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Author(s): James M. Swank

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THE MANUFACTURE OF IRON AND STEEL RAILS
IN WESTERN PENNSYLVANIA.

BY JAMES M. SWANK.

This country leads all other countries in the production of iron and steel. This prominence in the manufacture of these products is only in part due to the bounty of nature in providing liberal supplies of the raw materials that are needed; it is largely the result of friendly legislation by the General Government: first, in more firmly establishing in 1861 the protective tariff policy, which has since been effectively maintained with but brief interruptions, and, second, in adopting in 1850 and in subsequently maintaining the policy of liberal grants of public lands to railroad companies. Through the operation of the protective policy the home market has been largely preserved for the home producers of iron and steel, and through the operation of the land-grant system, supplemented by the homestead policy, which first became effective in 1862, during the civil war, thousands of miles of railroad have been built in the Western States and Territories that would not otherwise have been built. With the building of these roads and of other railroads in the Eastern, Middle, and

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Southern States the population of all sections of the country has been greatly increased, the consumption of iron and steel and of other manufactured products has been greatly enlarged, vast mineral resources have been discovered and developed, and the whole country has been phenomenally enriched. Thousands of new farms have been opened, our agricultural products have been many times multiplied, and both home and foreign markets for the sale of our surplus crops and of all other products of the farm, the forest, the fishery, the mine, and the factory have been quickly and cheaply reached.

It is the exact truth to say that many of these railroads could not have been built if our protective tariff policy had not built up our iron-rail industry in the third quarter of the nineteenth century and our steel-rail industry in the fourth quarter. Until we began to make our own iron rails and afterwards our own steel rails foreign manufacturers charged us excessive prices for such rails as we could afford to buy. Both of the rail industries mentioned had at the first to struggle for their very existence against foreign competition, the early duties on foreign iron rails and afterwards on foreign steel rails not being sufficiently protective, but in the end the control of the home market was gained, the production of rails increased enormously, and the prices of both iron and steel rails to railroad companies were steadily reduced. Before we began to make our own steel rails English manufacturers charged us more than three times as much per ton for the steel rails we bought from them as American manufacturers have since charged for millions of tons. These millions of tons have also been sold at lower prices than were previously charged for iron rails, either of home or foreign manufacture.

The resisting and wearing qualities of a steel rail being far superior to those of an iron rail, it is capable of supporting a much heavier weight of cars, locomotives, freight, and passengers, and it permits trains to be moved at much higher speed; hence the carrying capacity of our railroads

has been increased many times, while the cost of operating them per ton of freight or per passenger has been greatly reduced. The life of a steel rail, notwithstanding the greater service it is called on to perform, being many times greater than that of an iron rail, the cost to our railroad companies for track renewals is many times less than if iron rails were still used. The immense agricultural crops of the country in the last thirty or thirty-five years, if they had been produced, never could have been transported to either home or foreign markets if only iron rails had been continued in use. The attempt to transport them upon iron rails, even with lighter cars and locomotives than are now used, would have so worn out the rails that the tracks would have been constantly torn up for repairs, and this condition would have resulted in a continual interruption to all traffic, while the heavy cars and locomotives of the present day could not have been used at all.

In ten years after we began the manufacture of steel rails in commercial quantities, which was in 1867, the charge for transporting a bushel of wheat by railroad from Chicago to New York was reduced from 44.2 cents a bushel to 20.3 cents, and it has since been further reduced to 8.75 cents. In 1860, with only iron rails, the charge for moving a ton of freight one mile on the New York Central Railroad was 2.065 cents; in 1870, after we had commenced to use steel rails, the charge was reduced to 1.884 cents; in 1880, when steel rails were in more general use on our trunk railroads, the charge was further reduced to 8.79 mills, and in 1901 it was still further reduced to 7.4 mills. In the decade from 1870 to 1880 the charge for transporting a barrel of flour from Chicago to New York by rail fell from \$1.60 to 86 cents. In 1903 the freight rate over the Pennsylvania Railroad system in car-load lots from Chicago to New York was 36 cents per barrel.

