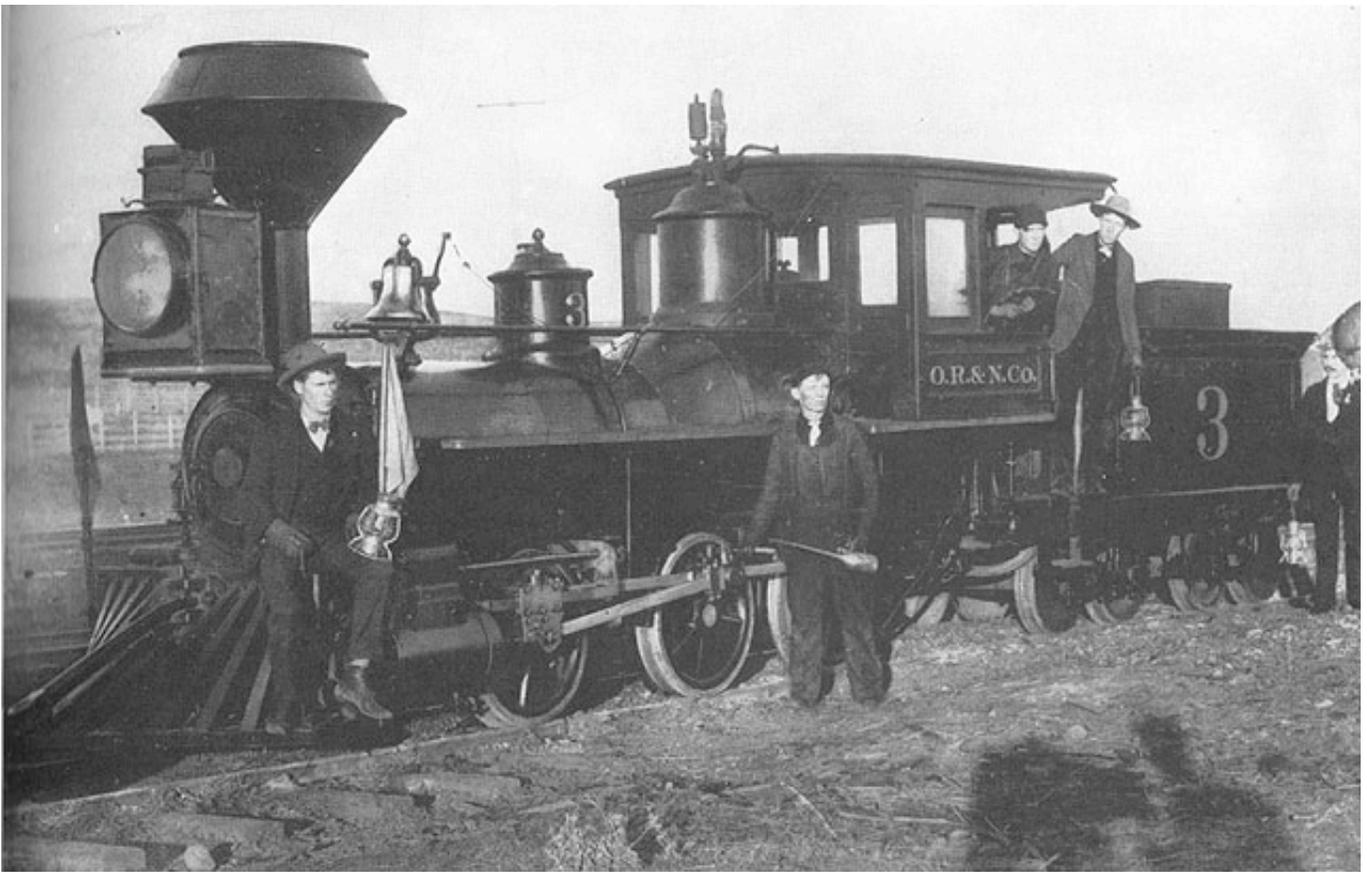


Some of the last images of the Dinky

The Last Porter Bell Type C

Porter would reorganize in 1878 into H.K. Porter & Company, and would continue to build 0-6-0 and 2-6-0 type locomotives, most of a larger class, utilizing 36" wheels and wagon top boilers: a neat mid-sized road engine for the 1880s. Several of this larger class would run in Colorado, the Black Hills area, California and even Japan! Of the original smaller Porter Bell 10 to 16-ton types from the 1870s, only one survives today.

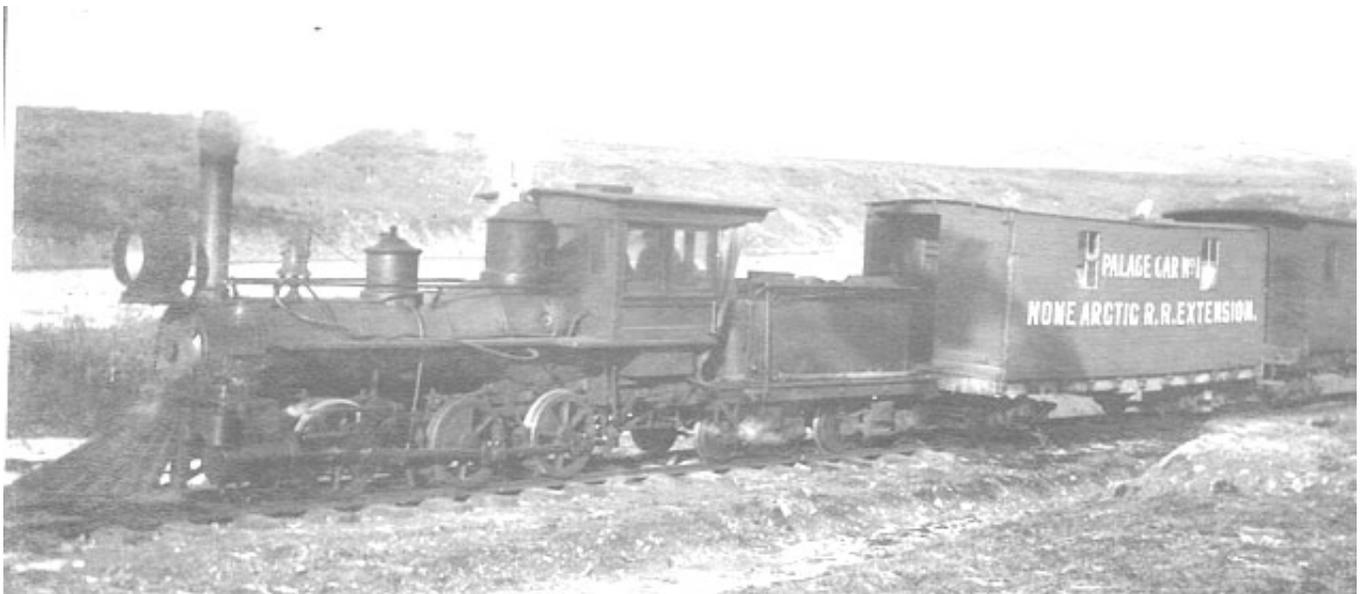
The 14-ton, *Blue Mountain*, built for Dr. Baker's Walla Walla & Columbia RR in 1878. Here she is as photographed after 1878 operating on the Oregon Steam Navigation Co. line.

