

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

Photograph Robert M. Cargo, courtesy Wilkesburg Historical Society

2

1850-1900

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.



This early Westinghouse coffee maker has a screw plug to match light sockets of the period.

Gift of Harold Ashcom.



Thomas Rodman
develops bullet press
at Allegheny Arsenal

First national
convention of
Republican Party
held in Pittsburgh

THE CRADLE OF THE G.O.P.



Thomas Rodman invents
cannon powders and a
cannon pressure gauge

A union of iron
puddlers forms
first national
iron union

1855

1856

1858

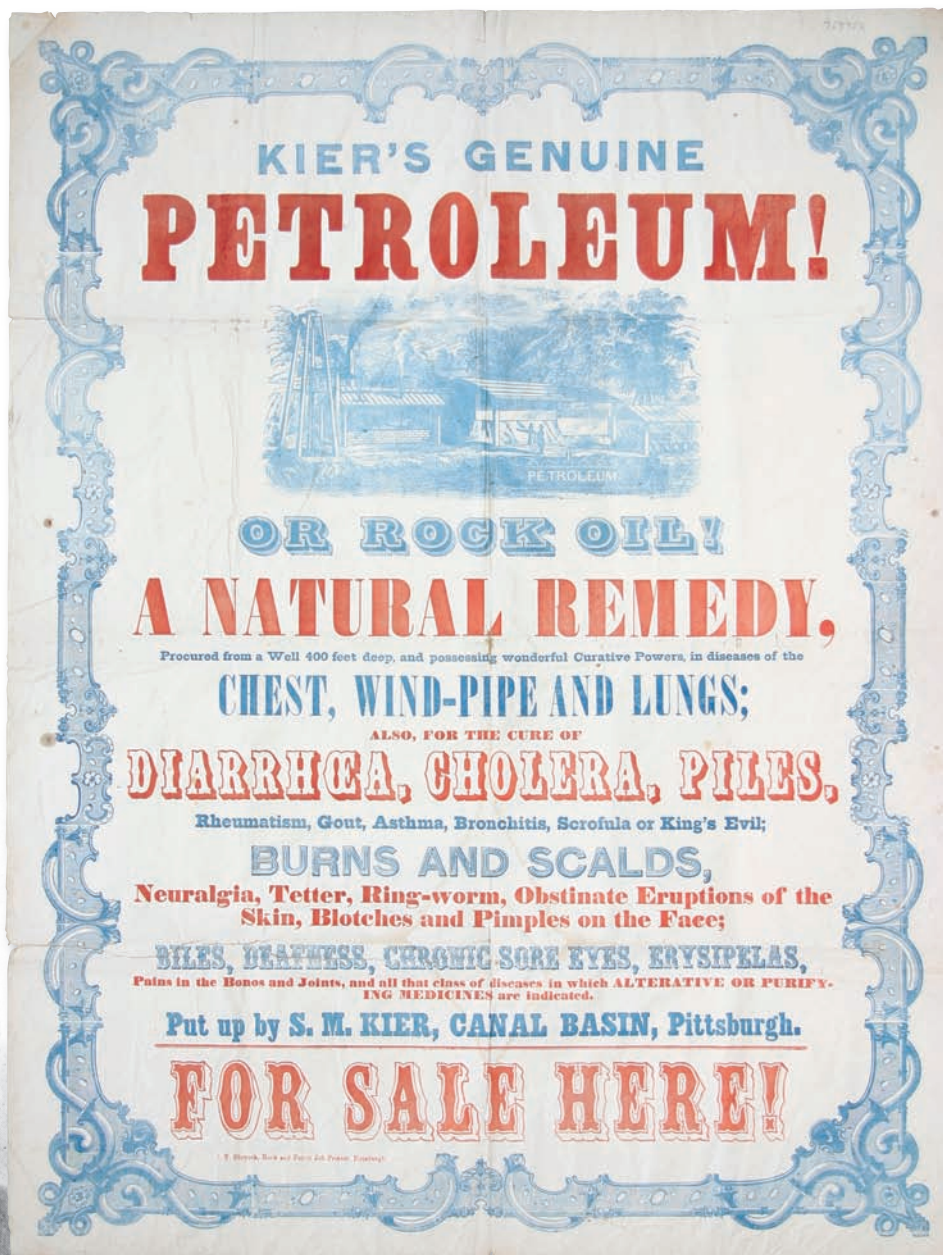
Samuel M. Kier: Oil Man

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.



Samuel M. Kier, c. 1889.
From *Pennsylvania Encyclopedia of Biography*, 1950.



Advertisement for Kier's Genuine Petroleum, c. 1850.

Courtesy of Pennsylvania Historical & Museum Commission,
Drake Well Museum Collection, Titusville, Pa.

A few sips of
Pennsylvania crude oil
could help the blind
see or the lame walk.



Pittsburgh's first successful steel business started by Curtis Hussey

Edwin Drake and crew successfully drill and pump oil in the U.S.

