An early train in the region arrives at Natrona, Pa., October 20, 1866.

Photograph Robert M. Cargo, courtesy Wilkinsburg Historical Society.
Crowds cheered as the final track of the Pennsylvania Railroad connected Pittsburgh to Philadelphia in 1852. The railroad opened a new age of industrial growth in the city. Much faster than a canal boat or wagon, it moved Pittsburgh products to the ready markets of the East and the growing markets in the West. Demand for arms during the Civil War further accelerated the local economy and created the first great fortunes in the region, building a foundation of capital that helped fuel unprecedented growth in industry, enterprise, and wealth.

Everyone wanted a piece of the prosperity—unregulated but rife with risk. The chance of failure was great, but the promise of reward shined brighter. Inventors, speculators, and dreamers came to Pittsburgh to make something—a product, a fortune, friends with capital and connections, or perhaps a new life with the promise of steady work. A local culture of new ideas—some borrowed, many adapted, others revolutionary—blossomed after the Civil War.
Samuel M. Kier: Oil Man

A few sips of Pennsylvania crude oil could help the blind see or the lame walk—that’s what Samuel M. Kier (1813–1874) advertised when he bottled the oil he gathered at his family’s salt mines in 1847. Despite such promising claims, Kier’s rock oil business did not thrive. Determined to find other markets for petroleum, he experimented with and researched its other uses.

With a keen eye for business, Kier recognized oil’s potential as an illuminant and in 1850, he established the world’s first oil refinery in Pittsburgh, albeit a one-barrel operation. He also invented a smokeless lamp, boosting use of rock oil over whale oil.
An ordnance officer at Allegheny Arsenal, young Rodman resolved to increase cannon strength and durability to prevent further accidents. Later dubbed the “Rodman process,” his technique used running water to cool cannons from a hollow core, rather than externally, thereby increasing their durability. Perfected at the Fort Pitt Foundry on the banks of the Allegheny River, Rodman’s process made possible the casting of the world’s largest and most powerful cannons. The U.S. Ordnance Bureau officially adopted the technique in 1859, and it held as the standard method of cannon production in the U.S. and Europe for the next 20 years.

Thomas Jackson Rodman and his Cannon

In 1844, a newly-cast cannon aboard the USS Princeton exploded during a demonstration for visiting dignitaries and politicians. The force of the charge caused the cannon’s breech to burst, showering the onlookers with shrapnel and killing six people, including U.S. Secretary of State Abel P. Upshur and Secretary of the Navy Thomas Gilmer. This deadly accident inspired West Point graduate Thomas Jackson Rodman to become one of the Civil War era’s most significant military innovators.
Experiments in Gunpowder

A military engineering pioneer, Thomas Jackson Rodman’s creative spark flared beyond the realm of cannon production. In 1856, he invented “mammoth” cannon powder to replace smaller-grained “corned powder,” and then “perforated cake” powder—large pellets of powder perforated with holes that allowed the powder to burn uniformly and progressively as the cannonball shot through the barrel. Rodman tested his theories by inventing a cannon pressure gauge—a key in developing cannons and powders that became the model for armies and navies worldwide. Slower burning powder greatly reduced internal pressure while increasing muzzle velocity, accuracy, and the range of large cannons. Together with Silas Crispin, Rodman also patented an improved metallic cartridge for use in breech-loading carbines, and he built bullet-making machines that became the standard for U.S. arsenals.

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Explosion at Allegheny Arsenal

Some accounts claimed that a spark from an iron horseshoe or wagon wheel ignited gunpowder that accumulated on the stone-paved streets. Others believed that static electricity from a female worker’s hoop skirt detonated loose powder. On September 17, 1862, Pittsburgh newspapers gave the Battle of Antietam second billing to a devastating local event—the explosion of Lawrenceville’s Allegheny Arsenal ammunition laboratories. A major producer of small arms cartridges, Allegheny Arsenal employed large numbers of women and children; 78 of these workers died in the blast. Many more were injured. Coroner and military investigations brought up questions about safety practices by DuPont, the supplier of gunpowder to the arsenal. The company reused powder barrels that allowed the powder to leak out through the slack staves and loose heads. Although investigators failed to find an exact cause, the tragedy focused public attention on workplace safety and the important role women workers played in the Union war effort.

Hussey’s High-Quality Steel

In 1858, a patent revealing an improved method for making high-quality steel through the crucible process crossed Curtiss Hussey’s desk. Hussey, a trained physician who made a fortune in the pork trade, also operated the first copper and brass rolling mill in the country. He seized this opportunity to launch Pittsburgh’s first steel business, making crucible steel, a high-grade steel fit for blades, cutlery, and tools.