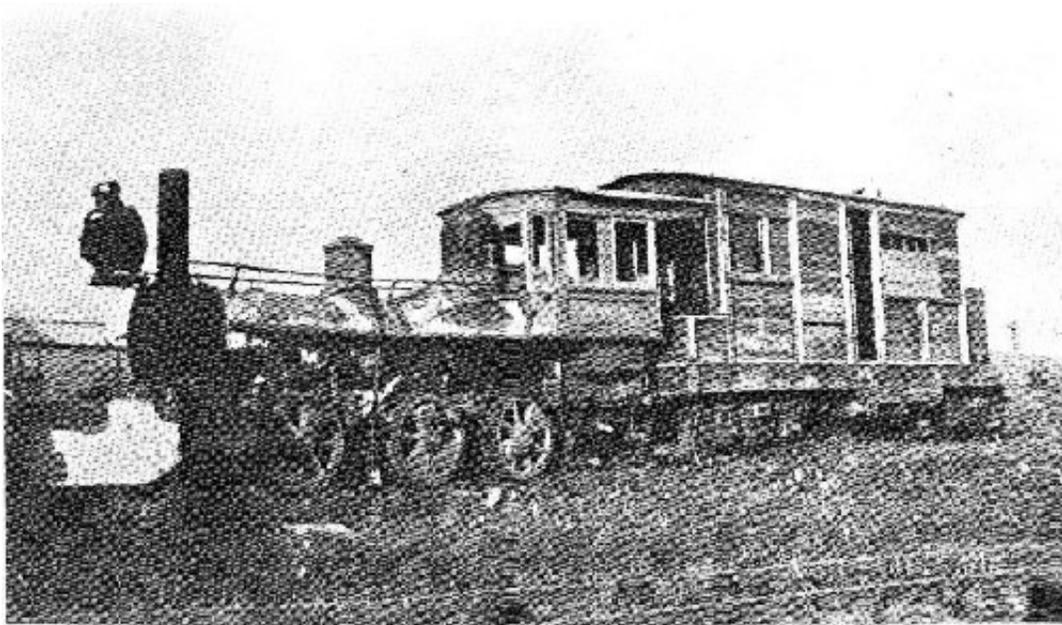


Her survival is quite the miracle having spent many years submerged in sea water in Alaska. She may one day be cosmetically restored:

<http://www.wsrhs.org/bmhis.htm>

The following are some shots from the life of *Blue Mountain*.