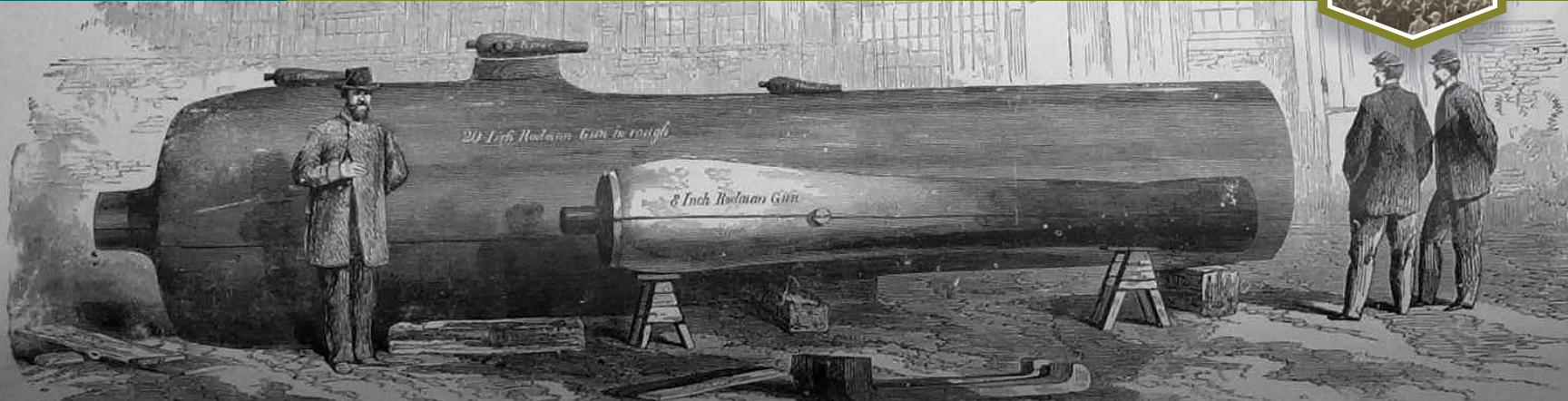


John Wagner patents a sausage-stuffing device

Clinton blast furnace is Pittsburgh's first for making pig iron

15-inch Rodman columbiad cannon is cast at the Fort Pitt Foundry

1859



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.

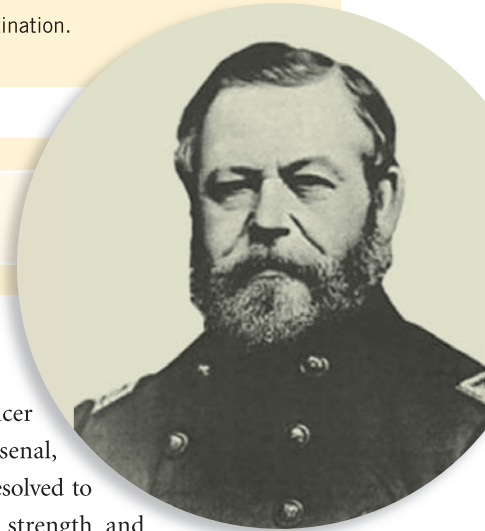
The 20-inch Rodman en route to New York's harbor defenses, Harrisburg, 1864.

Courtesy of Marcus McLemore.

A grown man could easily fit inside the barrel, demonstrating the massive bore of this gun. In fact, the weight of the mammoth 20-inch Rodman posed a logistical problem for foundry officials: how to best transport the weapon to its destination at Fort Hamilton in Brooklyn, New York. It took 24 horses to haul the cannon to the nearby Pennsylvania Railroad freight yards. There, they placed it on a specially designed and reinforced flatbed railroad car. Still, it took an entire month to reach its destination.

Thomas Jackson Rodman.

Courtesy of Watertown Library.



Awful explosion of the "peace-maker" on board the U.S. Steam Frigate Princeton on Wednesday, 28th February, 1844.

Library of Congress, Prints & Photographs Division, LC-USZC2-3201.

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.

McClellan saddle produced at Allegheny Arsenal



Charles Lockhart brings oil downriver to Pittsburgh, exports it to England

Eliza Furnace built to make pig iron for Pittsburgh markets

Abraham Lincoln visits Pittsburgh en route to Washington, D.C.

Allegheny Arsenal produces innovative equipment for Union Army

1860

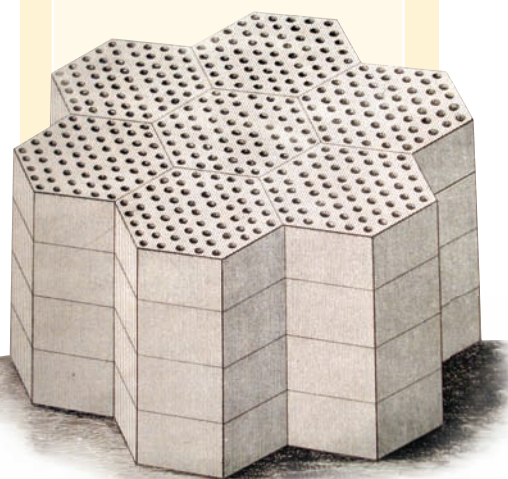
1861

S. CRISPIN. Cartridge.

No. 49,237.

Patented Aug. 8, 1865.

Perforated cake powder as pictured in *Reports of Experiments on the Properties of Metals for Cannons and the Qualities of Cannon Powder* (1861) by Thomas Jackson Rodman.



Above: Rodman and Crispin cartridge, c. 1863.

Courtesy of Dean Thomas.

Left: The patent drawing for the Rodman and Crispin cartridge.

U.S. Patent Office.

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.

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.

Rifle musket cartridge tool, c. 1862.

Gift of Alfred L. Millbach.

Sarah Finn Millbach used this tool at the Allegheny Arsenal to manufacture .58 caliber rifle musket cartridges. Skilled tool and die makers operated an arsenal machine that pressed minié balls from cold lead at the rate of 2,000 per hour. Arsenal workers then

lubricated the bullets with a mixture of beeswax and tallow. Because of their smaller, nimble fingers, women and boys rolled paper tubes cinched closed with thread and filled each with 60 grains of gunpowder. They then inserted the minié ball into an outer tube, into which also went the powder tube. Completed cartridges were wrapped in bundles of 10 and packed in wooden cases holding 1,000 rounds. By the end of 1861, arsenal workers produced an average of 124,000 cartridges per day in order to meet escalating wartime demand.