But for our cheap steel rails flour and meat, lumber and coal, and numerous other heavy products could not have been cheaply distributed to consumers, the necessities of

life would have been largely enhanced in price through the high cost of transportation, and the whole country would have had a much less rapid growth than it has experienced.

The benefits which this country has derived from cheap steel rails of home manufacture are so numerous and enter so largely into the daily life of all our people that they have ceased to excite special comment, like the natural blessings of light, air, and water.

In the manufacture of iron rails Western Pennsylvania was prominent in the early days of American railroads. At Brady's Bend, on the Allegheny River, in Armstrong County, the Great Western Iron Works, embracing four furnaces and a rolling mill, were commenced in 1840 by the Great Western Iron Company, composed of Philander Raymond and others. The rolling mill was built in 1841 to roll bar iron, but it afterwards rolled iron rails, which were at first only flat bars, with holes for spikes countersunk in the upper surface, and in 1846 and afterwards it rolled T rails. In 1856 it made 7,533 tons of rails. It was one of the first mills in the country to roll T rails, our first rails of this pattern having been rolled in 1844 at the Mount Savage Rolling Mill, in Maryland. The Brady's Bend mill continued to make rails until after the close of the civil war. In October, 1873, it ceased operations. Shipments of rails were made by the Allegheny River. In 1849 the Great Western Iron Company failed and the Brady's Bend Iron Company took its place. The mill and the furnaces have long been abandoned and have gone to decay. In the *Railway Age*, of Chicago, for April 3, 1903, there appeared the following interesting reminiscence of the Brady's Bend enterprise, contributed by Mr. G. W. P. Atkinson.

The Allegheny Valley Railroad in 1865 operated only 44 miles from Pittsburgh to Kittanning. It is now part of the Pennsylvania system. At that time steamers ran up the Allegheny River from Pittsburgh to Franklin when there was water enough. There was a rail mill at Brady's Bend in 1865, with which the writer was connected, and which during the war made a great deal of railroad iron. William B. Ogden,

Chicago's first mayor, was president of it, and the writer had charge of its sales. If the river was not navigable for steamers we had to take the stage from the Kittanning end of the Allegheny Valley Railroad to Brady's Bend, and a tough ride it was. The writer and William B. Ogden made the trip several times together. Rails were shipped by river in barges to Pittsburgh or Cincinnati. In the fall of 1865 the writer shipped 2,000 tons of rails for the Nashville and Chattanooga Railroad (which was run by the government during the war) from the Brady's Bend mill in barges down the Allegheny and the Ohio Rivers and up the Cumberland River to Nashville. It took about six weeks to reach Nashville. As one passes East Brady Station to-day on the Allegheny Valley Railroad the tall stack of the rolling mill is visible on the opposite side of the river, all that is left of the once busy town of Brady's Bend, with 3,000 people. [The stack was torn down in 1903.]

In 1853 the Cambria Iron Works were built at Johnstown, in Cambria County, by the Cambria Iron Company, expressly to roll T rails, George S. King being the leading member of the company and the originator of the enterprise. Within a year the works were making rails. Several charcoal and coke furnaces were connected with these works. In 1856, under new management, they made 13,206 tons of rails, and their production was afterwards increased. For almost twenty-nine years, beginning with 1855, Daniel J. Morrell, who died in 1885, was the successful general manager of these works. In 1871, through his persistent advocacy of steel rails, their manufacture was added to that of iron rails, in which branch of the steel industry these works have ever since been prominent. John Fritz, the distinguished engineer, is entitled to the credit of having made the manufacture of iron rails at these works a conspicuous success, accomplished chiefly through his introduction of three-high rolls in 1857; while his brother, George Fritz, also distinguished as an engineer, successfully superintended the introduction at the same works of the Bessemer process and the manufacture of Bessemer steel rails. In 1898 the works were leased to the Cambria Steel Company, which now operates them.