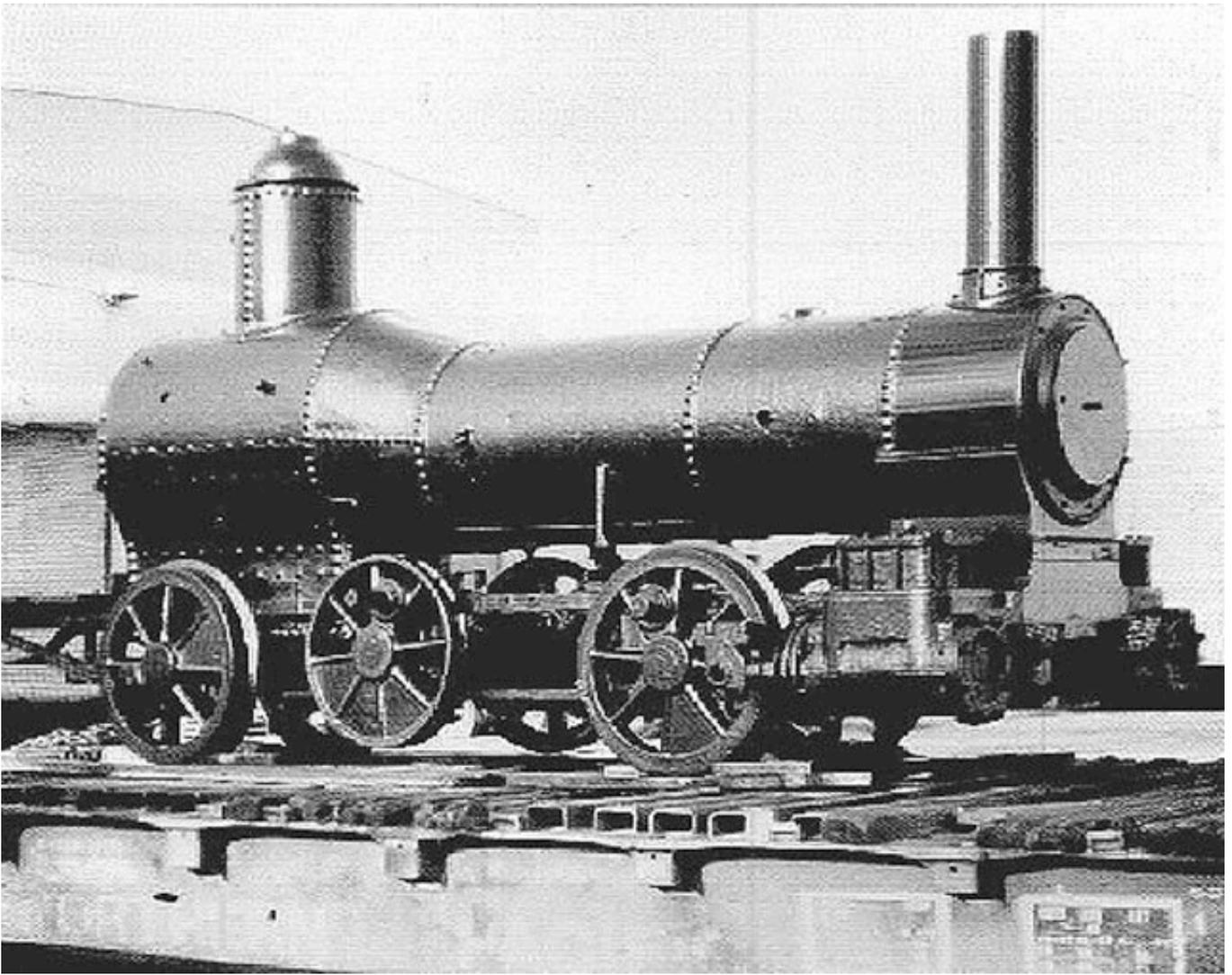




Old narrow gauge locomotive behind seawall near power plant
Nome, AK 1953



Dumped into the river



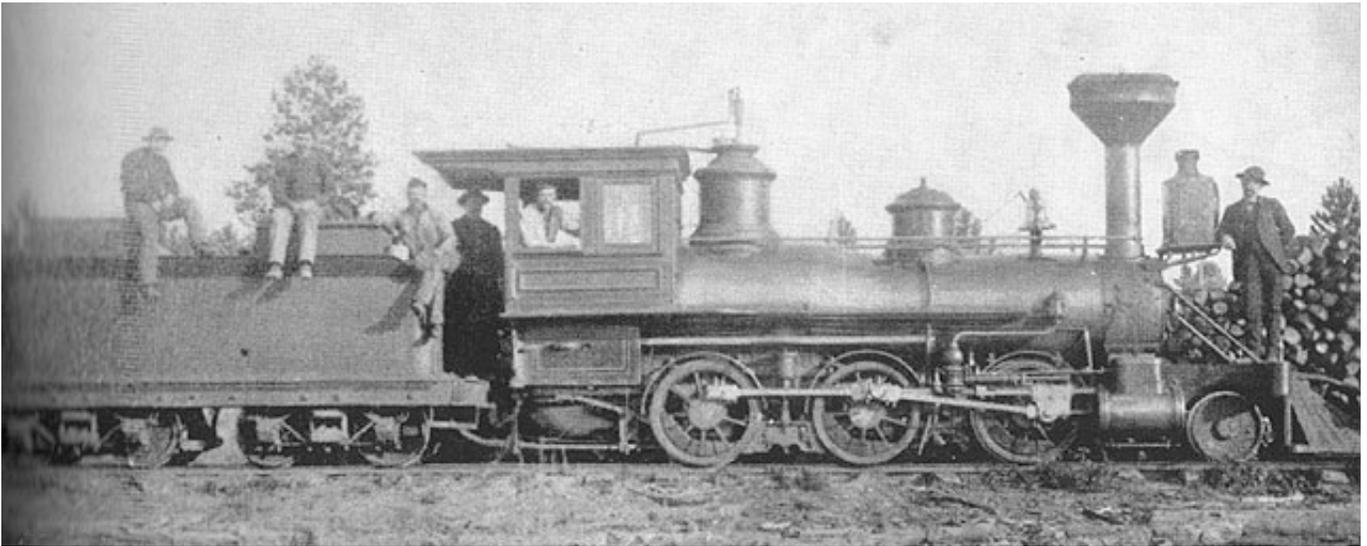
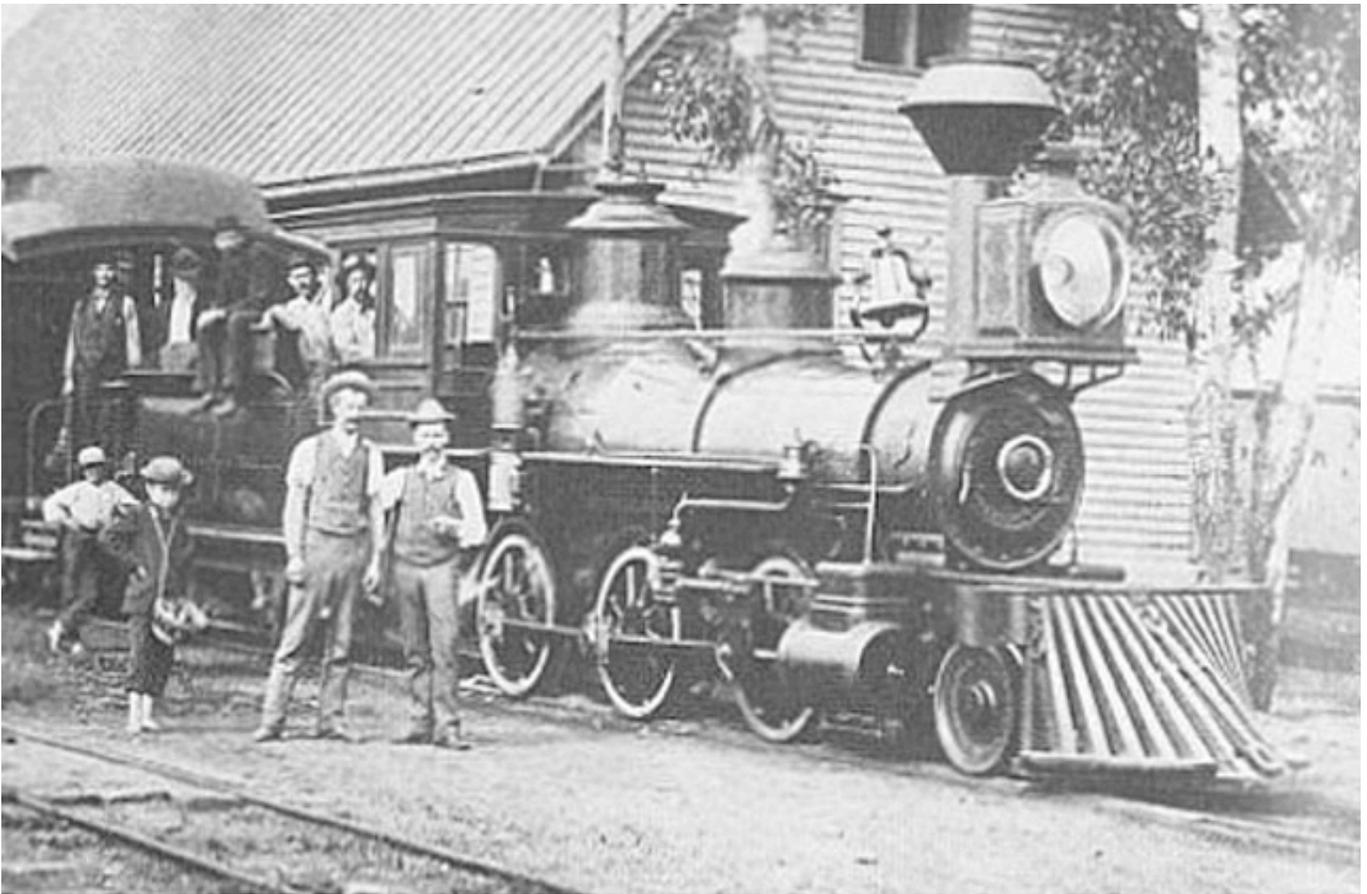
Recovered and Cleaned up!



As preserved today

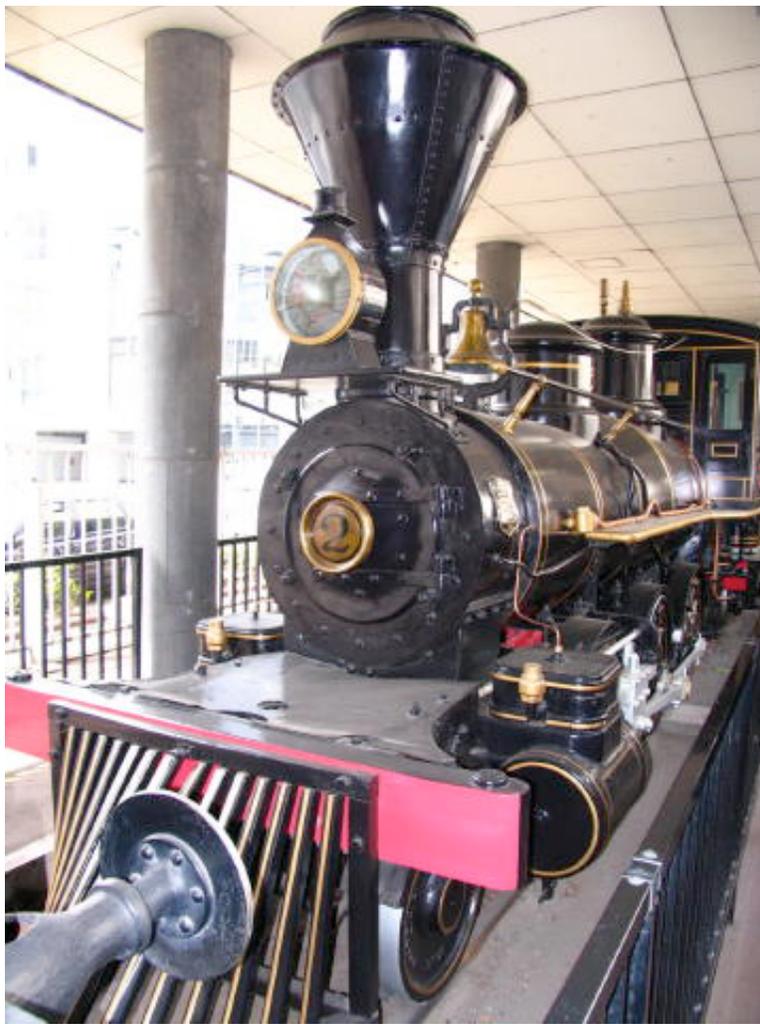
The Porter 2-C-T, the Most Copied Locomotive in the World!