But convincing American tradespeople that locally made steel tools matched the quality of those crafted in Sheffield, England, proved a major challenge. To compete, Hussey brought highly-trained steelmakers from England to Pittsburgh to help his company match the quality of British imports. Hussey’s endeavors succeeded well enough to attract inventor George Westinghouse. He came to the city seeking a source for high-quality crucible steel, but stayed and prospered as an innovator and industrialist.
Who Invented the Bessemer Process—Bessemer or Kelly?

Certain that someone had shared his secrets with Henry Bessemer, William Kelly claimed the revolutionary steelmaking process as his own. Kelly, born and raised in Pittsburgh, experimented with “pneumatic” steelmaking as early as 1847 at his iron works in Tennessee. He claimed Bessemer had stolen his method of injecting air into molten iron to create steel. In reality, both men received U.S. patents, but a 13-year legal battle ensued. In 1870, Bessemer’s American patent renewal was refused because Kelly was deemed the originator of the innovative, and highly profitable, steelmaking process. It is likely, however, that both men arrived at the idea at about the same time. In an age when iron workers could see the potential of steel, but did not yet have the technology to make it on a large scale, everyone was willing to “observe, question, and experiment” with the process—working toward the common goal of mass producing this metal of the future.

Carnegie Builds the Steel Skyline

Built by Andrew Carnegie’s rivals, the Homestead Works opened in 1881 as a state-of-the-art steel rail mill. Carnegie watched his competitors closely over the next two years, and when labor unrest and money troubles threatened to close the mill, he offered to take the business off their hands. Carnegie predicted a waning market for rails and set a new course for Homestead Works—structural steel. He employed the latest technological advances and thousands of immigrant workers to run the nation’s first successful open-hearth furnace. This was a new way to make steel, by producing large volumes of high-quality steel suitable for structures and armor. By 1890, architects and engineers turned to Carnegie’s steel to construct the buildings that forever changed America’s skyline.
As the steel industry grew in Pittsburgh, so too did a host of smaller firms making innovative machinery, specialized parts, and unique materials that outfitted the many mills in the area. The Frank-Kneeland Machine Company, established in 1897, made customized rolling mill machinery.

Isaac Frank received his engineering degree the year this photo was taken. Frank, the son of a prominent Jewish Pittsburgh family, applied his training to the steelmaking industry rather than his family’s glass business.

In 1892 he organized the Frank-Kneeland Machine Company and in 1901 was founding president of United Engineering & Foundry Co., a leading manufacturer of rolls and rolling mill machinery. The company had plants in Pittsburgh, Vandergrift, Youngstown, and Canton, Ohio. Gates and machinery for the Panama Canal were cast at United’s Vandergrift plant. Frank’s other business interests included American Sheet Steel, Empire Coal Mining, Damascus Bronze, & Phillips Sheet & Tin Plate, Weirton Steel, Copperweld Steel, and National Steel.
Westinghouse Air Brake

... a train can be stopped with the greatest ease...

– George Westinghouse, 1867

In the cold, rain, or heat, a railroad “brakeman” climbed on top of a speeding train, jumping from car to car, and cranked a wheel to apply the brakes. With brute strength, careful timing, and a bit of luck, this job was still one of the railroad’s most dangerous. In 1867 George Westinghouse figured out that by using the pressure of compressed air piped from car to car, an engineer could apply brakes “without leaving his stand.” Stopping trains safely allowed industry and modern transportation to move forward. Considered the railroad industry’s most important invention, the air brake’s basic system still stops every train that runs throughout the world.
Westinghouse: An Innovator for All Times

If someday it is said of me that with my work I have contributed something to civilization, something to the safety and happiness of human life, it will be sufficient.

– George Westinghouse, c. 1900

The contributions of George Westinghouse are vast and varied. His solutions to the most pressing challenges of the 19th century transformed the way we live and work. Safe and efficient train travel, natural gas replacing coal as a leading fuel, and his system for electricity set the course for the modern world. His approach to invention was ingenious, yet he praised the work of others and found his most creative solutions through collaboration. Westinghouse valued his employees’ contributions and set new standards for working conditions. He founded over 90 companies and was granted over 361 patents in his lifetime.

Samuel Langley Standardizes Time

As a boy in Massachusetts, Samuel Langley pondered the sky. “Some of these childish questions occupied many years of my adult life,” he later recalled. Trained as an architect, Langley’s interest in astronomy led him to Pittsburgh in 1867 where he served as the Allegheny Observatory’s first director and professor of astronomy and physics for the Western University of Pennsylvania, now University of Pittsburgh.

While lying beneath this telescope, an observer watched for the passing of certain stars across a vertical line, made by the thread of a spider’s web. The movement of these “time stars,” rather than the sun, allowed time to be measured much more accurately. Langley devised a system that used telegraphy to record and communicate these measurements to hundreds of railroad stations, jewelers, and other businesses across the country.

