Carolina Conductor

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Preserving the Past
Active in the Present
Planning for the Future

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

Meeting Site:
Fountain Inn Presbyterian Church
307 North Main Street
Fountain Inn, SC 29644
3rd Friday of the Month at 7:00 p.m.

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Articles can be submitted anytime.

Baldwin Locomotive Works

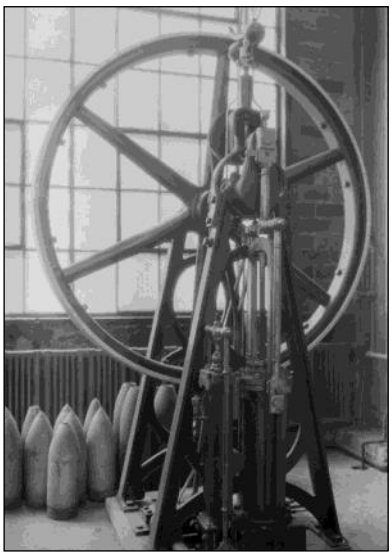
Founded: 1825 Philadelphia, PA
Founder: Matthias W. Baldwin
Defunct: 1951 Eddystone, PA
Headquarters: Eddystone, PA

Matthias W. Baldwin

The Baldwin Locomotive Works (BLW) was an American manufacturer of railroad locomotives from 1825 to 1951. Originally located in Philadelphia, it moved to nearby Eddystone, Pennsylvania, in the early 20th century. The company was for decades the world's largest producer of steam locomotives, but struggled to compete as demand switched to diesel locomotives. Baldwin produced the last of its 70,000-plus locomotives in 1951, before merging with the Lima-Hamilton Corporation on September 11, 1951, to form the Baldwin-Lima-Hamilton Corporation.

Beginning

The BLW had a humble beginning. Matthias W. Baldwin, the founder, was a jeweler and whitesmith, who, in 1825, formed a partnership with machinist David H. Mason, and engaged in the manufacture of bookbinders' tools and cylinders for calico printing. Baldwin then designed and constructed for his own use a small stationary engine, the workmanship of which was so excellent and its efficiency so great that he was solicited to build others like it for various parties, and



Original Baldwin stationary engine.

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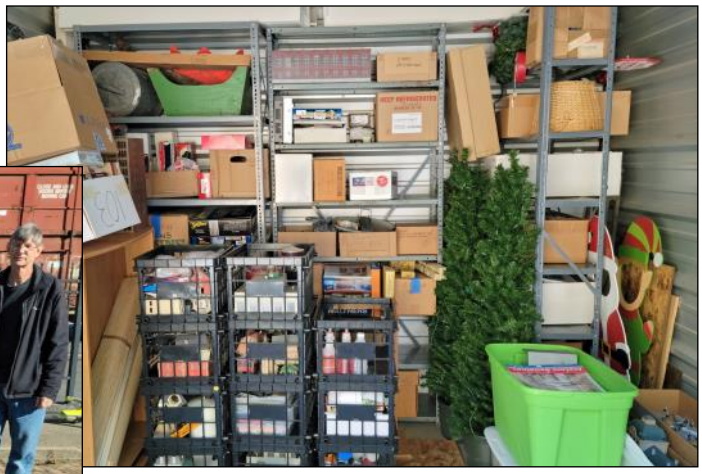
↖ **Please take notice of the new email addresses for the board members.**

Museum Happenings



The storage unit is getting full with donations. Lots of sorting of items to be put on sale in the caboose gift shop.

Work crew is placing the first of two restored baggage wagons at the museum. Second will be placed by the museum exit on the trackside of the building.

It's not just the kids that like watching trains on our observation deck.

These are the stencils developed by Bo Brown to letter the baggage wagons.