As noted, H.K. Porter went on to build many larger 2-6-0s, specifically a heavier class with 36" wheels. These locomotives ran on industrial and passenger lines across the U.S. Examples would be found in the Black Hills, Colorado, California and even Japan. The following is the typical larger 2-C-T class as seen running on the Denver, Utah & Pacific RR.



A great broadside view of one of two Porters that ran on the Black Hills & Fort Pierre RR

The most famous version of this type was the *Benkei*, exported to Japan in 1880. She survives today in good cosmetic order at the Tokyo Transport Museum. *Benkei* was the first of eight of this class delivered to Japan between 1880 and 1884.



During the 1970s and 1980s, Japan's toy industry saw battery and windup toys, Christmas trains, stencils, pencil case covers, jig saw puzzles, pencil sharpeners, model kits -- you name it -- based on that Japanese 2-C-T Porter. Today unknown by most, this single locomotive has become the blueprint of what an American "wild west" locomotive should look like, and has been reproduced indirectly to the tune of millions. Heck I even have a postage stamp of this Porter!



Here is my school pencil sharpener from 1979, again the *Benkei* with an extended rear firebox for the sharpener, and rear axle added making it a 2-6-2. The thing actually rolls great! "*Benkei*" is inscribed on

the cab wall.



Below is one of the N scale plastic kits made in the 1970s. Ma painted this one for me when I was 7 years old. Sadly the headlight broke off long ago. I also have a C-52 Japanese 4-6-2 kit from this era in good condition from the same N scale series.



There were 0 gauge versions, 1 gauge versions, plastic with press button sounds, some with no track at all that just ran along the floor making chuffing sounds! Today Japan's involvement in toy production has slowed, with similar toys now produced in China. However, whether the toy designers know it or not, this same Porter is still being reproduced in the latest battery Christmas trains from New Bright! I think it's a case now of the toys being based on toys, effectively 10th generation or more removed from the original source that once inspired these toys. Many are also now represented as 2-6-2s! Here is the New Bright version, a toy developed from prior Japanese toys, adapted into a 2-6-2:

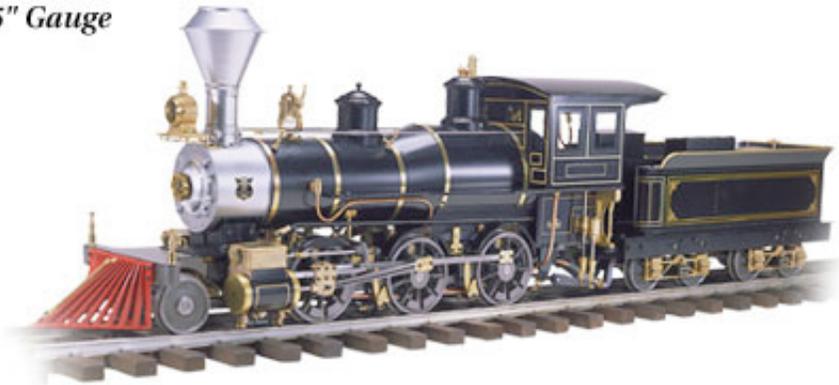


Benkei has not been forgotten, for as recently as 2003 Atlas N scale released a new 1870s/80s 2-6-0 onto the market, featuring for the first time accurate period paint schemes as developed by Historian Jim Wilke. The Prototype: a certain 2-C-T Porter Mogul currently preserved in Japan! Henry Kirke Porter would be proud!



The Atlas N scale model of Benkei with accurate D&RG paint scheme from 1871, designed by Jim Wilke

3.5" Gauge



O.S. Porter 4-6-0

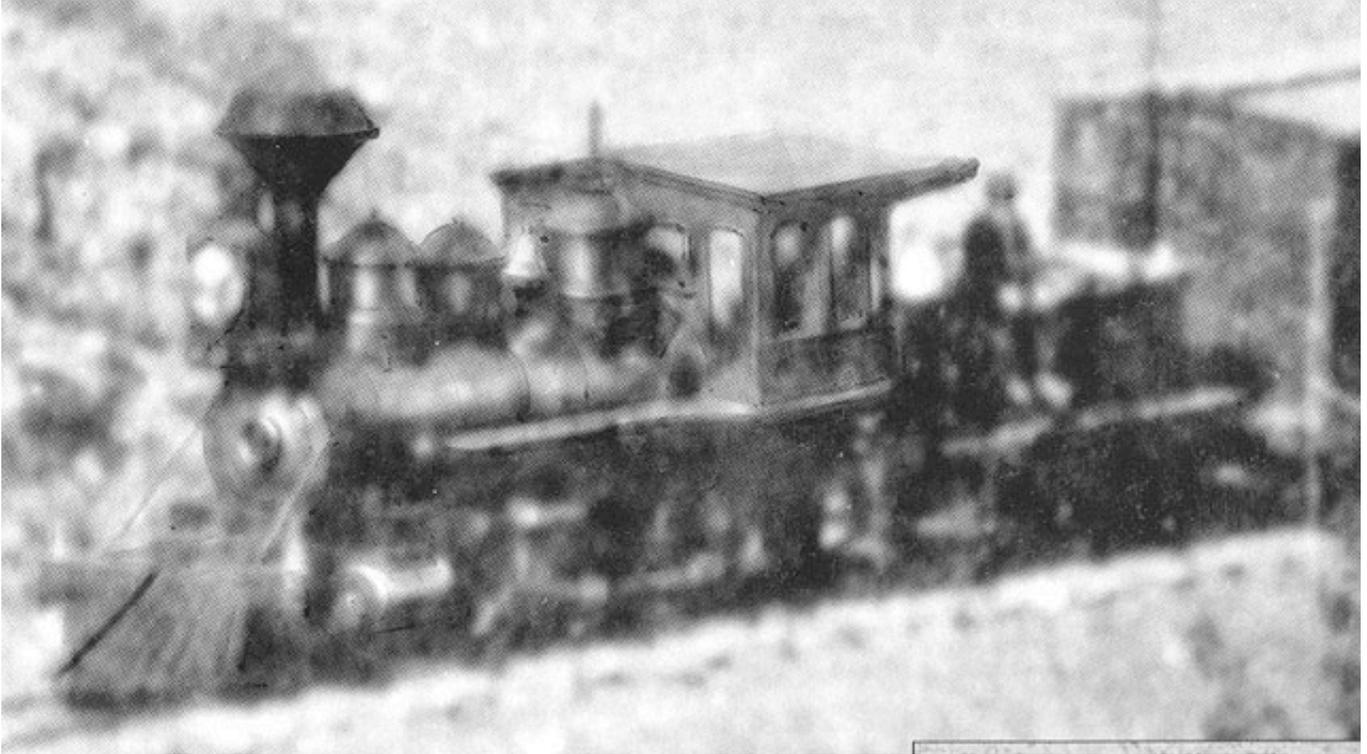
Live steam commercial models of the Benkei



