

# Expansion and Reform: Technology of the 1800s

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Word Count **977**



Railroad workers celebrate at the driving of the Golden Spike Ceremony in Utah on May 10, 1869, signifying completion of the first transcontinental railroad route created by joining the Central Pacific and Union Pacific Railroads, Courtesy of Wikimedia.

In the 1830s, French diplomat and historian Alexis de Tocqueville published a study titled "Democracy In America." In it, he observed that America's spirit of individualism and freedom of thought resulted in a practical application of scientific knowledge. "The Americans," he wrote, "always display a clear, free, original and inventive power of mind."

One of the driving forces behind American invention was the U.S. Patent Office. The U.S. Constitution authorized Congress "to promote the progress of science and useful arts" by giving people exclusive rights to their writings and inventions. Under a patent system developed in the 1790s, some of the most famous inventors in American history secured patents, including Eli Whitney for the cotton gin in 1794.

In 1836, the U.S. Congress changed the patent process and created a new Patent Office building. This magnificent structure became the symbol of American commitment to technological development. The number of patents issued by the office rose dramatically from 11,500 patents between 1790 and 1840, to 682,000 patents between 1840 and 1900.

## **Fuel of interest adds to the fire of genius**

“The patent system added the fuel of interest to the fire of genius,” said Abraham Lincoln, himself a recipient of a patent for a device to raise steamboats over sandbars.

The other major influence that drove America’s technological development was the expansion of the nation’s boundaries, population and economy. The territorial size of the United States quadrupled from 1800 to 1900 as it spanned the continent from the Atlantic to the Pacific. The population grew from 5.3 million people in 1800 to 75 million in 1900. The need to connect and supply this expansive nation encouraged breakthroughs in transportation, communication and manufacturing.

The main technology of the 19th century was steam power. Steam engines provided a more reliable and effective source of power than water or wind. American cities became centers of steam-powered manufacturing.

The most significant breakthrough in the Age of Steam was the development of railroads. The building of the first American railroad, the Baltimore and Ohio, began on July 4, 1828. The first 13 miles of rails were ready for a trial run in 1830. By 1900, the number of track miles had grown to almost 200,000, 40 percent of the world’s total.

## **First transcontinental rail link**

The railroads symbolized America’s technological ambitions, and the completion of the first transcontinental rail link in 1869 was one of the defining moments in the history of the nation — an impressive feat of engineering, finance and labor.

Technological advances changed nearly every aspect of life in the 19th century. New agricultural technology allowed farmers to greatly improve their harvests. Steel manufacturing also became an important new industry.

One immediate impact of the improvement in the quality of steel occurred in bridge-building technology. The best-known and most successful bridge designer during this time was John A. Roebling, a German immigrant. Roebling’s creative use of wire rope technology resulted in spectacular suspension bridges. His daring structures, including the Brooklyn Bridge, were both functional and beautiful.

## **Inventors are celebrated figures**

The full implications of some technological advances were not evident for many years or even decades. In August 1859, for example, Edwin Drake created the world’s first oil well near Titusville, Pennsylvania, using drilling technology he observed in local salt mines. By 1900, Pennsylvania produced half of the world’s oil supply and there was drilling activity in 13 other states. However, the uses of oil were limited in the 19th century mostly to

illumination and medical products such as petroleum jelly. Refining oil as a fuel and lubricant for cars, ships and locomotives and using oil as a base for plastic and other products would take place in the 20th century.

The 19th century was also a time when inventors became celebrated as central figures in the spectacular growth of technology. Samuel Morse's invention of the telegraph (1835) and Alexander Graham Bell's telephone (1876) made long-distance communication possible in a rapidly expanding nation. In 1846, Elias Howe patented the sewing machine, followed by Isaac Singer's improved version in 1851. The names of these inventors and others were inextricably linked with their products.

Thomas A. Edison was without question the most prominent figure among this extraordinary group of American inventors. In his lifetime, he amassed more than 1,300 patents including the electric voting machine (1869); the phonograph (1878); the incandescent lamp (1879); movie film and the motion picture camera (1889 and 1891); and the radio (1891). He constructed the world's first central electrical power plant and assembled the world's first industrial research laboratory.

## **Technological achievements**

The application of technology achievements drew upon the entrepreneurial skills of a rising business class. Andrew Carnegie, for example, was able to turn the breakthroughs in steel production into a formidable manufacturing corporation. John D. Rockefeller secured control of the production, refining, transportation and distribution of oil through his Standard Oil Trust. At the end of the century, Henry Ford established a company to manufacture automobiles on a scale never before seen.

The enormous scope of these corporate operations resulted in extraordinary wealth for America's leaders of industry, finance and business. The marriage of technology and business also offered great opportunities for millions of American workers. However, the struggle for wages and a safe workplace led to a series of conflicts between labor and management that erupted in nearly every major industry. At the same time, government regulation over industry and business became necessary to ensure fair competition and to protect consumers.

Just as the technology of the 19th century responded to the social and economic needs of a new and expanding nation, so too did the uses and consequences of technology extend into every aspect of life as America entered the 20th century.

*Brent D. Glass recently retired from the Smithsonian after nine years as director of the National Museum of American History in Washington, D.C.*

## Quiz

1 Which of the following selections from the article BEST develops the article's central idea?

- (A) The best-known and most successful bridge designer during this time was John A. Roebling, a German immigrant. Roebling's creative use of wire rope technology resulted in spectacular suspension bridges.
- (B) However, the uses of oil were limited in the 19th century mostly to illumination and medical products such as petroleum jelly. Refining oil as a fuel and lubricant for cars, ships and locomotives and using oil as a base for plastic and other products would take place in the 20th century.
- (C) The 19th century was also a time when inventors became celebrated as central figures in the spectacular growth of technology. Samuel Morse's invention of the telegraph (1835) and Alexander Graham Bell's telephone (1876) made long-distance communication possible in a rapidly expanding nation.
- (D) However, the struggle for wages and a safe workplace led to a series of conflicts between labor and management that erupted in nearly every major industry. At the same time, government regulation over industry and business became necessary to ensure fair competition and to protect consumers.

2 Read the sentence from the section "Technological achievements."

*Andrew Carnegie, for example, was able to turn the breakthroughs in steel production into a formidable manufacturing corporation.*

Does this sentence support a main idea of the article? Why or why not?

- (A) Yes, it explains how technological breakthroughs led to powerful and influential businesses.
- (B) Yes, it illustrates one way in which the inventions of the 19th century led to wealth for everyone.
- (C) No, it is a minor detail that does not describe an innovation of the 19th century.
- (D) No, it does not speak to the importance of the inventors of the new technologies.

- 3 How does the article develop the idea of the railroads' importance in 19th-century United States?
- (A) by describing the labor that was involved in the completion of the transcontinental rail link
  - (B) by giving the date of the first American railroad and explaining that it had 13 miles of track
  - (C) by explaining that railroads would not have been possible without the invention of steam power
  - (D) by describing how the railroads grew quickly and demonstrated the nation's technological strength
- 4 According to the article, each of the following contributed to the innovation boom of the 19th century EXCEPT:
- (A) the 1836 change in the U.S. patent process
  - (B) the expansion of America's economy during the 19th century
  - (C) the publishing of Alexis de Tocqueville's "Democracy in America"
  - (D) the growth in America's population and its spread across the continent