Jane Grey
Swisshelm works
as a nurse for
the Union Army



Charles Lockhart
builds the first major
oil refinery in the
United States

Alexander Hays
defends Cemetery
Ridge at Battle of
Gettysburg

Charles Lockhart
and John Gracie
invent a still for
petroleum

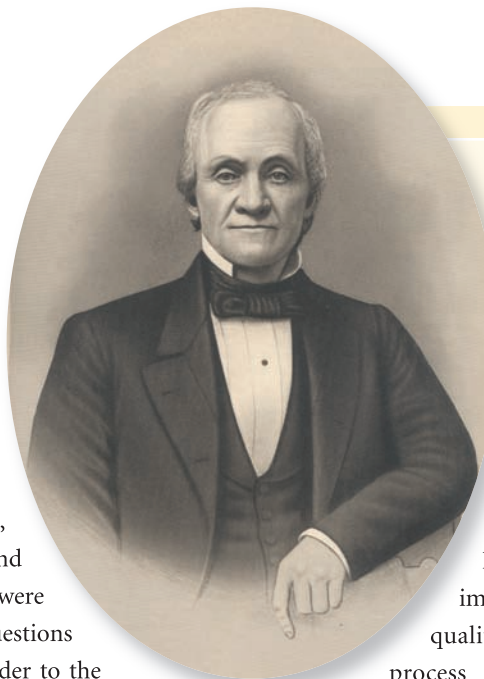
Little Round Top
defended by Strong
Vincent of Erie



1863

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.



Curtiss G. Hussey, renaissance man (1802–1893), c. 1885.

From Pennsylvania Encyclopedia of Biography, 1950.

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 trades people 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.



Hussey, Wells & Company made cast steel tools and knives.
Pittsburgh City Directory, 1869-70.

The Sanitary fair raises funds for wounded Union soldiers



Fort Pitt Foundry casts 20-inch cannon

Chevalier Jackson born in Pittsburgh, later improves techniques for bronchoscopy

Martin Delany highest ranking African American officer in U.S. military

Union Iron Works founded by Andrew Kloman and Andrew Carnegie

1864

1865

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.

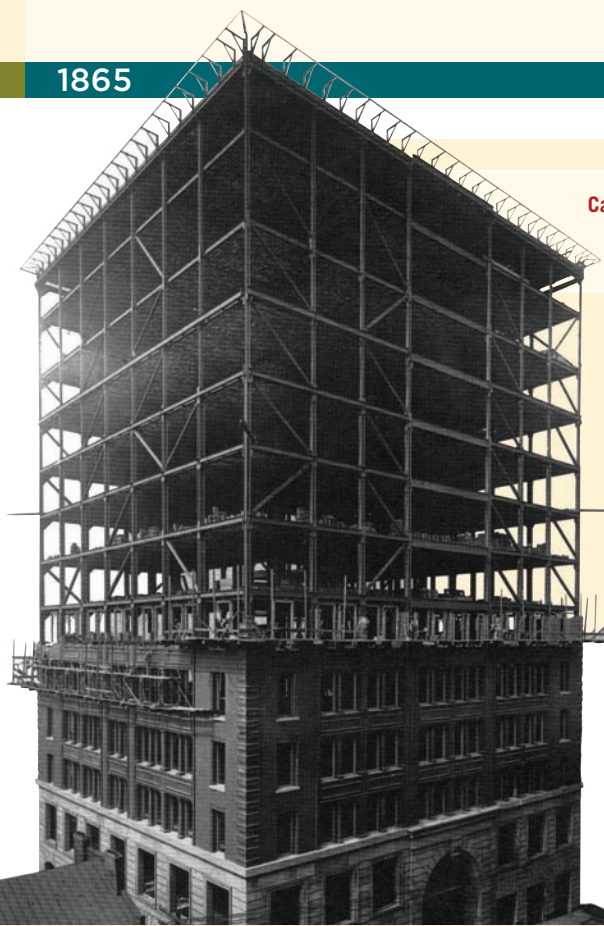
A Pittsburgh steel mill.

Allegheny Conference on Community Development.

Carnegie Building, Pittsburgh's first skyscraper, 1894.

Courtesy of the Carnegie Library.