His solutions to the most pressing challenges of the 19th century transformed the way we live and work.
A New Fuel for Pittsburgh: Natural Gas

It has cheapened the cost of production, added to the capacity of the industries and has given to Pittsburgh and Allegheny advantages with which other cities, not so highly favored, are unable to compete.

– Pittsburgh and Allegheny Illustrated Review, 1889

By 1887, for the first time in decades, the smoky skies over Pittsburgh cleared as mills, furnaces, and factories burned natural gas instead of coal. Drillers in the oil fields and salt wells of the region had stumbled across natural gas for decades, yet its potential as a clean-burning, inexpensive alternative to coal remained largely unknown. George Westinghouse began experimenting with the fuel in 1884 when he built a gas well in his backyard, but natural gas drilling was dangerous and highly flammable. Westinghouse devised a safe delivery system and founded the first commercial gas company to supply the product. Within two years of drilling his experimental gas well, Westinghouse held over 30 patents in the area of natural gas distribution.

John Brashear and the Telescope

Eight-year-old John Brashear peered through a telescope for the first time in 1848, and the wonder he saw in the sky that night never left him. Nearly 30 years later, Brashear worked late into the night after 12-hour shifts in a Pittsburgh rolling mill, building his own telescope. More than a tinkerer’s toy, his device impressed Samuel Langley of the Allegheny Observatory, who encouraged him to continue building telescopes. Through his “love of the stars” and mechanical genius, Brashear built some of the finest instruments ever made. He left his work at the mill in 1881 and opened a small shop. By the 1890s astronomers and scientist throughout the world used his lenses, telescopes, and scientific tools.
A Trail Blazed Around the World: Journalist Nellie Bly

Energy rightly applied and directed will accomplish anything.

– Nellie Bly, 1880s

Committed to the Blackwell’s Island Insane Asylum in New York for 10 days in fall 1887, reporter Nellie Bly used courage and creativity to go undercover and expose the mistreatment of those in need. It was her first job as a “stunt” reporter for the New York World newspaper, the first of many. Born Elizabeth Jane Cochran just outside of Pittsburgh, she took the pen name Nellie Bly and worked as a journalist who refused to cover lady-like subjects like society gossip or fashion. Already well-known by 1889, Bly’s popularity soared when, as a publicity scheme, the New York World dared her to circle the globe in less than 80 days, imitating novelist Jules Verne’s character Phileas Fogg from Around the World in 80 Days. She completed her trip in just 72. Bly left journalism for a time to direct her husband’s business, but then returned at the outbreak of World War I to become the first woman journalist on the eastern front.
The Chicago World’s Fair: Pittsburgh on Display

The World’s Columbian Exposition of 1893 in Chicago had many spectacular attractions, but none held more wonder than the Ferris wheel, designed by George Ferris, a bridge engineer from Pittsburgh. At night, visitors found the fairgrounds and buildings “bewilderingly bright and exciting,” because of George Westinghouse’s alternating current system chosen to illuminate the fair. Eager pickle-eaters flocked to the display of the H.J. Heinz Company as word spread that samples and a little “pickle charm” were free for the asking. These attractions showcased Pittsburgh and galvanized the city’s reputation around the world as a place for innovation and

The Ferris wheel dazzles the Chicago World’s Fair, 1893. Courtesy of Smithsonian Institution.

The world’s first Ferris wheel fulfilled the fair planners’ desire to feature something, “original, daring, and unique,” as a main attraction. The inventor of the wheel, Pittsburgher George Ferris, drew on his expertise as a designer and builder of railroad and bridge structures to create a giant wheel that carried up to 2,000 people at a time more than 250 feet in the air.

H. J. Heinz, c. 1870.

The impressive Heinz display. From: The Book of the Fair, 1893.
Westinghouse Lights the World’s Fair

George Westinghouse and his company dazzled visitors to the 1893 Chicago World’s Fair. The company’s massive switchboard allowed just one operator to control all the Westinghouse alternating current apparatus, including 10 of its 1,000-horsepower generators that had been manufactured in downtown Pittsburgh.

That electricity lit 92,000 Westinghouse lamps on opening night in May 1893. For the first time, people could attend a world’s fair at night. During the six months of the fair, Westinghouse manufactured a quarter million of these lamps at its former Air Brake Company plant on General Robinson Street in Allegheny City. The patent for these two-piece, all-glass lamps was upheld when challenged by Thomas Edison.

Success in illuminating the fair tipped the scales in Westinghouse’s favor two years later when his electric company was awarded the contract to
Woods Run row houses in early Pittsburgh.

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