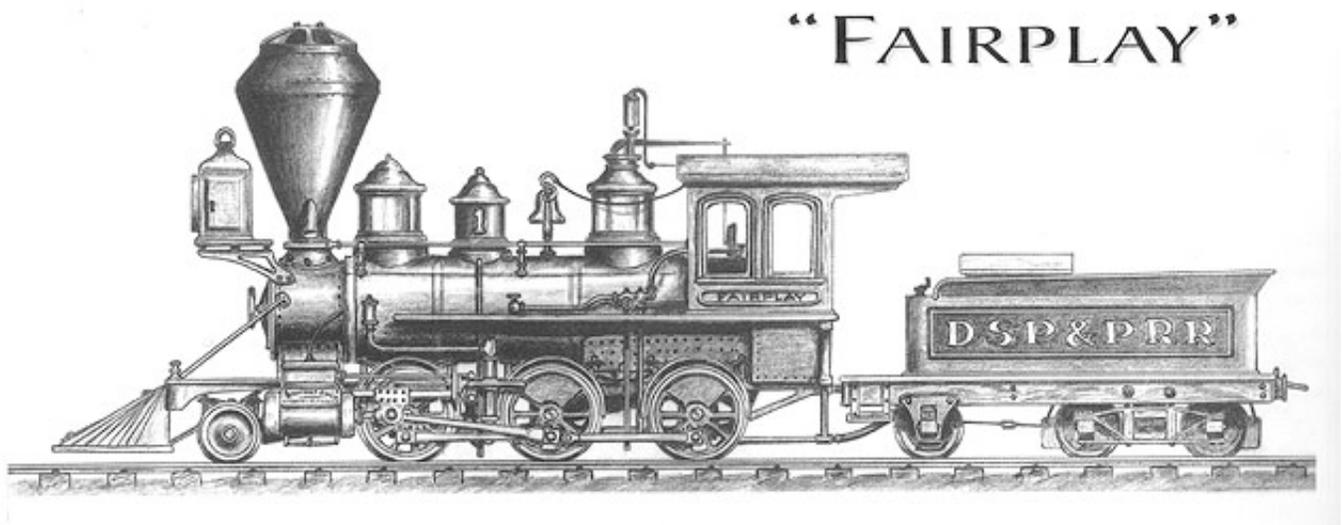
The National Locomotives of the DSP&P and the CC RR

The National Locomotive Works, otherwise known as Dawson & Bailey, produced only about 80 locomotives before closing their doors by 1878, around the time Porter Bell was reorganized. The relevance to this class is somewhat remote, except that the first two locomotives built for the Denver, South Park &

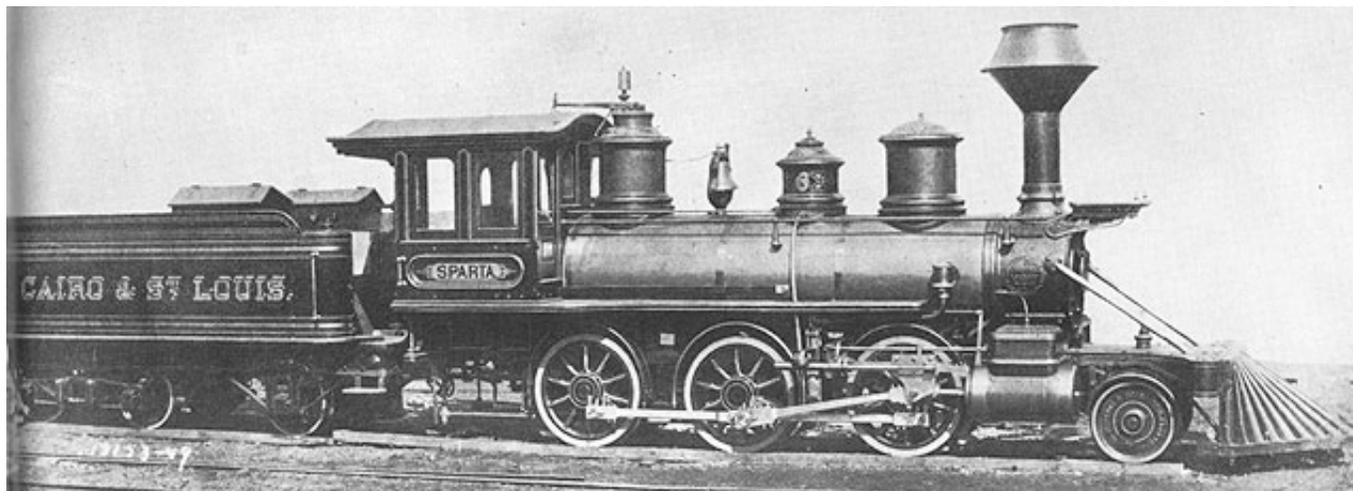
Pacific RR were a National 2-6-0 and a National 4-4-0. The 2-6-0 *Fairplay* was a tiny Mogul, with 33" drivers. Little is known about the exact nature of this locomotive, as the only photos of it are just too distant and blurry to detect much. Among the DSP&P fraternity, it is thought that *Fairplay* might have had a 6-wheeled tender, not unlike the Porters of the CC RR. Also in many other aspects she seems almost identical, having a small wagon top boiler fitted with two steam domes (the first steam dome was up front behind the stack). Mal Hope Ferrell's *The South Park Line* has a computer enhanced reproduction of the only photo that shows the loco in any detail, but again it doesn't show much. The shine on the boiler however clearly indicates a wagon top, with two steam domes.



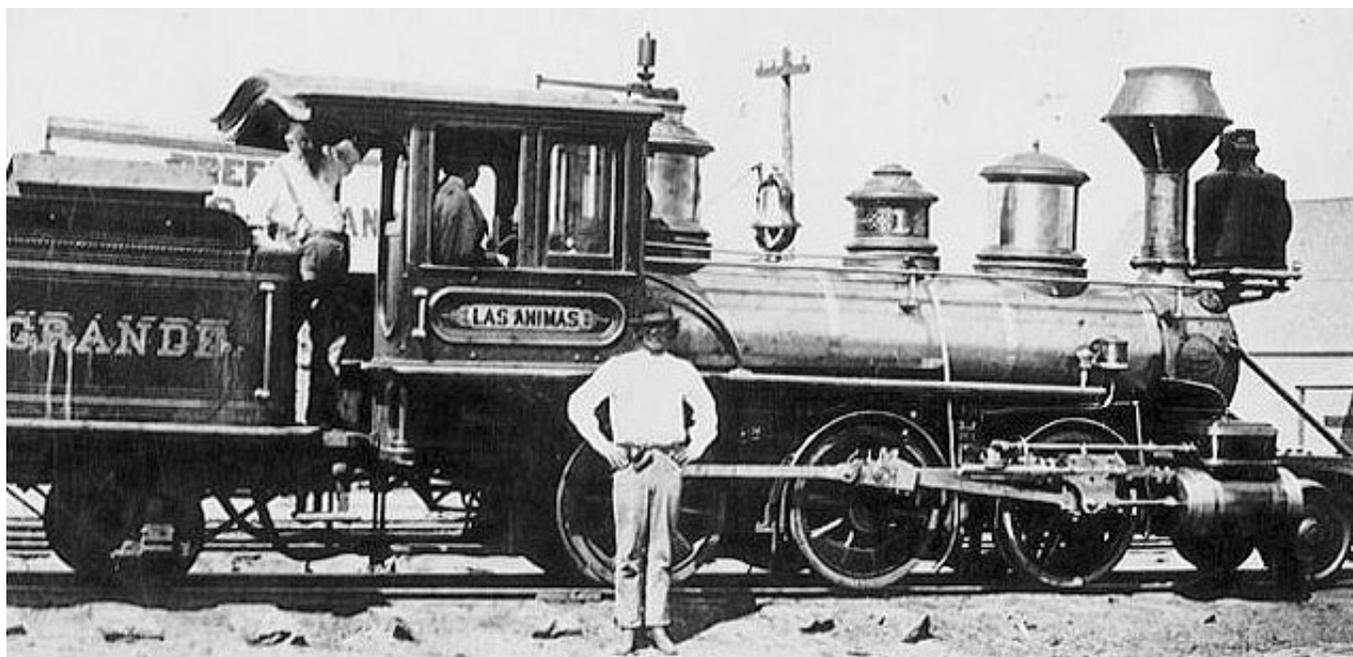
A cartoon of the loco is also shown in the book as sketched by noted artist and photographer, Phil Ronfor. In this sketch, Ronfor depicts the 6-wheeled tender as having a 4-wheeled truck with a fixed axle to the front, much like the Baldwin class 35 locos with 6-wheeled tenders from 1872 that ran on the D&RG. Danforth also built narrow gauge locomotives with this type of tender in the mid 1870s.