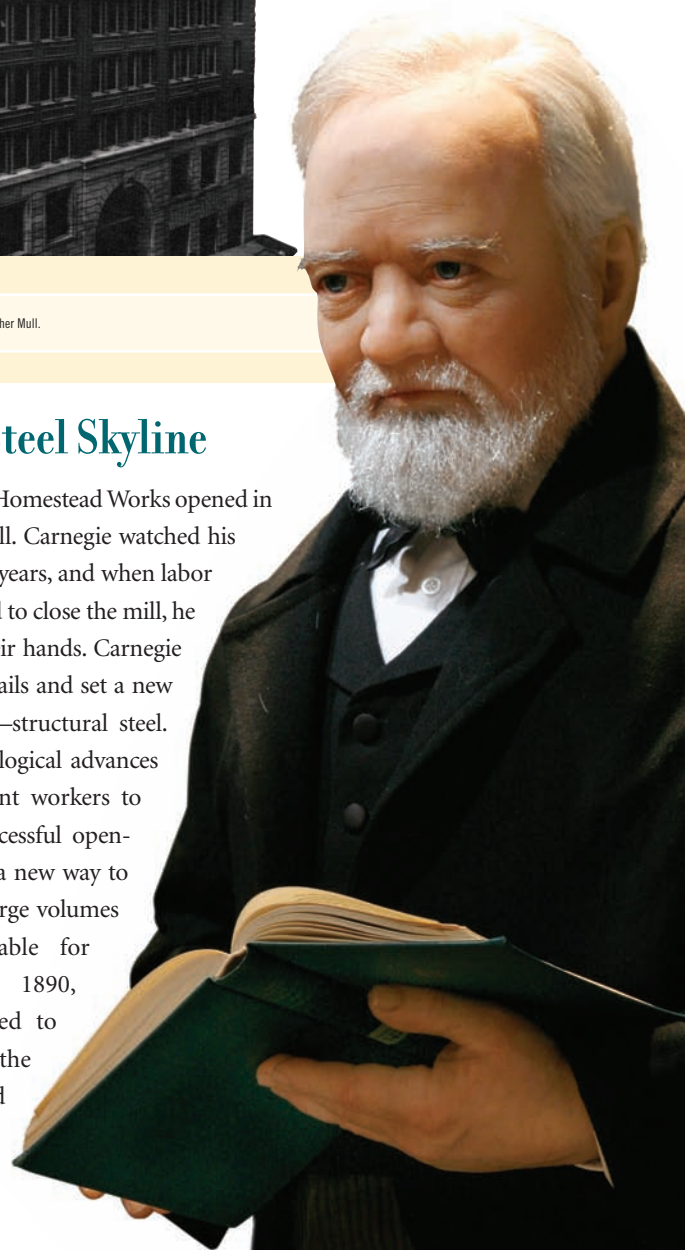
Carnegie erected Pittsburgh's first skyscraper, the Carnegie Building, on Fifth Avenue downtown. He ordered the partially-constructed building to remain unfinished for almost a year as a way of displaying, and advertising, the steel-beams within.



Andrew Carnegie. LifeFormations, photograph Heather Mull.

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.





John Arbuckle
invents machine
to package
coffee

Soldiers and Sailors
Convention solidifies
Union vets as
Republicans

Anti-smoke
measure passed
in Pittsburgh

Samuel Langley
proposes standardized
time to the railroads
through the telegraph

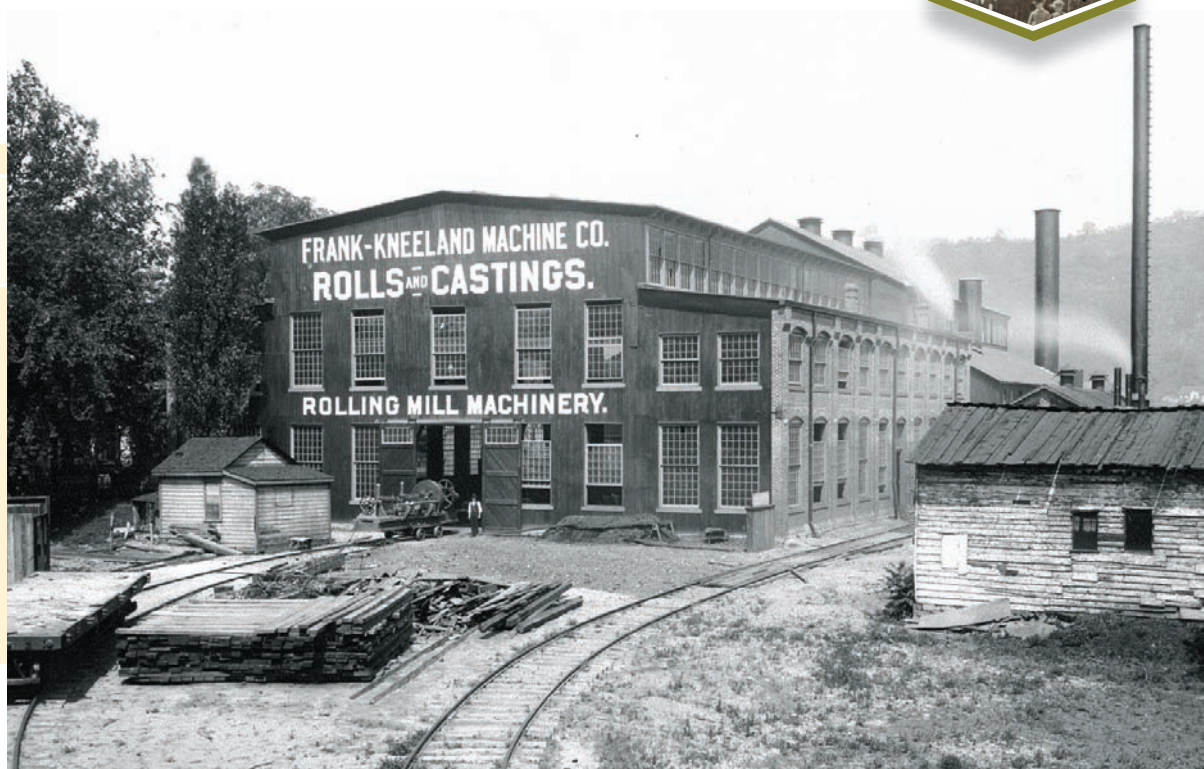
1866

1869

The Frank-Kneeland Machine Company, c. 1900.

Gift of Ruth O. Frank.

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 W. Frank's son, William, at his father's company, the Frank-Kneeland Machine Company, c. 1895.

