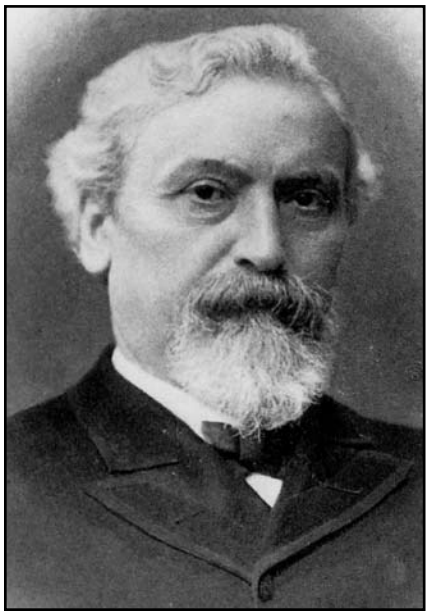
The Inspirations of a German Immigrant

Albert Fink

By Frank Griggs



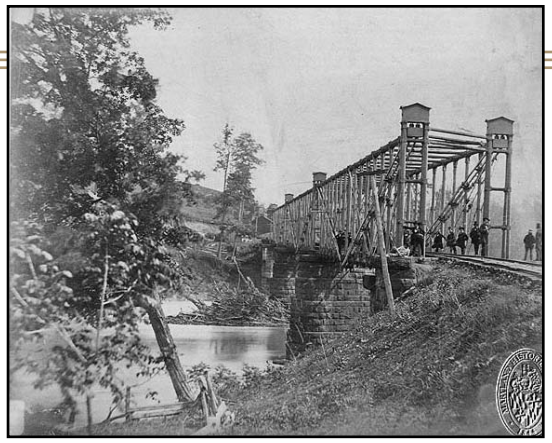
Albert Fink

On October 27, 1827 Fink was born in Lauterbach, Germany the son of Andreas, an architect, and Margherita Jacob. His father designed many buildings and churches in the area, and built a fine home he called Building Court. His father died young and Albert decided to go to the Polytechnic at Darmstadt to study architecture and civil engineering. During part of his training, he learned carpentry in the town of Offenbach. It was here that he met his future wife Mimi. He graduated in 1848 during tumultuous times and revolutions throughout Europe and Germany. He was offered a position as a teacher at the University, but decided to go to America with his brother Henry. In August he wrote, "In America a man may rise to the highest positions on his own merits. Surely this is the true freedom I long for." He was active in the revolution in September 1848 which made him even more determined to go to America. He set sail for America, landing in New York on May 2, 1849. He had no connections, but heard the Baltimore and Ohio Railroad was looking for engineers to lengthen its line from Harper's Ferry to the west.

He went to Baltimore and requested an interview with Wendel Bollman, the Master of the Road, after learning that Bollman had no engineering training and would likely welcome someone with his education. While waiting for the interview, Fink, probaly in order to make a better impression, designed and made a model of an iron bridge that could be built on the B & O. He noted in his diary "Bollman has come to my room several times, staying for hours, to study my drawings, and always he would say when I would ask him for a place. 'Come to my Office.'" Yet Bollman never made an offer and Fink went to work with a cabinet maker. It wasn't until December 21, 1849 that Benjamin Latrobe, Chief Engineer of the B & O, offered him a position as a draftsman upon the recommendation of a local sculptor. At the age of 22, his career in America began with that appointment.

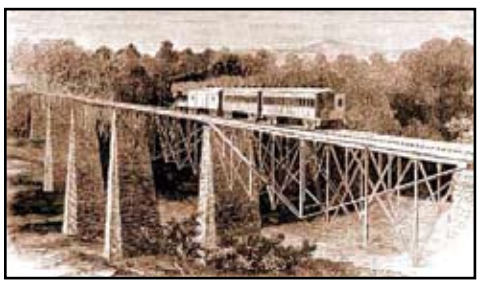
His first effort was to complete his design for an iron bridge to use on the B & O. He prepared his drawings, and he and Latrobe decided to enter them into a design competition held in Boston. He wrote in his diary, "The competition is over. We who have brought designs were handsomely entertained. I did not win. Latrobe has taken my defeat greatly to heart. I was surprised when he told me politics influenced the decision." On his return trip, Latrobe had Fink visit Major Mahan and Major Clark at West Point to show them his plan. They encouraged him to develop it and to keep them posted on its progress. Even though Squire Whipple had published his book on Bridge Building in 1847, in which he detailed the correct methods to analyze a truss, the method had not yet worked its way into the bridge building profession.