In 1865 the Superior Iron Company built the Superior

Rolling Mill at Manchester, in Allegheny County, to make iron rails. Connected with this mill were two coke furnaces, built in 1863. The company operated the works until September, 1867, when they were leased by Springer Harbaugh. On January 1, 1870, Harbaugh, Mathias & Owens took possession as owners, and on August 1, 1874, they failed, when the manufacture of rails was abandoned. The works themselves have long been abandoned. A few other iron-rail mills in Western Pennsylvania, including those which were equipped for the manufacture only of mine rails and other light rails, need not be mentioned. Of these mills those which made rails of heavy sections never at any time produced any considerable tonnage. It is a noteworthy fact that Allegheny County, with all its enterprise in the manufacture of iron and steel, did not begin to make rails of heavy sections until the Superior Rolling Mill was built in 1865.

Iron rails are not now made in Western Pennsylvania, except occasionally a very few tons of light rails for lumber and mine roads.

The Bessemer process for the manufacture of steel, which has given us the steel rail, dates from 1855, in which year Henry Bessemer, of England, obtained his first patent for this process. Other patents followed in 1856, but the important invention was not perfected until 1857, in which year Robert Forester Mushet, also of England, added his essential spiegeleisen improvement. In 1856 Mr. Bessemer obtained patents in this country for his invention, but he was immediately confronted by a claim of priority of invention preferred by William Kelly, of Eddyville, Kentucky, but a native of Pittsburgh, Pennsylvania, which claim was approved by the Commissioner of Patents. Experiments were made with Mr. Kelly's process at the Cambria Iron Works in 1857 and 1858, and in September, 1864, steel was successfully made by this process at experimental works which were erected at Wyandotte, Michigan, by the Kelly Pneumatic Process Company, of which Daniel J. Morrell, of Johnstown, and William M. Lyon and James

Park, Jr., of Pittsburgh, as well as Mr. Kelly, all Western Pennsylvanians, were members. Success, however, was attained only by the use of the Mushet improvement, the control of which for this country the company had secured. In February, 1865, the firm of Winslow, Griswold & Holley was successful at Troy, New York, in making steel by the Bessemer process with the Mushet improvement, the firm having obtained the control for this country of the Bessemer patents but not the right to use the Mushet improvement. In 1866 the ownership of all the above patents was consolidated, and soon afterwards the manufacture of Bessemer steel in this country in commercial quantities was commenced. At first and for many years afterwards only rails were made from Bessemer steel, and to-day nearly all the rails that are in use in this country were so made.

Steel rails have almost entirely supplanted iron rails on American railroads. *Poor's Manual of the Railroads of the United States* for 1901 contains a statement which shows the number of miles of steam railroad track, exclusive of elevated city passenger railway tracks, that were laid with iron and steel rails respectively in each year from 1880 to 1901. In 1880 there were 81,967 miles laid with iron rails and 33,680 miles, or 29.1 per cent., laid with steel rails. In 1901 there were 19,181 miles laid with iron rails and 246,811 miles, or 92.7 per cent., laid with steel rails. In both years side tracks and double tracks are included. The length of the steam railroads completed in the United States at the close of 1901, without regard to the number of their tracks, and excluding all elevated city passenger railways, was 198,787 miles.

Much of the progress of this country in the manufacture of Bessemer steel rails has been due to the enterprise displayed by Andrew Carnegie at the Edgar Thomson Steel Works, at Braddock, near Pittsburgh, the site of Braddock's defeat in 1755, the construction of which works was undertaken in 1873 and completed in 1875 by a company of which Mr. Carnegie was the leading spirit and of which

his brother, Thomas M. Carnegie, who died in 1886, was a member. Andrew Carnegie was the leading stockholder in the company. These works were built expressly to make Bessemer steel rails. The first Edgar Thomson steel rail was rolled on September 1, 1875. At first only a Bessemer plant and a rolling mill were built, but in 1879 the erection of large blast furnaces was commenced. Until these furnaces were built the Edgar Thomson steel plant was largely supplied with pig iron from the two near-by Lucy Furnaces, built respectively in 1872 and 1877, and owned in 1875 and subsequently by Carnegie Brothers & Co.