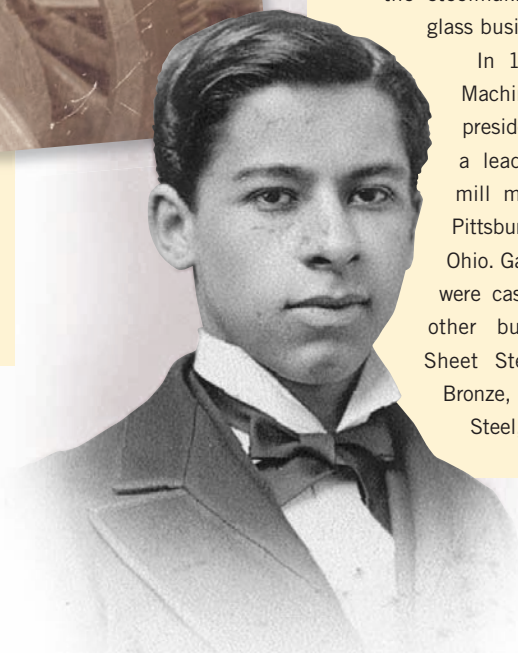
Gift of Ruth O. Frank.

Engineer Isaac W. Frank, c. 1876. His company cast the gates and machinery for the Panama Canal.

Gift of Ruth O. Frank.

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.



Apparatus for
cleaning cesspools
invented by
William McCarthy

National Tube
Works organized
by John Flagler

Direct current track
circuit invented by
William Robinson

Charles Taze Russell
founds Watchtower Bible
and Tract Society

Keystone Bridge Company
makes steel for first
bridge across Mississippi

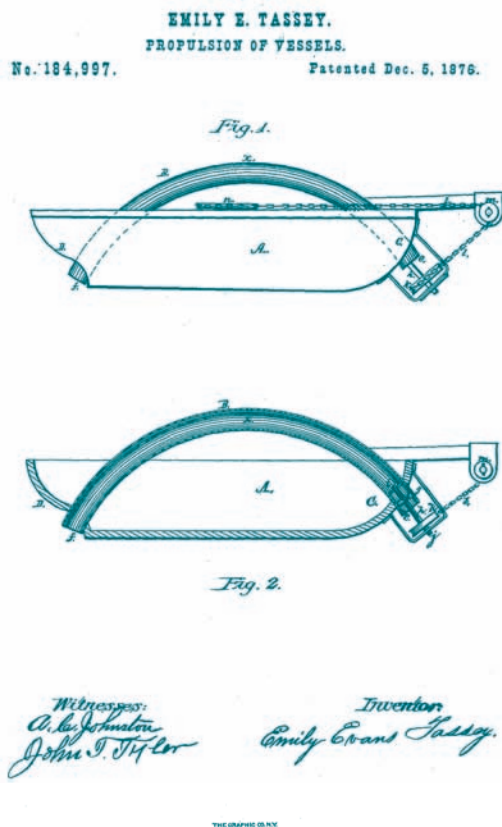
Spang & Chalfant
are first to use
natural gas for
iron furnaces

1870

1871

1872

1874



Emily Tassey, Inventor

Emily Tassey (1823–c.1899) received five patents in her lifetime. Widowed in 1857, she supported her three children by working as a teacher in Pittsburgh and nearby Brownsville, Pa. Tassey patented her inventions, all of which related to boats and river transportation.



Patent model and
drawing by Emily E. Tassey
for "Improvement for
Propulsion of Vessels," 1874.

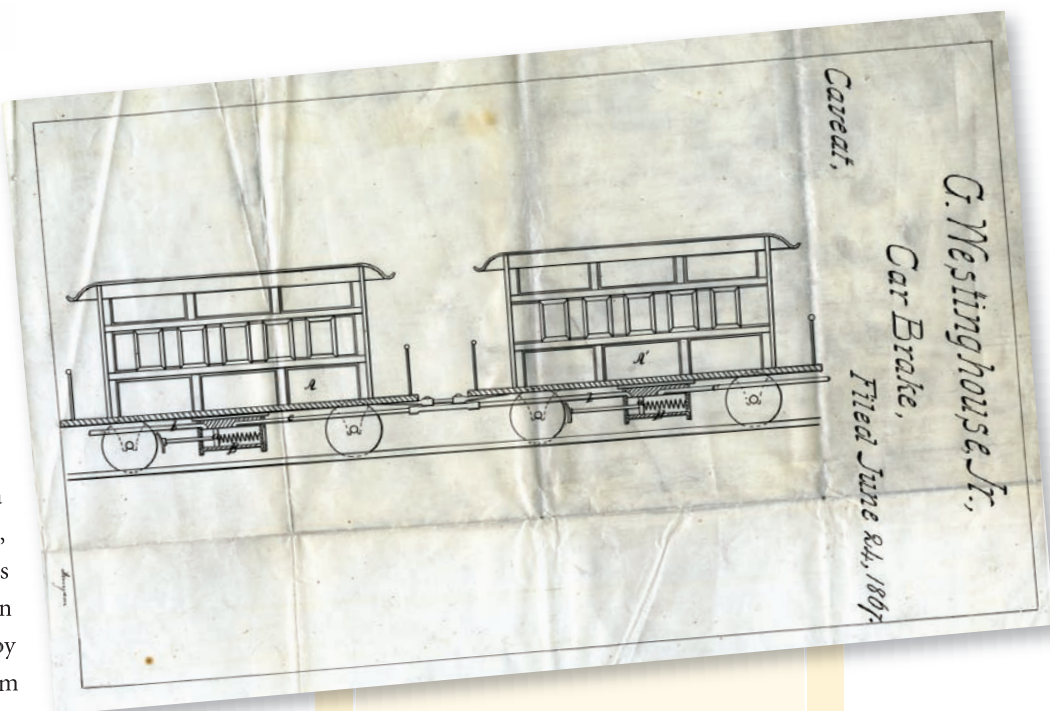
Courtesy of Hagley Museum.