Hungerford, described Fink's design method in his history of the B & O as, "the rule of thumb methods that were used in the creation of so many early iron and wooden bridges were hardly to be trusted in the making of an all iron one. So Fink would go to work with pieces of tin and wires, building up trusses in miniature, testing strains and stresses carefully upon these, and from such experiments making his deduction and formulas for the construction of full sized spans." Based upon this work, Latrobe gave him the project of building a three span bridge across the Monongahela at Fairmount, Virginia, in 1852. Bollman by this time had patented and built several trusses and they were the accepted truss for shorter spans. Fink's plan was better suited to longer spans and was adopted by Latrobe for those sites requiring such spans.

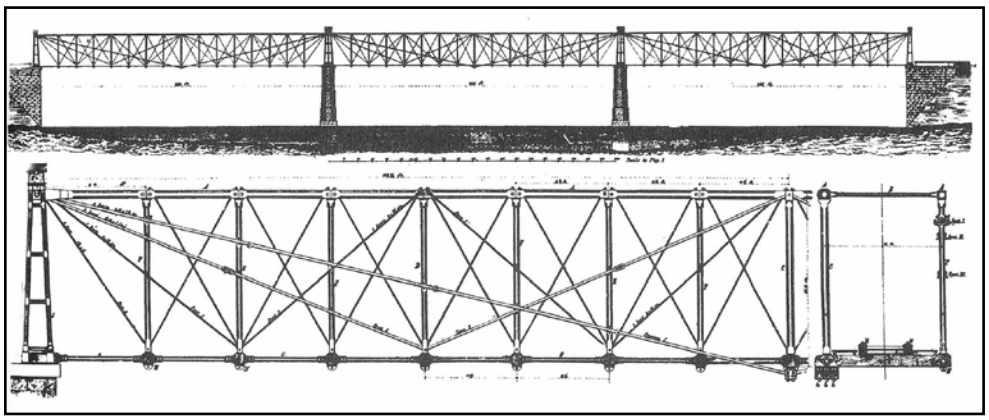


Monongahela Bridge 1852

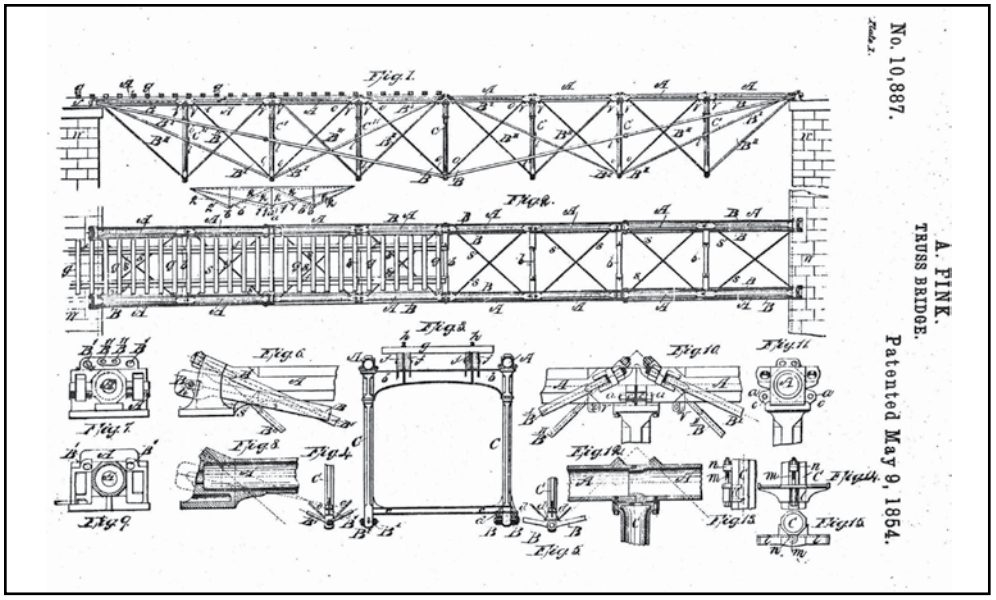
He wrote home to Mimi, "I am in complete charge of the building of our bridge across the Monongahela River, a project which will cost $120,000… I cannot help but think often of my colleagues in Germany who are



