Carolina Conductor

Volume 4 Number 9 **Monthly Newsletter of the Carolina Railroad Heritage Association, Inc.** September 2017

Preserving the Past.
Active in the Present.
Planning for the Future.

Web Site: hubcityrrmuseum.org
Facebook: Carolina Railroad Heritage Association

Meeting Site:
Woodmen of the World Bldg.
721 East Poinsett Street
Greer, SC 29651-6404
Third Friday of the Month at 7:00 pm

Hub City Railroad Museum and SOU Caboose #X3115:
Spartanburg Amtrak Station
298 Magnolia Street
Spartanburg, SC 29301-2330
Wednesday 10-2 and Saturday 10-2

Officers:
President:
David Winans — 864-963-4739
Vice-President:
Mac McMillin — 864-624-9658
Secretary:
Marv Havens — 864-292-3852
Treasurer:
Terry Brelsford — 864-320-6201

Directors:
Milton Ashley — 864-504-5202
Charles Conn — 864-326-6070
Lee Dobbs — 864-268-3939
Bruce Gathman — 864-850-3642
Bob Klempner — 864-431-5409

Mailing Address:
Suite #129
2123 Old Spartanburg Road
Greer, South Carolina 29650-2704

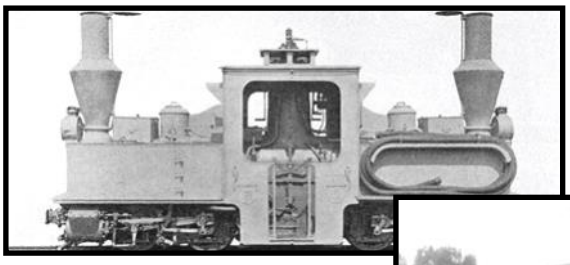
Editor:
Bruce Gathman—
shaygearhead@bellsouth.net
Articles and club news due by the 2nd Wednesday of month.

Baldwin Locomotive Works

Part 2

World War I

Baldwin was an important contributor to the Allied war effort in World War I. Baldwin built 5,551 locomotives for the Allies including separate designs for Russian, French, British and United States trench railways. Baldwin built railway gun carriages for the United States Navy and manufactured 6,565,355 artillery shells for Russia, England and the United States. From 1915 to 1918, Remington Arms subcontracted the production of nearly 2 million Pattern 1914 Enfield and M1917 Enfield rifles to the BLWs.



Locomotive built to French design by Baldwin for WWI.

Baldwin built standard "War Dept." 4-6-0 narrow gauge trench locomotive.

After the end of World War I Baldwin continued to supply export orders, as the European powers strove to replace large numbers of locomotives worn out by the war effort and European locomotive factories were still re-tooling from armaments production back to railroad production. In 1919 and 1920 Baldwin supplied 50 4-6-0 locomotives to the Palestine Military Railway that became the Palestine Railways H class.

Decline

After the boom years of World War I, Baldwin's business would decline as the Great Depression gripped the country and Diesel engines became the growth market on American railways at the end of the 1930s. During the 1920s the major locomotive manufacturers had strong incentives to maintain the dominance of the steam engine. Nevertheless, ALCO, while remaining committed to steam production, pursued R&D strategies in the 1920s and '30s that would ensure its competitiveness in the event that diesel locomotives would predominate. In contrast, Baldwin in the 1930s discounted the possibility that diesel could replace steam. In 1930 Samuel Vauclain, Chairman of the Board, stated in a speech that advances in steam technology would ensure the dominance of the steam engine until at least 1980. Baldwin's Vice President and Director of Sales stated in December

Baldwin Class H loco built for the Palestine Railway system.