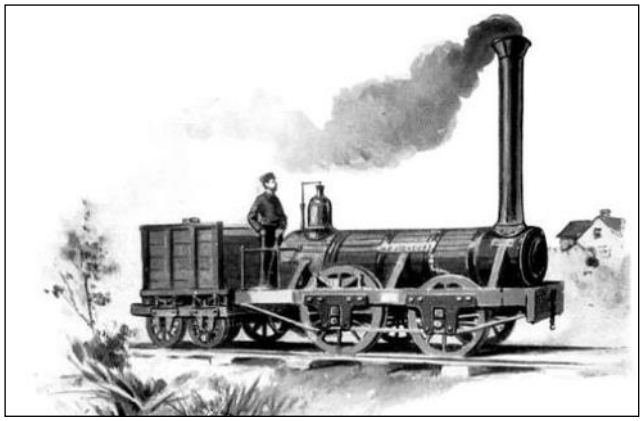
Wanted—Articles for the Carolina Conductor

Submit an article of 200 words or more with some photos and captions and see them in print. Every one of us has some unique railroad experience that would make interesting reading for our membership. Your editor

thus led to turn his attention to steam engineering. The original engine was in use and powered many departments of the works for well over 60 years, and is currently on display at the Smithsonian Institution in Washington, D.C.

In 1831, at the request of the Philadelphia Museum, Baldwin built a miniature locomotive for exhibition which was such a success that he received that year an order from a railway company for a locomotive to run on a short line to the suburbs of Philadelphia. The Camden and Amboy Railroad Company (C&A) had shortly before imported a locomotive, the *John Bull,* from England, which was stored in Bordentown, New Jersey. It had not yet been assembled by Isaac Dripps (under the direction of C&A president Robert L. Stevens) when Baldwin visited the spot. He inspected the detached parts and made notes of the principal dimensions. Aided by these figures, he commenced his task.

The difficulties attending the execution of this first order were such that they are not easily understood by present-day mechanics. Modern machine tools simply did not exist; the cylinders were bored by a chisel fixed in a block of wood and turned by hand; the workmen had to be taught how to do nearly all the work; and Baldwin himself did a great deal of it with his own hands.



"Old Ironsides" - Baldwin's first locomotive.

It was under such circumstances that his first locomotive, christened *Old Ironsides*, was completed and tried on the Philadelphia, Germantown and Norristown Railroad on November 23, 1832. It was at once put in active service and did duty for over 20 years. It was a four-wheeled engine, weighing a little over five tons; the driving wheels were 54 inches in diameter, and the cylinders were of 9½ inches bore by 18 inches stroke. The wheels were of heavy cast iron hubs, with wooden spokes and rims, and wrought iron tires, and the frame was made of wood placed outside the wheels. It had a 30 inch diameter boiler which took 20 minutes to raise steam. Top speed was 28 mph.

Early Years

Baldwin struggled to survive the Panic of 1837. Production fell from 40 locomotives in 1837 to just nine in 1840 and the company was heavily in debt. As part of the survival strategy, Matthias Baldwin took on two partners, George Vail and George Hufty. Although the partnerships proved short-lived, they helped Baldwin pull through the economic hard times.

Zerah Colburn was one of many engineers who had a close association with BLW. Between 1854 and 1861, Colburn went to work more or less permanently in London, England. The journalist was in frequent touch with M. W. Baldwin, as recorded in Zerah Colburn: *The Spirit of Darkness*. Colburn was full of praise for the quality of Baldwin's work.

In the 1850s, railroad building became a national obsession, with many new carriers starting up, particularly in the Midwest and South. While this helped drive up demand for Baldwin products, it also increased competition as more companies entered the locomotive production field.

Still, Baldwin had trouble keeping pace with orders and in the early 1850s began paying workers piece-rate pay. By 1857, the company turned out 66 locomotives and employed 600 men. But another economic downturn, this time the Panic of 1857, cut into business again. Output fell by 50 percent in 1858.