Green River Bridge



Monongahela Bridge



Patent drawing for deck structure

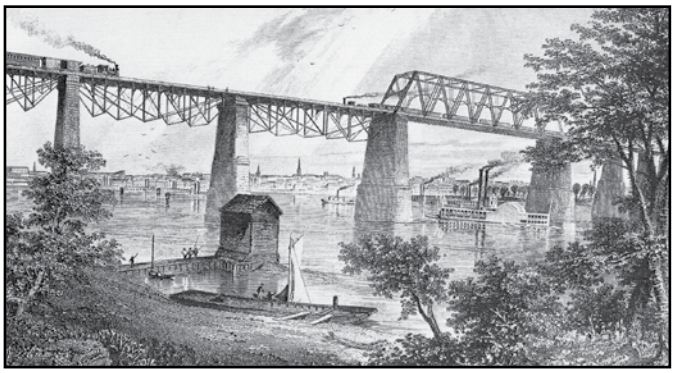
still sitting with their feet under a desk waiting for some opening…." The bridge, with its three 205 foot spans, was the longest span railroad bridge in the United States when completed, and served as the prototype for most long span bridges built on the B & O. Its top chord and vertical compression members were circular cast iron members, with all tension diagonals being fabricated wrought iron bars. For the next five years, Fink held various positions with the B & O and built the Fox Run and Trey Viaducts, both major cast iron structures.

On May 9, 1854 he received patent number 10,887 for a truss bridge. It was for a deck truss and a through truss like he built over the Monongahela River. His bridge was unique and patentable for *"the method of combining the different systems of triangular bracings, above described, so that a weight coming on one of the systems of the truss is not only transferred over one or more other systems, before it is carried back to the abutments; but the foot of the post in each triangle, being unconnected with the tension rods of the other triangular bracings, can settle vertically, as well as move to the side; so that the tension rods of each system of the triangular bracing will be strained equally, when the bridge settles under a superincumbent weight. This would not be the case, if the foot of the post in the 2d system of triangular bracing rested on the tension chord of the post, in the first system, as heretofore used…"* He also noted *"the sinking of a portion of the truss by a superincumbent weight, or by changes in the condition of the material used in construction from the effect of temperature, will not cause the several parts of the truss to deviate from their mutual adjustments…"* The truss he is referring to is the Bollman Truss, which had been patented two years earlier and was being built on the eastern segment of the B & O.

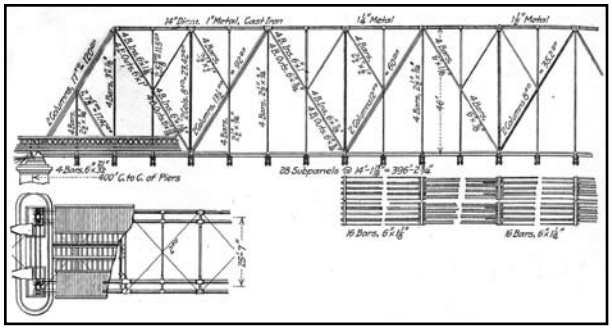
He left the B & O in 1857 to work on the Louisville and Nashville (L & N) railroad. One of his first efforts was the construction of the Green River Bridge near Mammoth Kentucky. It was a five span deck bridge with the three middle spans of 208 feet each, and the two outer spans 181 feet. The deck level was 115 feet above the water level in the river. The bridge opened in 1859, but during the Civil War the Confederates blew up the two southerly spans. Throughout the War, Fink had to constantly rebuild the line as it ran through an area that changed hands several times. He developed teams of men who would quickly rebuild the line in areas where the northern armies resumed control. Most of these repairs were temporary. It wasn't until the end of the War that Fink rebuilt the bridges and track permanently.