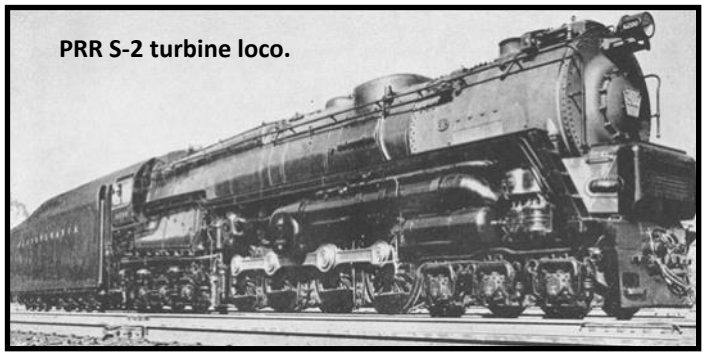
Continued on Page 3 - *Baldwin*

Arrivals

Baldwin Steam Turbines

In the waning years of steam, the Baldwin Locomotive Works undertook several attempts at alternative technologies to diesel power. In 1944, Baldwin built the sole example of the S2 class, for the Pennsylvania Railroad, delivering it in September 1944. It was the largest direct-drive steam turbine locomotive in the world and had a 6-8-6 wheel arrangement. It was originally designed as a 4-8-4, but due to shortages of lightweight materials during World War II, the S2 required additional leading and trailing wheels.

Numbered 6200 on the PRR roster, the S2 had a maximum power output of 6,900 HP and was capable of speeds over



PRR S-2 turbine loco.

100 mph. With the tender, the unit was approximately 123 feet long. The steam turbine was a modified marine unit. While the gearing system was simpler than a generator, it had a fatal flaw: the turbine was inefficient at slow speeds. Below about 40 mph the turbine used enormous amounts of steam and fuel.

At high speeds, however, the S2 could propel heavy trains almost effortlessly and efficiently. The smooth turbine drive put far less stress on the track than a normal piston-driven locomotive. However, poor efficiency at slow speeds doomed this turbine, and with diesel-electrics being introduced, no more S2s were built. The locomotive was retired in 1949 and scrapped in May 1952.

In 1947–1948 Baldwin built three unique coal-fired steam turbine-electric locomotives for passenger trains on the Chesapeake and Ohio Railway. Their designation was M1, but because of their expense and poor performance they acquired the nickname "Sacred Cow". The 6,000 horsepower units, which had Westinghouse electrical systems, had a 2-C1+2-C1-B wheel arrangement. They were 106 feet long. The cab was in the center with a coal bunker ahead of it and a backwards-mounted conventional boiler behind it (the tender only carried water).

These locomotives were intended for a route from Washington, D.C. to Cincinnati, Ohio but could never travel the whole route without some sort of failure. Coal dust and water frequently got into the traction motors. While these problems could have been fixed given time, it was obvious that these locomotives would always be expensive to maintain and all three were scrapped in 1950.

In May 1954 Baldwin built a 4,500 horsepower steam turbine-electric locomotive for freight service on the Norfolk and Western Railway, nicknamed the *Jawn Henry* after the legend of John Henry, a rock driller who famously raced against a steam drill and won, only to die immediately after. Length including tender was 161 ft. 1-1/2 inches, probably the record for a steam locomotive; engine-only length was 111 ft. 7-1/2 inches, perhaps the record for any single unit.

The unit looked similar to the C&O turbines but differed mechanically; it was a C+C-C+C with a Babcock & Wilcox water-tube boiler with automatic controls. The boiler controls were sometimes problematic, and coal dust and water got into the motors. The *Jawn Henry* was retired from the N&W roster on January 4, 1958.

C&O class M-1
"Sacred Cow" turbine.

N&W #2300 "Jawn Henry" turbine .

Departures

Continued from Page 1 - *Baldwin*

1937 that "Some time in the future, when all this is reviewed, it will be found that our railroads are no more dieselized than they electrified." Baldwin had deep roots in the steam locomotive industry, and may have been influenced by heavy investment in its Eddystone plant.

Baldwin lost its dominant position in electric locomotives when the Pennsylvania Railroad selected General Electric's PRR GG1 instead of Baldwin's design in 1934.

When Baldwin emerged from bankruptcy in 1938 it underwent a drastic change in management. The new management revived their development efforts with diesel power but the company was already too far behind. In 1939 Baldwin offered its first standard line of diesel locomotives, all designed for yard service. By this time, GM-EMC was already ramping up production of diesel passenger locomotives and developing its first Diesel road freight locomotive.

As the 1930s drew to a close, Baldwin's

coal-country customers such as Pennsylvania Railroad, Chesapeake and Ohio, and Norfolk and Western were more reluctant than other operators to embrace Diesel technology, which could undermine the demand for one of their main hauling markets. All three continued to acquire passenger steam locomotives into the early postwar years, as dieselization was gaining momentum elsewhere in the rail industry.