From year to year Mr. Carnegie steadily increased the capacity of the Edgar Thomson Works and thus cheapened the cost of producing rails. From the first he had unbounded faith in the future of the steel rail; he knew that its general substitution for the iron rail on American railroads was sure to come at an early day. He foresaw this evolution and fully prepared for it when experienced manufacturers and even many railroad officials continued to praise the iron rail. Hence, when others were timid or neglectful of their opportunities, he introduced at the Edgar Thomson Works from time to time the best and most economical methods of manufacture; the blast furnaces at these works were the best in the country, the Bessemer converters were the largest, and the rail mill was the swiftest; so that, when an extraordinary demand for steel rails would come, as it often did come, he was fully prepared to meet it and at a lower cost than that of his competitors. He had business foresight in an eminent degree; he had unfaltering courage; and more than all his contemporaries he believed in tearing out and making a scrap heap of even modern machinery when better could be found. The best engineering talent in the country was engaged to bring the Edgar Thomson Works up to the highest possible state of efficiency.

These characteristics were again illustrated when Mr. Carnegie and his partners in the firm of Carnegie, Phipps

& Co. succeeded to the ownership of the Homestead Steel Works in 1883, and again in 1890 when Carnegie Brothers & Co., then operating the Edgar Thomson Works, succeeded to the ownership of the Duquesne Steel Works, with the result that steel in other forms than rails has been greatly cheapened to all consumers. This lowering of prices was accomplished through the use of the best mechanical appliances and the production of the largest possible tonnage. At the Edgar Thomson Works Mr. Carnegie set the pace for a large annual tonnage of steel rails, and this policy was afterwards applied to the production of pig iron and other products. His American competitors were soon compelled to abandon their conservative ideas and to enlarge the capacity and increase the efficiency of their works. And he has compelled Europe to revise in a large measure its metallurgical practice and also to cheapen its prices for all steel products. It has freely copied the devices and processes which his engineers, with his encouragement, had introduced or perfected. Of the engineers referred to, Mr. Carnegie's first superintendent at the Edgar Thomson Steel Works, Captain William R. Jones, whose tragic death occurred in 1889, is entitled to special mention. To these engineers and to his "young partners" Mr. Carnegie has always acknowledged that he was under great obligations.

Mr. Carnegie's distinguished and remarkable career as an iron and steel manufacturer, which conspicuously began on the threshold of the fourth quarter of the nineteenth century, when the Edgar Thomson Works were first put in operation, although he had previously been identified with our iron industry, may be said to have ended immediately after the close of the century, in February, 1901, when he transferred the ownership of all the iron and steel properties and auxiliary enterprises in which he had a controlling proprietary interest to the United States Steel Corporation. Soon afterwards, in 1902, he was chosen president of the Iron and Steel Institute, whose membership is not restricted by political or geographical lines, but which has

its home in Great Britain, and he presided over its deliberations at the spring and autumn sessions of 1903, at London and Barrow respectively, on each occasion delivering an address. Mr. Carnegie was the first American to receive this honor. No higher honor can be conferred upon any iron and steel manufacturer, wherever his home may be, than to be elected to the presidency of the Iron and Steel Institute.