His major bridge after the War was his Louisville Bridge over the Ohio River that opened in 1870. It was his largest bridge and was the longest bridge (5,250 feet) in the world, at the time. It consisted of 25 conventional Fink deck trusses with spans ranging from 50 feet to 245-feet and 5-inches, and two major long span trusses of 370 feet and 400 feet. It was in the design of these trusses that Fink, once again, exhibited his innovative design power. The long span trusses were the first subdivided panel trusses in the United States. The 400 foot span while long was far from being the longest railroad span at the time.

His use of a Warren style truss with the panel sub-divided into four parts was a first in the United States. To carry the load, Fink doubled up the trusses with two identical trusses on each side of the span. The top



Louisville Bridge 1870 over the Ohio River



Louisville Bridge-400' main span, half section

Zoarville Bridge being dismantled (photo courtesy of Dave Tschantz.)

chord was a cast iron hexagonal shape (14-inch diameter) with a circular hole, leaving a wall thickness of 1 to 1½ inches. The compression members were wrought iron Phoenix sections with diameters varying from 5½ to 17 inches. All tension members were wrought iron bars with the lower chord consisting of 16 links varying between 6 x 1⅛ inches to 6 x 1¼ inches. The floor beams were cast iron with wrought iron trussing bars. The clearance over the two shipping channels was 101.5 feet. A swing bridge over the Louisville and Portland canal on the Kentucky side with a 264 foot total length was flanked on the land side by two 50 foot spans. Fink used a combination of cast and wrought iron and a variation on a common truss style to design a bridge that could carry the double track railroad. The bridge had a very long life and was not replaced until 1920. Construction of the superstructure started in May 1868 and finished in February 1870.

This was the last major bridge Fink designed, as in 1875 he left the L & N Railroad. He then finished his career with a position as Chairman of the Southern Railway and Steamship Association, formed to control and regulate rates among 25 participating rail lines, for one year. This was followed by his Chairmanship of the Trunk Line Association, an organization formed by the Pennsylvania Railroad, the Erie and New York Central and Hudson River Railroads to divide traffic to the west. In these positions, Fink demonstrated his understanding of the railroading business and developed methods for determining costs and rates. When the Interstate Commerce Act was passed in 1887, his position and work were nullified and he retired in 1888. Between 1877 and 1880 he served as Vice President and President of the American Society of Civil Engineers (ASCE).

Fink's bridge career spanned from 1852 to 1875 with the B & O and L & N railroads, and from 1875 to 1888 as a manager of railroad organizations throughout the eastern United States. His truss was adopted and promoted primarily by the Baltimore Bridge Company under C. Shaler Smith, who had worked with Fink on the L & N Railroad. Shortly after the Civil War the design was supplanted for railroads by Squire Whipple's double intersection truss. His ASCE memoir states "to be able to do good, to relieve suffering, was his principal happiness. He was a most remarkable man, a true gentleman and one who had reached the highest type of humanity." He died in 1897 after remarrying and having a daughter who wrote a mini biography of her father.

Only two of his bridges survive. The first was constructed approximately in 1870 as a railroad bridge and converted to vehicular use in 1893. The truss elements were moved to a park in Lynchburg, Virginia in 1985, where it is now used as a footbridge. It was designated a National Historic Civil Engineering Landmark in 1985. A 108 foot single span through truss originally built by Smith & Latrobe Company in 1869 was one of three spans to cross the Tuscarawas River at Zoarville, Ohio. It utilized Phoenix wrought iron compression members and cast iron junction blocks and was a modified Fink Truss, lacking four verticals. It was replaced with a new bridge in 1905 and moved to the present location where it was abandoned in place in 1940. Recently, it was removed to be restored and rebuilt at a new site.▪

Dr. Griggs specializes in the restoration of historic bridges, having restored many 19th Century cast and wrought iron bridges. He was formerly Director of Historic Bridge Programs for Clough, Harbour & Associates LLP in Albany NY and is now an independent Consulting Engineer. Dr. Griggs can be reached by email at **fgriggs@nycap.rr.com**