Ronfor's Sketch of Fairplay



Typical designs from Baldwin, 1872

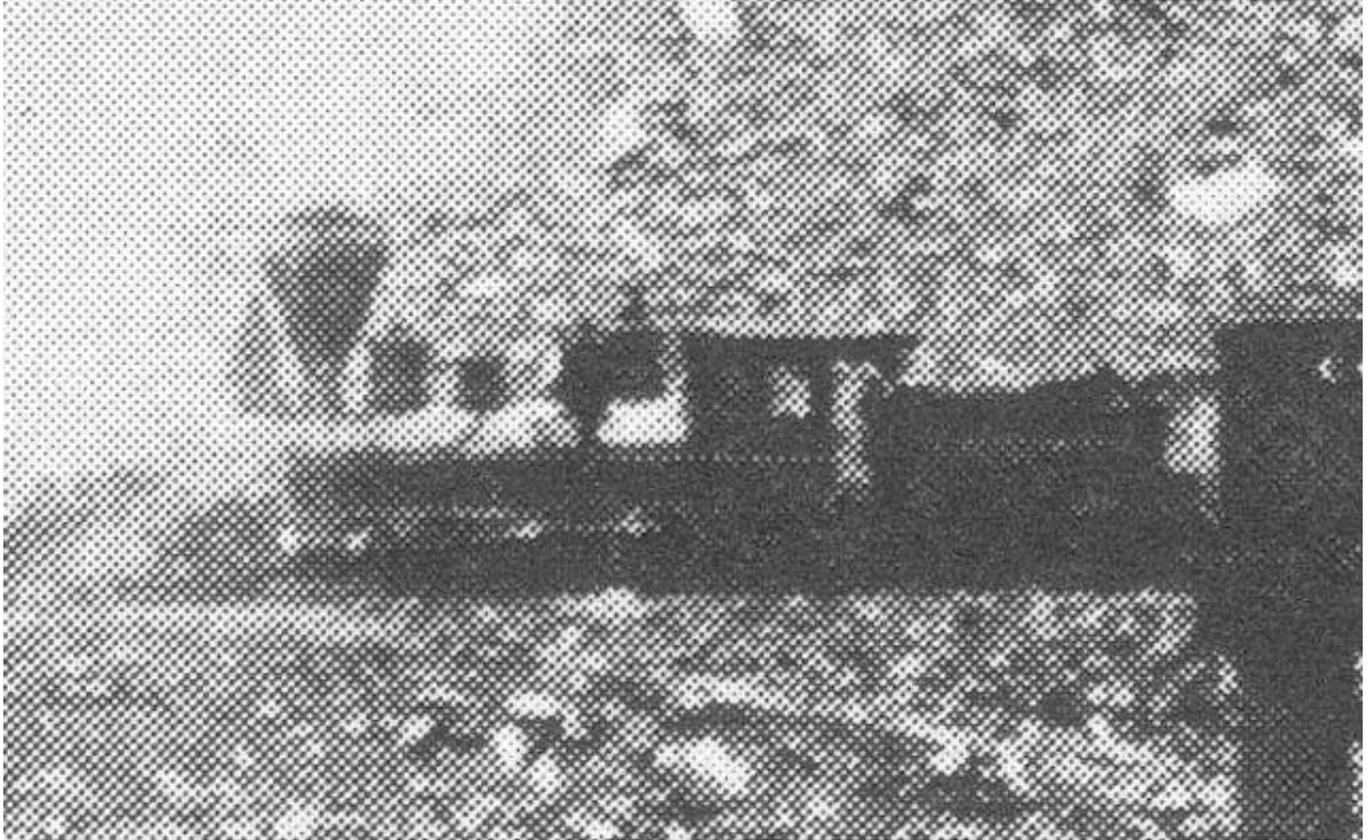


The Baldwin class 35 delivered to the D&RG also sported a 6-wheeled tender. These Baldwin locos, with 36" wheels, were larger than our Porter and the National locomotives.