1860–1899

The Civil War at first appeared disastrous for Baldwin. According to John K. Brown in *The Baldwin Locomotive Works, 1831–1915: A Study in American Industrial Practice*, at the start of the conflict Baldwin had a great dependence on Southern railways as its primary market. In 1860, nearly 80 percent of Baldwin's output went to carriers in states that would soon secede from the Union. As a result, Baldwin's production in 1861 fell more than 50 percent compared to the previous year. However, the loss in Southern sales was counter-

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balanced by purchases by the U.S. Military Railroads and the Pennsylvania Railroad, which saw its traffic soar, as Baldwin produced more than 100 engines for carriers during the 1861–1865 war.

Typical loco built by Baldwin in the 1850-80s.

By the time Matthias Baldwin died in 1866, his company was vying with Rogers Locomotive and Machine Works for the top spot among locomotive producers. By 1870 Baldwin had taken the lead and a decade later, it was producing 2½ times as many engines as its nearest competitor, according to the U.S. Manufacturing Census.

In 1897 the Baldwin Locomotive Works was presented as one of the examples of successful shop management in a series of articles by Horace Lucian Arnold. The article specifically described the Piece Rate System used in the shop management.

Burton commented, that "in the Baldwin Locomotive Works... piecework rates are seldom altered. Some rates have remained unchanged for the past twenty years, and a worker is there more highly esteemed when he can, by his own exertions and ability, increase his weekly earnings. He has an absolute incentive to increase his output as much as he possibly can, because he knows that he will not, by increasing his own income, lead to cutting piece-work rates, and so be forced to make still further exertions in order to maintain the same weekly wage."

20th Century

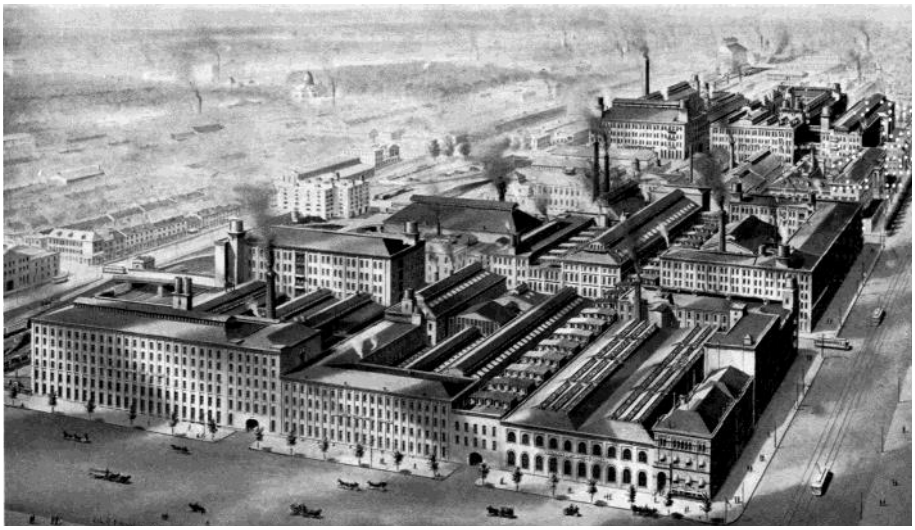
Initially, Baldwin built many more steam locomotives at its cramped 196 acres Broad Street Philadelphia shop but would begin an incremental shift in production to a 616 acres site located at Spring Street in nearby Eddystone, Pennsylvania, in 1906. Broad Street was constricted, but even so, it was a huge complex, occupying the better part of 8 square city blocks from Broad to 18th Streets and Spring Garden Street to the Reading tracks just past Noble Street. Eddystone on the other hand was spread out over 600 acres. Its capacity was well over 3000 locomotives per year. The move from Broad Street was completed in the late 1920s.