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.



Petition to the U.S. Patent Office submitted
by George Westinghouse describing his
improved "car brake," 1867.

HC L&A George Westinghouse Museum transfer.

Andrew Carnegie
builds Edgar
Thomson Works
steel mill

William Jones
patents more than 50
inventions assigned
to Carnegie Steel



Railroad Strike is
the first nationwide
strike; crowds
vandalize rail yards

American Flint Glass
Workers of North
America found United
Glass Workers Union

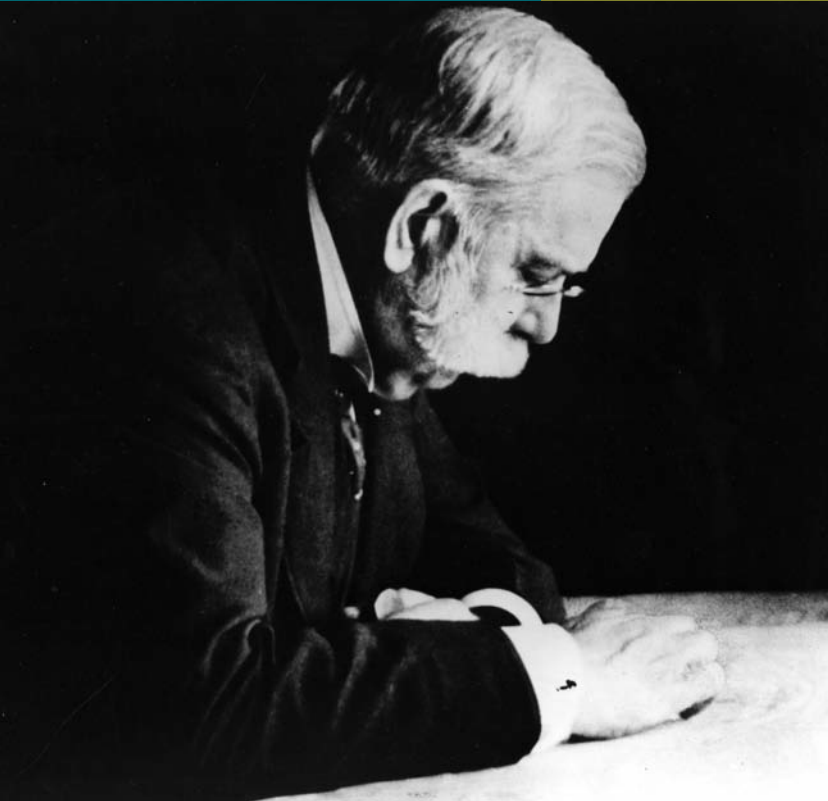
First commercial
gas well drilled
in Murrysville



1875

1877

1878



George Westinghouse at his desk. HC MSP 424.

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.

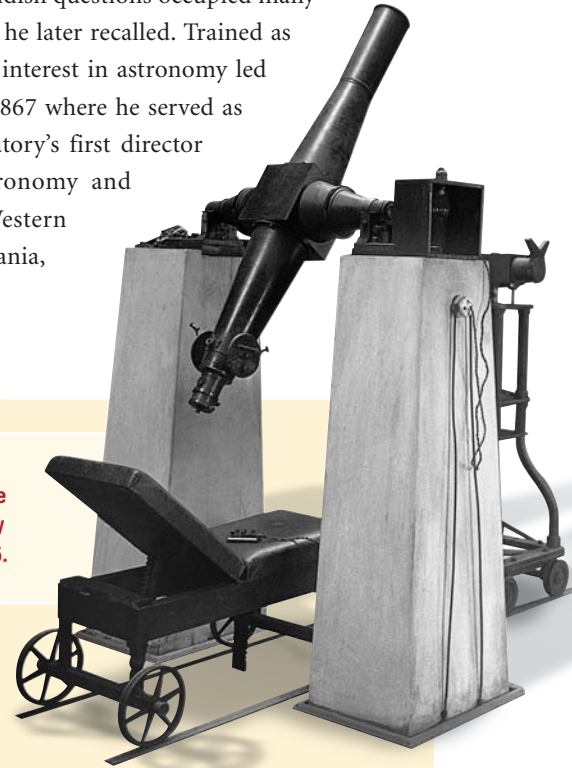


Samuel Langley Standardizes Time

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.

Langley used this telescope to measure time at the Allegheny Observatory, c. 1885.
Courtesy of Arthur Glaser.

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.

George Westinghouse gives the first Saturday half-day holiday

Federation of Organized Trades & Labor Unions is created

Pittsburgh Plate Glass establishes the first plate glass plant in America

Homestead Works opens as a state-of-the-art steel rail mill

Pittsburgh Proclamation, early statement by the anarchist movement

H.J. Heinz Company packages horseradish in clear glass jars

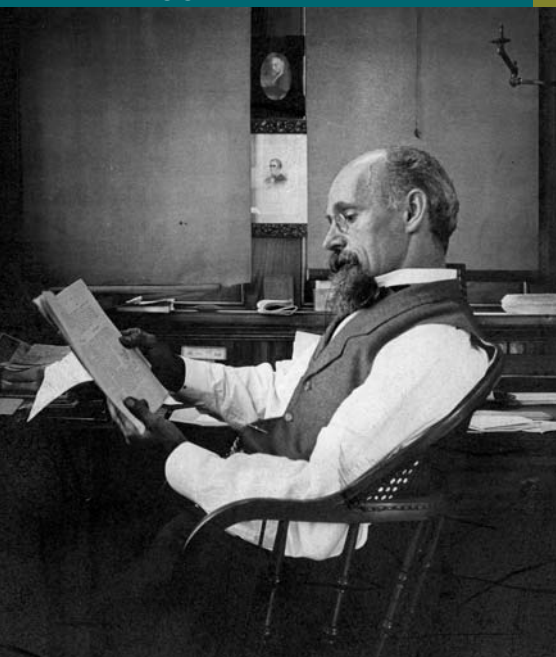
Carnegie Steel in first skyscraper, Home Insurance Building, Chicago



1881

1883

1884



Above: John Brashear at his desk c. 1890.