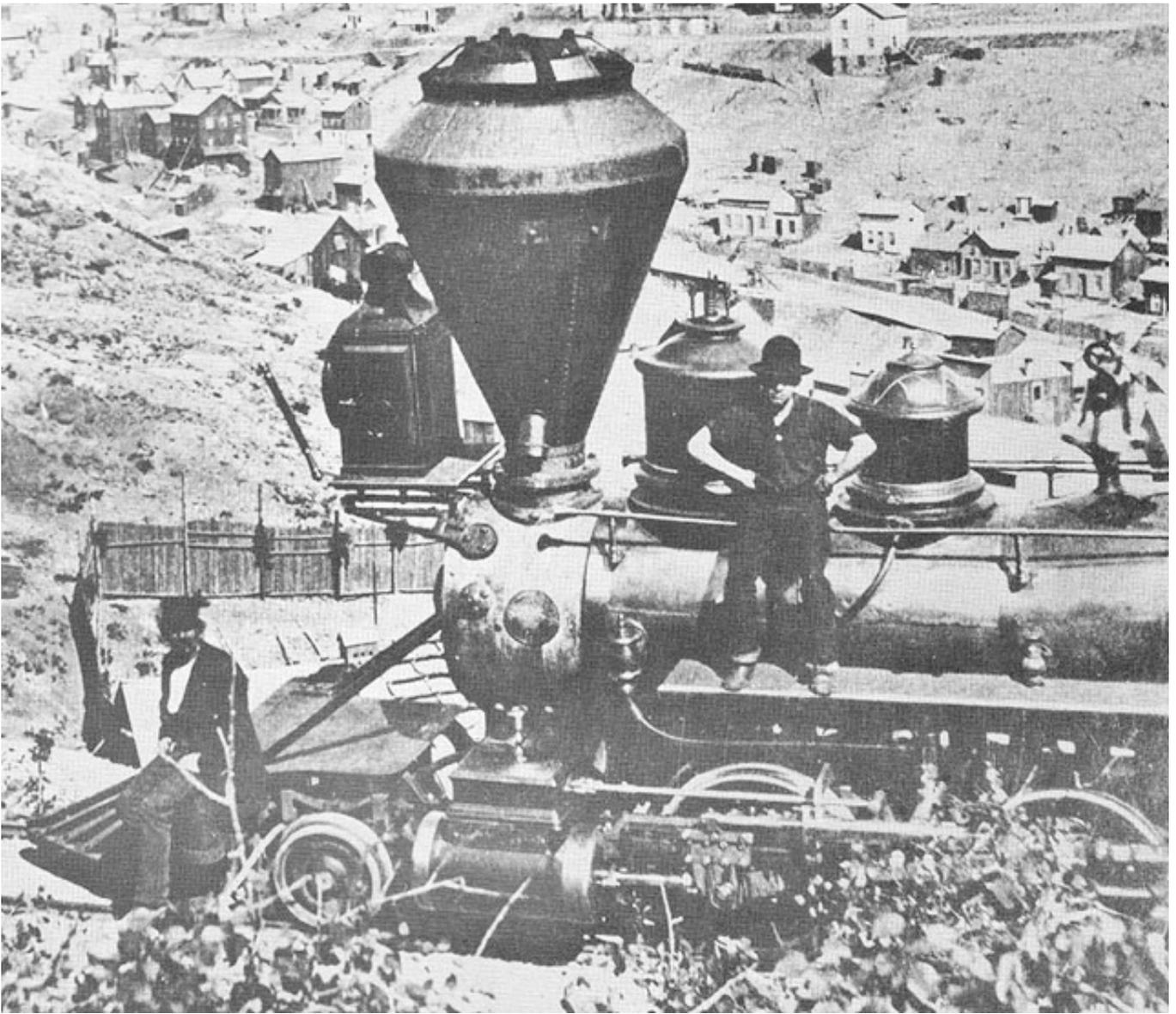
Ronfor's general arrangement, as guessed from that one image of *Fairplay*, clearly reflects the designs used by Baldwin for those early D&RG class 35 locos, and the batch built for the Cairo & St Louis in 1872. However the straight boiler doesn't seem in keeping with the photo, nor with the other National 2-6-0 as delivered to the CC RR as their second #1, prior to the delivery of the 3rd Porter. The National 2-6-0 from the CC RR was a tad larger than the DSP&P *Fairplay* with 37" wheels, standing taller on the rails. However, she was built in the same year, 1874, and sports just about every other feature in common with *Fairplay*, as can be gleaned from the photo. This would also appear to be the loco upon which Phil Ronfor based his painting of *Fairplay* with the Mason *Eureka* in the foreground. Here his depiction of the National locomotive is almost a dead ringer for the Porters from the CC RR, including the rigid-framed 6-wheeled tender. This I believe to be a much more rational view of what the *Fairplay* really looked like, and relates closely to the National loco from the CC RR of the same year. It should also be noted that the National

loco from the CC RR had an 8-wheeled tender: *Fairplay* may also have had an 8-wheeled tender. With regard to the 'Fairplay' tender, either the 6 wheel rigid frame or the Baldwin semi-rigid frame would be reasonable - both designs were common in this time period.

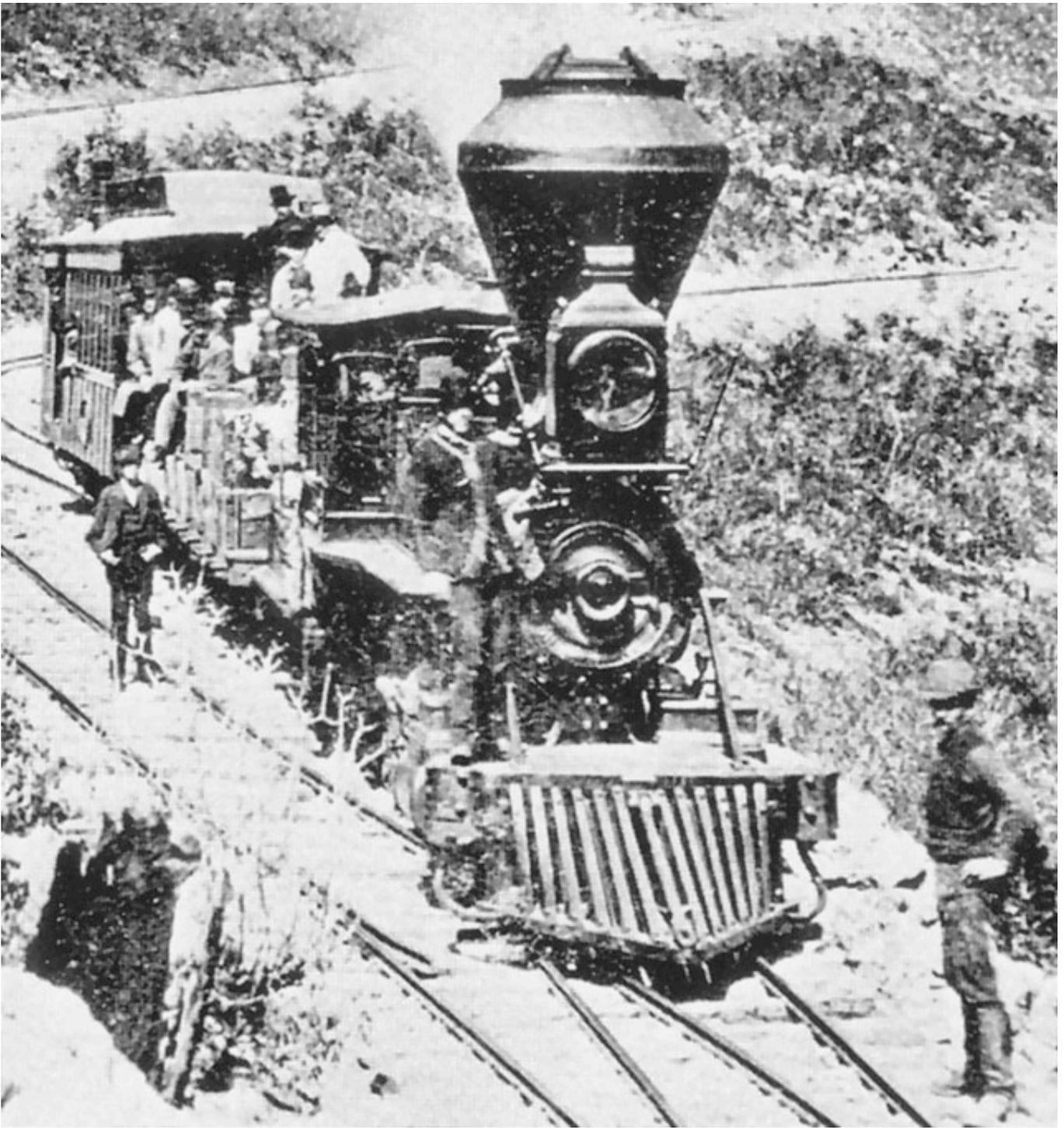
Here are some views of the CC RR National loco with 37" drivers, their second #1:



Side view

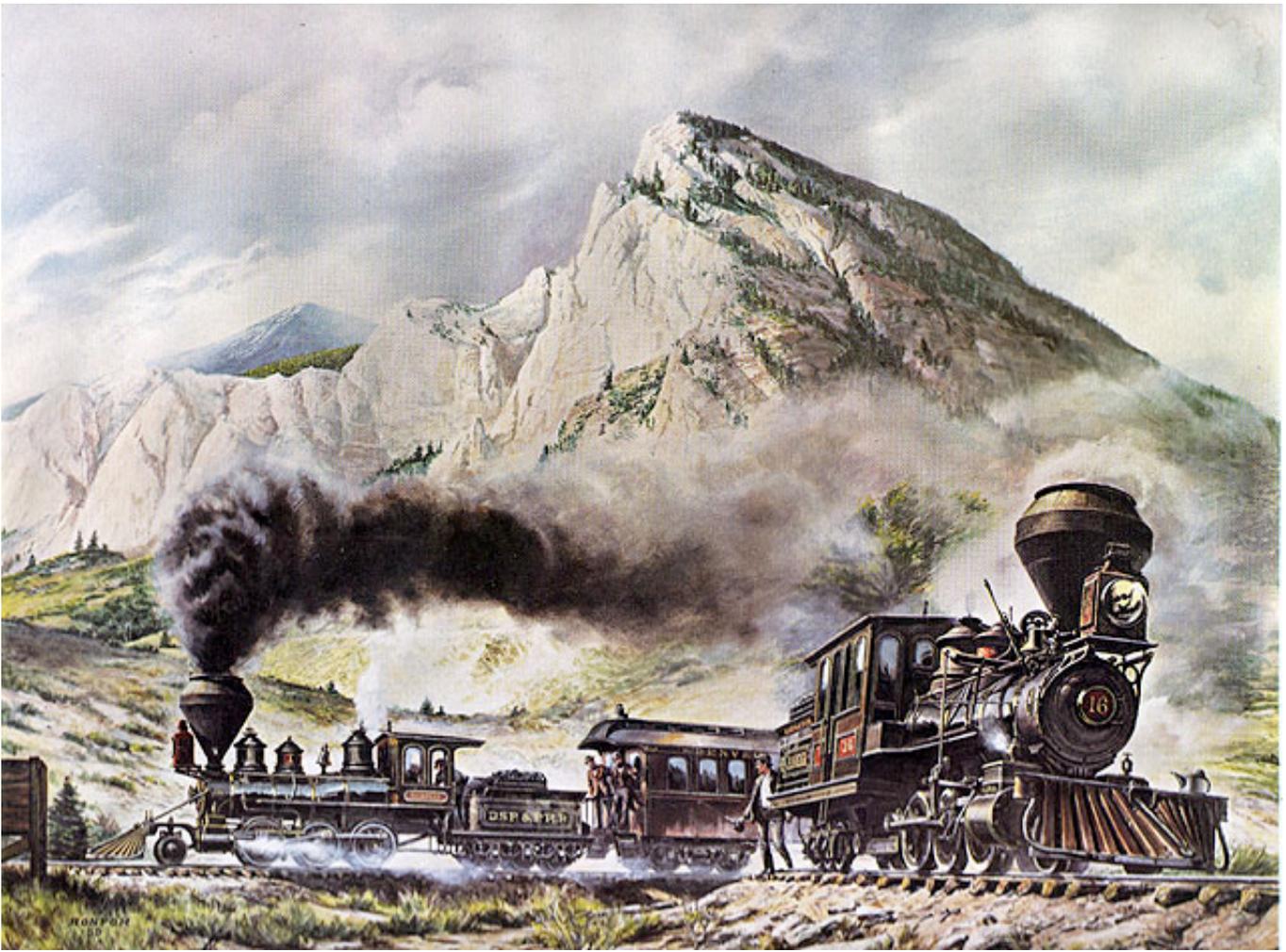


Note the bell fitted to the wagon top taper, much like the Porters, #2, #3, #6 and #7.

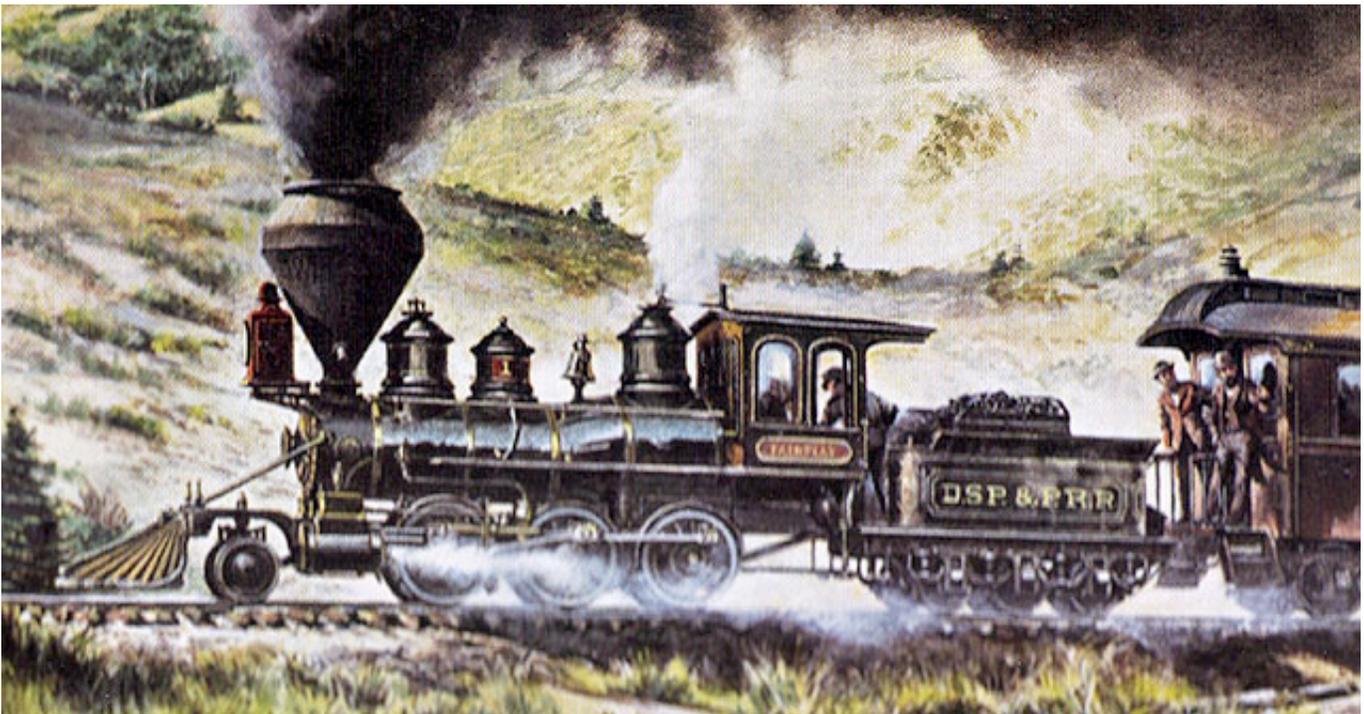


A nice front on view of CC RR #1, National Locomotive Works, 1874

Here is an image of the fantastic painting by Ronfor, depicting *Fairplay* and *the Mason Bogie*, Eureka:



and a close up of his view of *Fairplay*:



If one wanted to build a non-Porter 2-6-0 with a DSP&P theme, the above is a very good indication of how

to modify the class materials to build a reasonable model of *Fairplay*. It is, in every sense, the same as Porter CC RR #7, except with the domes moved around, and a set of safety valves on the lead steam dome. Most other templates could be used without alteration. The pilot deck has some interesting framing as can be seen in the Ronfor Painting and the CC RR #1.

Well lets get on with it: building the Porters of the Colorado Central Railroad!

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