In the late 1930s Baldwin and the Pennsylvania Railroad made an all-in bet on the future of steam in passenger rail service with Baldwin's duplex-drive S1 locomotive. It proved difficult to operate, unreliable, costly to maintain, and unsuited for its intended service. Baldwin developed a revision of the same basic design with the T1, introduced in 1943. While the T1s were used for PRR's long distance express trains, they still had many of the problems of the S1. The whole S1-T1 venture resulted in losses for PRR and investment in a dead-end development effort for Baldwin at a critical time for both companies. In the early 1940s Baldwin embarked upon its efforts to develop steam turbine power, producing the S2 direct-drive turbine locomotive in 1944. Baldwin's steam turbine program failed to produce a single successful design. Baldwin's steam-centered development path had left them flat-footed in the efforts necessary to compete in the postwar Diesel market dominated by EMD and ALCO-GE.

World War II

The United States' entry into World War II impeded Baldwin's diesel development program when the War Production Board dictated that Alco and Baldwin produce only steamers and diesel-electric yard switching engines. Electro-Motive Division (EMD) was assigned the task of producing road freight Diesels (namely, the FT series). EMD's distinct advantage over its competitors in that product line in the years that followed World War II, due to the head start in diesel R&D and production, is beyond doubt, however, assigning it solely to WPB directives is questionable. Longtime GM chairman Alfred P. Sloan presented a timeline in his memoir that belies this assumption, saying that GM's diesel-engine R&D efforts of the 1920s and 1930s, and its application of model design standardization (yielding lower unit costs) and marketing lessons learned in the automotive industry, were the principal reason for EMD's competitive advantage in the late 1940s and afterward (clearly implying that the wartime production assignments were merely nails in a coffin that Baldwin and Lima had already built for themselves before the war). In his telling, the R&D needed to adapt earlier Diesels (best suited to marine and stationary use) to locomotive use (smaller; higher power-to-weight ratio; more reliable given more vibration and less maintenance) was a capital-intensive project that almost no one among the railroad owners or locomotive builders was willing (latter) or able (former) to invest in during the 1920s and 1930s, save the people of Winton, Electro-Motive, and Charles F. Kettering of the GM Research Corporation.

Baldwin was benefited by the petroleum crisis of 1942-43, which boosted demand for their coal-fired steam locomotives while acquisition of EMD's Diesel locomotives was in its most restricted period.

In 1943 Baldwin launched its belated road Diesel program, producing a prototype "Centipede" locomotive which was

Continued on Page 4 - *Baldwin*

Continued from Page 3 - *Baldwin*

later rebuilt to introduce their first major product in the postwar market.

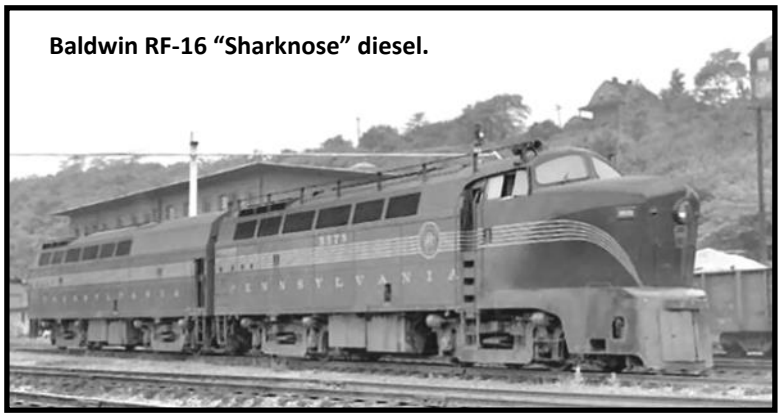
During World War II Baldwin's contributions to the war effort included not only locomotives and switchers but also tanks. Baldwin was one of the manufacturers of several variants of the M3 tank (M3 Lee, M3A2, M3A3, M3A5) and later the M4 Sherman. A Baldwin subsidiary, the Whitcomb Locomotive Company, produced hundreds of 65-ton diesel electric locomotives for the Army and received the Army-Navy "E" award for production. Baldwin ranked 40th among United States corporations in the value of wartime production contracts.