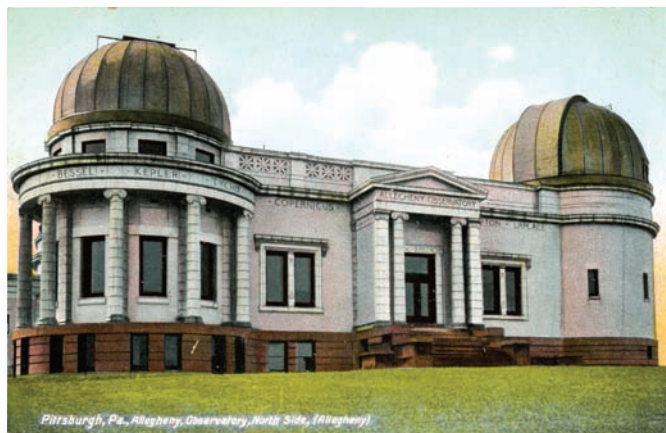
Courtesy of University of Pittsburgh.

Right: Allegheny Observatory.

HC L&A, GPCC.

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.



Pittsburgh, Pa., Allegheny Observatory, North Side, (Allegheny)

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.



The Gas, Light & Coke Company touted natural gas over coal.

University of Pittsburgh, AIS, Mellon Institute Collection, box 5, folder 12.



Hudson Samson
invents new
techniques in
mortuary science

1885

Charles Martin Hall
discovers process
for smelting
aluminum

1886

Alternating current
electrical system
successfully
demonstrated

Westinghouse
Electric
Company
founded

Coopers
International Union
of America founded
in Titusville

1890

H.J. Heinz Company
introduces screw
cap for ketchup
bottle

Ed Acheson
patents
carborundum,
an industrial
abrasive

1891



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.

**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.**

Nellie Bly, world traveler.

Corbis/Bettman Archives.

Pro football
born when
player accepts
\$500 to play



Bertha Lamme is the
first female electrical
engineer to receive
her degree

Westinghouse
Electric alternating
current illuminates
1893 World's Fair

The Carnegie Building,
Pittsburgh's first
skyscraper, built on
Fifth Avenue

Alcoa and Carborundum
Company first customers
of Niagara Falls Power

Ralph C. Stiefel
designs first
seamless tubes

1892

1893

1894

1895

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



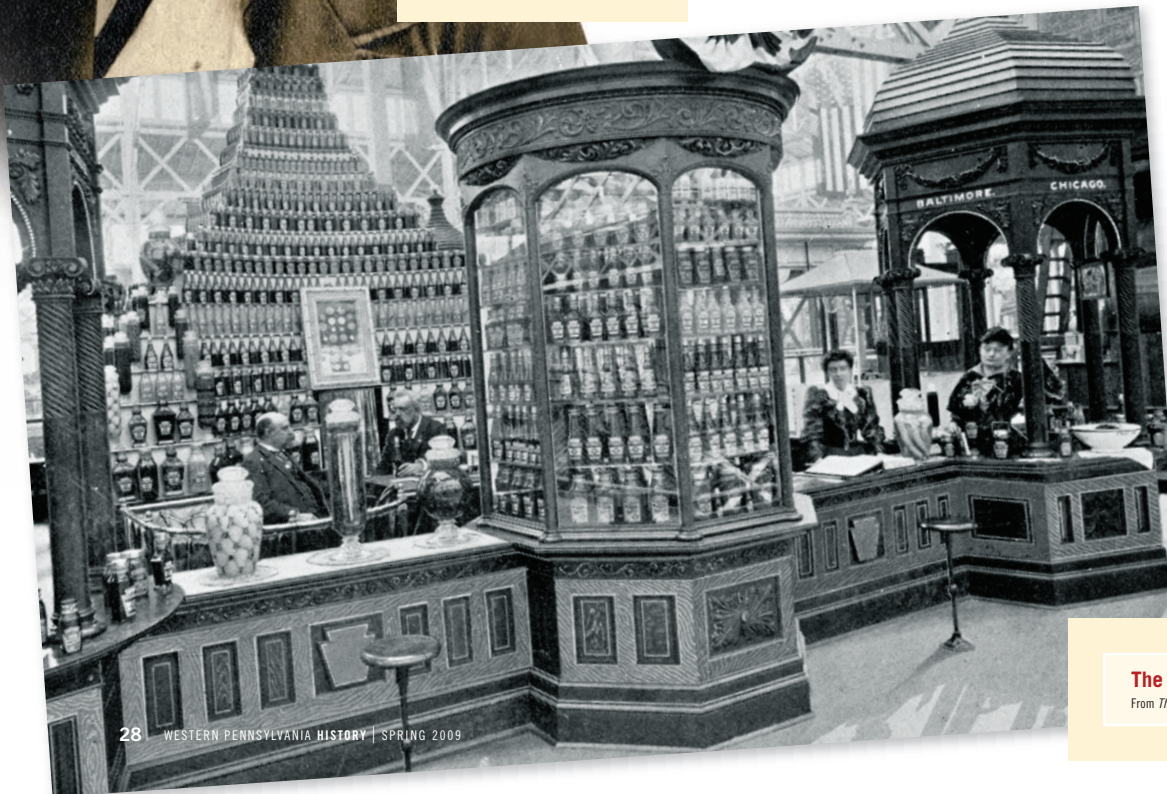
H. J. Heinz, c. 1870.