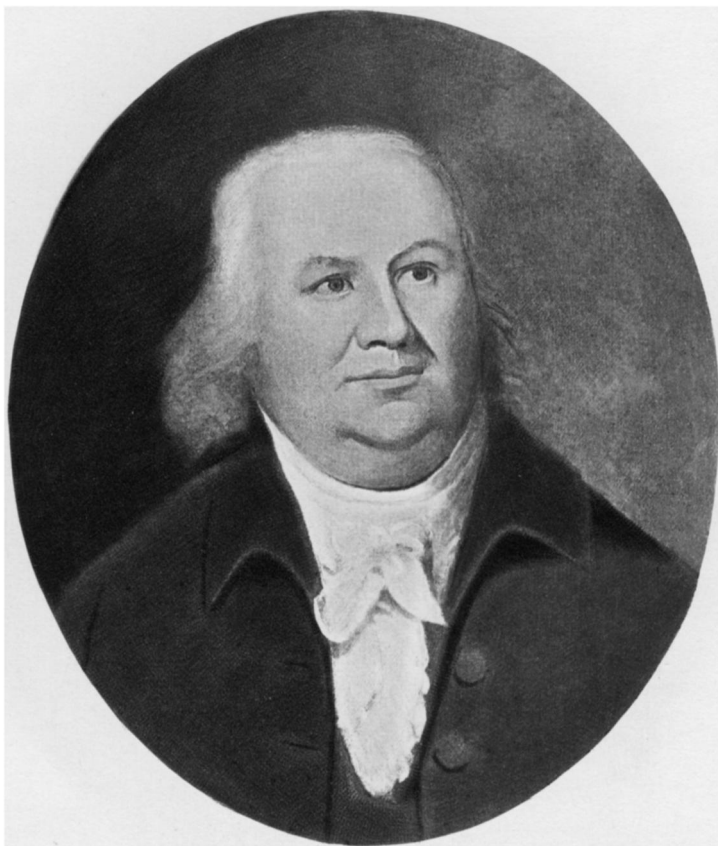
The great success of the Edgar Thomson Steel Works and of other Bessemer steel plants in the United States led to the erection in Allegheny County of two competing steel works, noticed above: the Homestead Steel Works, which were completed and put in operation in 1881, and the Duquesne Steel Works, which were undertaken in 1886 and put in operation in 1889. Both these works were built to make Bessemer steel, but, while the Homestead Works were erected to make miscellaneous steel products, including rails, the Duquesne Works were built to make rails only. The Homestead Works rolled their first steel rail on August 9, 1881, and the Duquesne Works rolled their first steel rail in March, 1889. Down to their absorption by Carnegie, Phipps & Co. in 1883 the Homestead Works rolled in all about 125,000 tons of rails, and down to their absorption by Carnegie Brothers & Co. in 1890 the Duquesne Works rolled in all about the same number of tons, all, or nearly all, of the rails rolled by both works being of heavy sections. Since the changes in ownership above noted these works have not made many rails. The Homestead Works have not made any rails since 1894 and the Duquesne Works have not made any since 1892. The Homestead Works were built by the Pittsburgh Bessemer Steel Company and the Duquesne Works by the Allegheny Bessemer Steel Company.

The prominence of Western Pennsylvania in the manufacture of steel rails to-day is best shown by a reference to the statistical record. In 1902 the whole country made 2,935,392 tons of Bessemer steel rails, and of this large

production Western Pennsylvania made 950,266 tons, or nearly one-third of the country's total production. This large tonnage was almost entirely rolled at the two works above mentioned, the Edgar Thomson and the Cambria Works, operated respectively by the Carnegie Steel Company and the Cambria Steel Company, less than three thousand tons having been rolled by the Jones & Laughlin Steel Company, which has never made the manufacture of rails a leading specialty.

The first thirty-foot rails ever rolled in this country are claimed to have been rolled at the Cambria Iron Works in 1855. These rails were perfectly made, but there being no demand for them they were used in the company's tracks. In 1876 these works rolled the largest aggregate tonnage of rails that had been rolled in one year by one mill in this country up to that time. Their production of rails in that year was 103,743 net tons, of which 47,643 tons were iron rails and 56,100 tons were steel rails.

The first sixty-foot rails ever rolled in this country were rolled at the Edgar Thomson Steel Works in the fall of 1875 and were made of steel. At the Centennial Exhibition at Philadelphia in 1876 the Edgar Thomson Steel Company exhibited a steel rail which at that time was the longest steel rail that had ever been rolled. It was 120 feet long and weighed 62 pounds to the yard.



Robert Morris

*After the portrait by Edward Savage
owned by Charles Henry Hart, and
now in The Corcoran Gallery, Washington, D.C.*