The End

Between 1940 and 1948, domestic steam locomotive sales declined from 30 percent of the market to 2 percent. By 1949, there was no demand for steam locomotives. Baldwin's attempts to adapt to the changed market for road locomotives had been unsuccessful; the reliability of their offerings was unsatisfactory, epitomized by notorious failures such as their "Centipede" diesel locomotives and their steam turbine-electric locomotives, which proved to be money pits unsuited for their intended service. In July 1948 Westinghouse Electric, which had teamed with Baldwin to build diesel and electric locomotives and wanted to keep their main customer in the rail industry afloat, purchased 500,000 shares, or 21 percent, of Baldwin stock, which made Westinghouse Baldwin's largest shareholder. Baldwin used the money to cover various debts. Westinghouse vice president Marvin W. Smith became Baldwin's president in May 1949. In a move to diversify into the construction equipment market, Baldwin merged with Lima-Hamilton on December 4, 1950, to become Baldwin-Lima-Hamilton. However, Lima-Hamilton's locomotive technology was unused after the merger and market share continued to dwindle. By January 1952 Baldwin closed its factory in Rochelle and consolidated Whitcomb production at Eddystone. In 1953 Westinghouse, discontinued building electrical traction equipment, so Baldwin was forced to reconfigure their drive systems based on General Electric equipment. In 1954, during which time they were being virtually shut out of the Diesel market, Baldwin delivered one steam turbine-electric locomotive to the Norfolk and Western railroad, which proved unsatisfactory in service.

In 1956 the Pennsylvania Railroad, which was slow in accepting diesels, finally decided to retire its steam fleet, which was the largest in the world at that time, and buy a large order of diesels. Baldwin bid, expecting its lifelong loyal customer to help keep Baldwin in business by buying at least some Baldwin diesels. General Motors' EMD division, however, gave the PRR an exceptional deal on new, reliable GP9s, so the PRR, which was in a financial pinch itself, sent the business to GM. This one lost deal proved to be the end of the line, and after 125 years of continuous production Baldwin closed most of its Eddystone plant. It produced no more locomotives after 1956, instead concentrating on heavy construction equipment. More than 70,500 locomotives had been produced when production ceased in 1956.

In 1965 Baldwin became a wholly owned subsidiary of Armour and Company. Greyhound Corporation purchased Armour and Company in 1970, and in 1972 Greyhound closed Baldwin.



Baldwin RF-16 "Sharknose" diesel.

Baldwin S-12 switcher, built late '40s.

Baldwin model DT-6-6-2000 locomotive.

Rare Mileage

Baldwin – Westinghouse Electrics

Baldwin, the locomotive manufacturer, and Westinghouse, the promoter of AC electrification, joined forces in 1895 to develop AC railway electrification. Soon after the turn of the century, they marketed a single-phase high-voltage system to railroads. From 1904-05 they supplied locomotives carrying a joint builder's plate to a number of American railroads, particularly for the New Haven from New York to New Haven, and other New Haven lines.

Experimental Locomotives - In 1895, a box-cab locomotive, 32 feet long with two four-wheel trucks and weighing 46 tons was built at the East Pittsburg works of Westinghouse. It was used for more than a decade of AC and DC experimentation. Sold in 1906 to the Lackawanna & Wyoming Valley Railroad as a 600 hp. 500 volt DC locomotive, it was in service until 1953.

#9, the first single-phase locomotive built in America, was completed in 1904. Weighing 126 tons and operating on 6600 volts AC, it had six 225 hp traction motors with quill drive on two three-axle trucks.

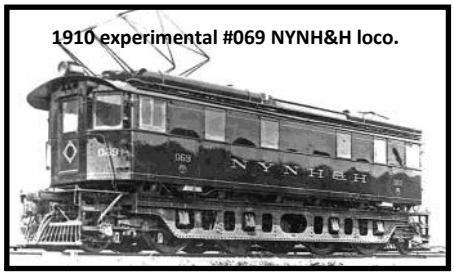
New Haven - In 1905 New Haven investigated electrification for their 35 miles


Baldwin-Westinghouse NYNH&H EP-1.

line from Grand Central Station to Stamford, with a possible extension to New Haven, Connecticut. Electrification for passenger service was required in New York. Operation of such trains to the suburbs was preferred, changing to steam outside New York. Electrification of the busy main line would increase the capacity of the existing four tracks. Proposals were obtained from General Electric and Westinghouse. Both companies submitted a variety of AC and DC schemes, though GE favored DC electrification. But New Haven chose single-phase AC as proposed by Westinghouse, at 11 kV 25 Hz.