**The Ferris wheel dazzles the
Chicago World's Fair, 1893.**

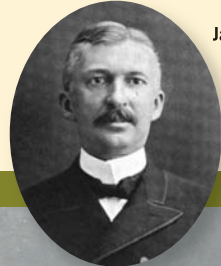
Courtesy of Smithsonian Institution.

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.



The impressive Heinz display.

From *The Book of the Fair*, 1893.



James Keeler makes important astronomical discoveries

Iron Workers Union founded in Pittsburgh

Alfred L. Cralle designs and invents the ice cream scoop

Andrew Carnegie funds pioneering work in paleontology

Duquesne Gardens opens with world's largest indoor ice rink

First large-scale complete dinosaur skeleton goes on display

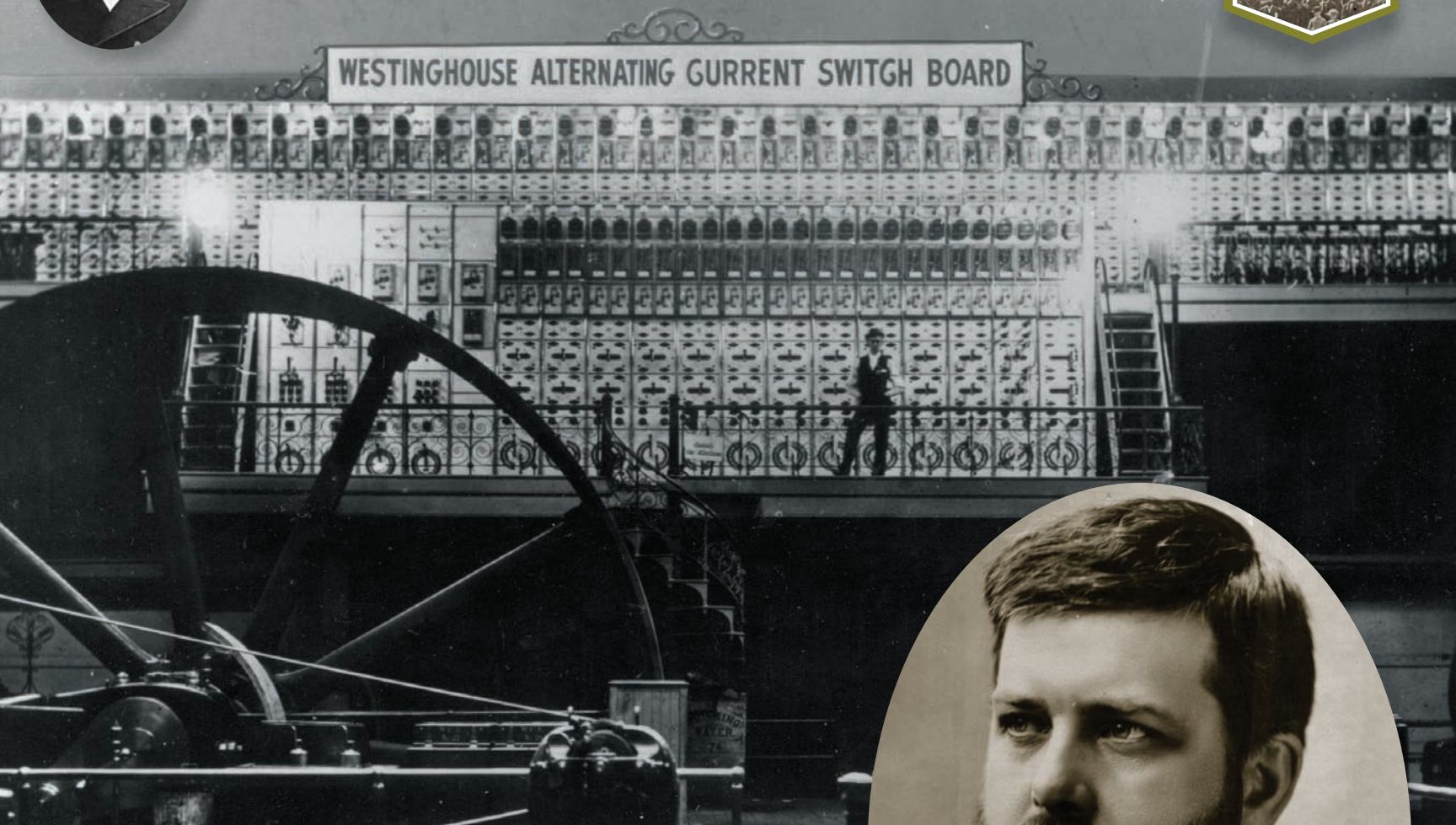
CHAPTER 2



1896

1897

1899



ingenuity.

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



One of the Westinghouse two-piece, all-glass stopper lamps that illuminated the fair.

HC L&A, Westinghouse collection.

The massive Westinghouse alternating current switchboard at the 1893 Chicago World's Fair, and George Westinghouse about the time of the fair.

HC L&A, Westinghouse collection.

Woods Run row houses in early Pittsburgh.

University of Pittsburgh, 715.218950.cp.