Gilded Age

The American railroad industry expanded significantly between 1898 and 1907, with domestic demand for locomotives hitting its highest point in 1905. Baldwin's business boomed during this period while it modernized its Broad Street facilities. Despite this boom, Baldwin faced many challenges including the constraints of space in the Philadelphia facility, inflation, increased labor costs, Labor tensions, the substantial increase in the size of the locomotives being manufactured and the formation of the American Locomotive Company, an aggressive competitor which eventually became known simply as Alco.

From 1904 to 1943, Baldwin and Westinghouse marketed Baldwin-Westinghouse electric locomotives and A.C. electrification of railroads, particularly to the New Haven Railroad.

In 1906 the Hepburn Act authorized greater gov-



The Baldwin Eddystone plant in its heyday.

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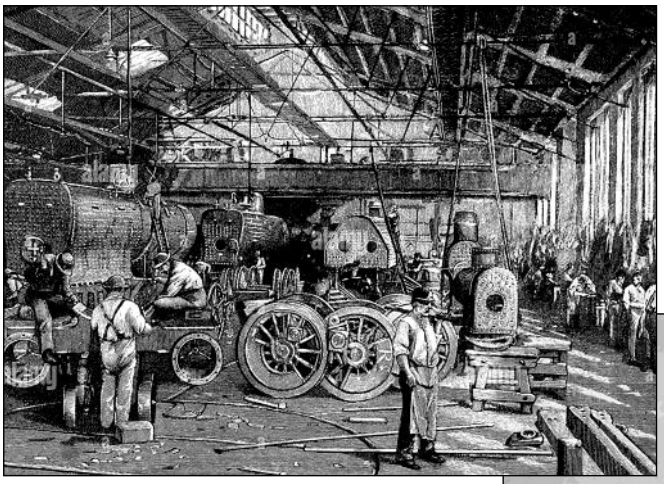
ernmental authority over railroad companies, and revitalized the Interstate Commerce Commission (ICC), which stepped up its activities. The ICC was given the power to set maximum railroad rates, and to replace existing rates with "just-and-reasonable" maximum rates, as defined by the ICC.

The limitation on railroad rates depreciated the value of railroad securities, and meant that railroads stopped ordering new equipment, including locomotives. This may have been a factor in precipitating the Panic of 1907, which in turn disrupted finance and investment in new plants. Both of these events had a direct negative effect on the railroad industry, especially the locomotive builders.



Early erecting shop view.

Baldwin's locomotive output dropped from 2,666 in 1906 to 614 in 1908. The company cut its workforce from 18,499 workers in 1907 to 4,600 the following year. Baldwin's business was further imperiled when William P. Henszey, one of Baldwin's partners, died. His death left Baldwin with a $6 million liability. In response, Baldwin incorporated and released $10 million worth of bonds. Samuel Vauclain wanted to use these funds to expand Baldwin's capacities so it would be prepared for another boom. While other Baldwin officers opposed this expansion, Vauclain's vision won out; Baldwin would continue to expand its Eddystone plant until its completion in 1928. By 1928, the company moved all locomotive production to this location, though the plant would never exceed more than one-third of its production capacity.

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, Great Britain 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 Baldwin Locomotive Works. Baldwin expanded their Eddystone, Pennsylvania, shop opened in 1905 into the Eddystone Arsenal which manufactured most of these rifles and artillery shells before being converted to locomotive shops when the war ended.

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.

Typical trench railway locomotive delivered by Baldwin to the Allies.

Decline

After the boom years of World War I and its aftermath, Baldwin's business would decline as the Great