An initial order of 35 EP-1 locomotives were supplied 1905-1907. The design was similar to No. 9 above, with two two-axle trucks and a Westinghouse gearless quill drive, which supported the motor on the truck frame and reduced the un-sprung weight. The locos weighed 102 tons and were 37 ft. 6½in long. They had to operate over the 12 miles of New York Central track electrified at 660 V DC third rail from Grand Central to Woodlawn, so had AC/DC series commutator motors; the four Westinghouse 130 motors had a total hourly rating of 1,420 hp. The loco could change from AC to DC without stopping; power pickup was by eight third-rail shoes which could be lowered, plus two large AC pantographs and a small pantograph for DC where short sections through switches were too complicated for third-rail supply. A second order of six supplied in 1908 had design changes, including guide wheels at each end to obviate "nose" or oscillation at high speed. The highly successful class operated to 1947, although some were retired from 1936.

In 1910 New Haven decided to extend electrification, and to electrify freight and switching as well as passenger service. Before placing a major order, the line ordered four experimental locomotives from Baldwin-Westinghouse, built in 1910-11. They


1910 experimental #069 NYNH&H loco.

were numbered No 069, No 070, No 071 and (?).

While three were equipped for passenger service, the EF-1 was intended for freight service. As such, it did not have train-heating boilers or third-rail DC equipment.

Five 1-C-1 + 1-C-1 passenger loco were supplied by Baldwin-Westinghouse in 1919. They were 69 feet long and weighed 175 tons, with a top speed of 70 mph. The hourly rating was 2460 hp, and maximum tractive effort of almost 50,000 lb. A further 12 were supplied in 1923 and 10 in 1927; totaling 22.

This 1942-43 order for 10 freight locos was split between GE and B-W. They were AC only, weighed 246 tons, and rated 4860 hp with a tractive effort of 90,000 lb. In 1948, 5 Baldwin-Westinghouse locos were equipped with train-heating boilers for passenger service.

Great Northern - Z-1 class locomotives were supplied to the Great Northern Railway for the new longer and lower Cascade Tunnel and the extended electrifica-


GN Z-1 loco.

tion of the line through the Cascade Range. They were used from January 1927 through the old tunnel, and through the new tunnel when opened in 1929. Two were supplied in 1926 and 3 in 1928.

Each Z-1 locomotive had two semi-permanently coupled 1-D-1 box-cab units; the pair weighed more than 371 tons with an hourly rating of 4330 hp and a continuous tractive effort of 88,500 lbs. per unit and a maximum starting effort of 189,000 lb. The locos had a motor-generator set with a synchronous AC motor and DC generator which supplied the Westinghouse 356-A traction motors geared to each driving axle. They were equipped for multiple-unit control and regenerative breaking. A pair of Z-1s with four units could move a 2900-ton train over the 2.2% maximum gradient of the new Cascade line.


Typical BLW steeple-cab electric.

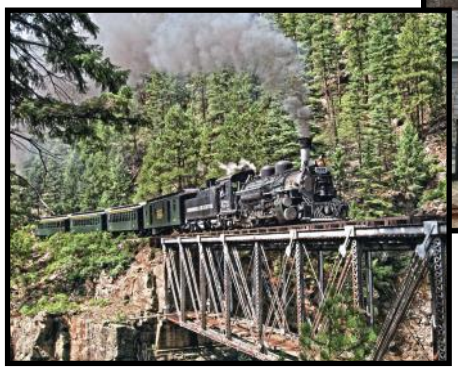
Marker Lights

2nd Annual Photo Contest Winners

There was a tie for Best of Show, winners were Steve Baker and David Winans. They also won 1st place in Other and Diesels categories.

1st place in Steam category was taken by Steve Baker.

2nd place in Diesel was submitted by Brian Martsolf.



Craig Myers won second place in Steam category

2nd place in Other was taken by Anne Winans.

Third place in Steam was by Bruce Gathman.

Articles for the Carolina Conductor

Submit an article of 200 words or more with some photos and captions and see them in print. Your editor needs more contributions of local railway history and news.

CHECK OUT THE CRHA:

WWW.FACEBOOK.COM/GROUPS/CRHAINC/
WWW.HUBCITYRRMUSEUM.ORG/CAROLINA-RAILROAD-HERITAGE-ASSOCIATION

CHECK OUT THE HCRRM:

WWW.FACEBOOK.COM/HUBCITYRRMUSEUM/
WWW.HUBCITYRRMUSEUM.ORG