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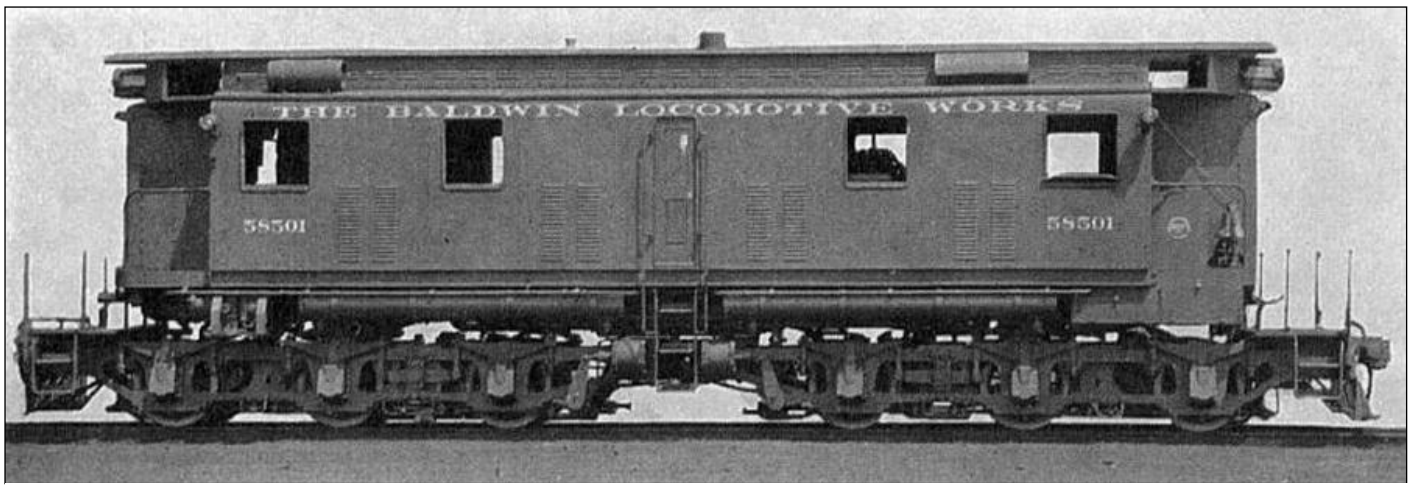
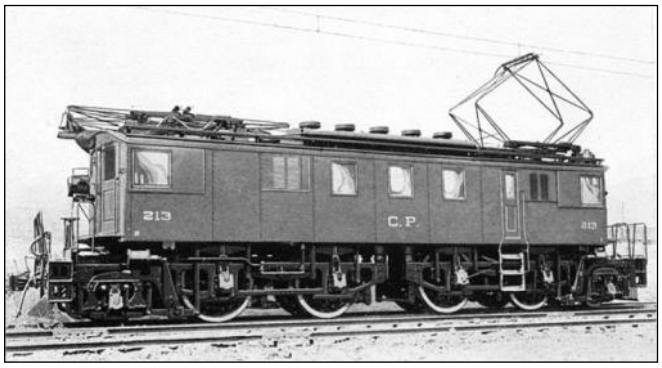


1925 Baldwin's first diesel locomotive. It was a twin engined failure.



Electric No. 213 of the Paulista Railroad, built by Baldwin and Westinghouse in 1921 for passenger service.

Depression gripped the country and diesel locomotives became the growth market on American railways towards the end of the 1930s. During the 1920s the major locomotive manufacturers had strong incentives to maintain the dominance of the steam engine. The Baldwin-Westinghouse consortium, which had produced electric locomotives since 1904, was in fact the first American locomotive builder to develop a road diesel locomotive, in 1925. Its twin-engine design was not successful, and the unit was scrapped after a short testing and demonstration period. Westinghouse and Baldwin collaborated again in 1929 to build switching and road locomotives (the latter through Baldwin's subsidiary Canadian Locomotive Company). The road locomotives, Canadian National class V1-a, No. 9000 and No. 9001, proved expensive, unreliable, frequently out of service, and were soon retired.

Westinghouse cancelled its efforts in the diesel locomotive field with the onset of the Great Depression, opting to supply electrical parts instead. The early, unsuccessful efforts of Baldwin-Westinghouse in developing diesel-electric locomotion for mainline service led Baldwin in the 1930s to discount 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 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, which had left them overextended financially and operating at a fraction of capacity as the market for steam locomotives declined in the 1930s.

In contrast, ALCO, while remaining committed to steam production, pursued R&D paths centered on both steam mainline engines and diesel switch engines in the 1920s and '30s, which would position them to compete in the future market for diesel locomotives.

In 1928 Baldwin began an attempt to diversify its product line to include small internal combustion-electric locomotives but the Great Depression thwarted these efforts, eventually leading Baldwin to declare bankruptcy in 1935. At the invitation of the owners of the Geo D. Whitcomb Company, a small manufacturer of gasoline and diesel industrial locomotives in Rochelle, Illinois, Baldwin agreed to participate in a recapitalization program, purchasing about half of the issued stock. By March 1931, the small firm was in

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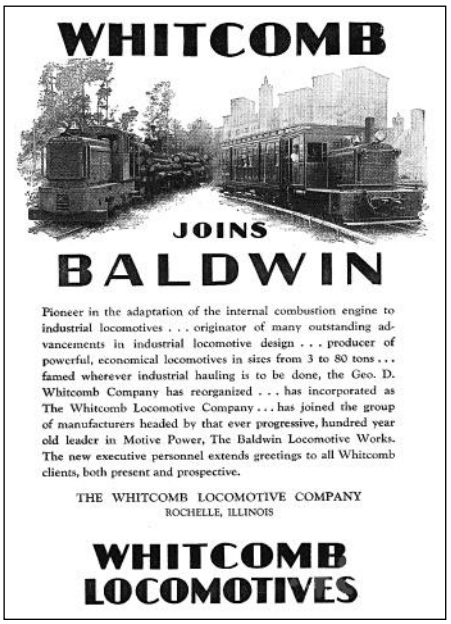

financial trouble and Baldwin filed a voluntary bankruptcy for Whitcomb with Baldwin gaining complete control and creating a new subsidiary, the Whitcomb Locomotive Company. This action would lead to financial losses, an ugly court battle between Baldwin and William Whitcomb, the former owner of the company, and bankruptcy for both parties.

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, EMD 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, prone to slipping, 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 could operate on more tracks than the S1, they still had many of the problems of the S1 and additional mechanical problems related to their unique valve design. 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.

Baldwin/Westinghouse S2 locomotive built for the PRR.

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. The General Motors Electro-Motive Division 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

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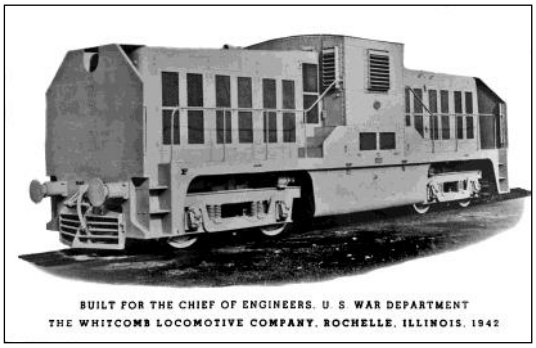
1930s, and its application of model design standardization (yielding lower unit costs) and marketing lessons learned in the automotive industry, were the principal reason for EMD's competitive advantage in the late 1940s and afterward (clearly implying that the wartime production assignments were merely 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 (more flexible output; 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 except for the GM Research Corporation led by Charles F. Kettering, and the GM subsidiaries Winton Engine Corporation and Electro-Motive Corporation.

Baldwin made steam engines for domestic US railroads, the US Army, British Railways, and made around one thousand E or Ye type engines for the Soviet Union in the Lend Lease arrangement (of an order of 2000 or so engines with other builders contributing to the total). Baldwin obtained a short-term market boost from naval demand for diesel engines and 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 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 (M4, M4A2). 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.

Soviet E type loco built for the Lend-Lease program.



BUILT FOR THE CHIEF OF ENGINEERS, U. S. WAR DEPARTMENT
THE WHITCOMB LOCOMOTIVE COMPANY, ROCHELLE, ILLINOIS, 1942

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