

## 3.1 Invention and Mechanization

How did the development of new technologies change life in the United States?

### Explore

## Better Production Methods

How were production methods mechanized?

### Assembling Raw Materials

As the production of goods expanded, the demand for more raw materials to make those products also increased. Raw materials are resources that can be manufactured, processed, or combined to create a new and useful product, such as the wood that is made into a chair. To meet the demand for raw materials, business leaders supported the extensive search for underground resources such as iron ore, coal, and petroleum. During the late 1800s, vast deposits of iron ore were mined under the land around Lake Superior. As a result, the total amount of iron ore mined in the United States increased from 7 million tons in 1880 to more than 27 million tons by 1900.

Mechanized methods of removing minerals from underground also drove progress. Scientists developed an early power tool called the longwall cutter to cut coal out of the earth. This tool greatly increased how much coal a single worker could extract, or pull out, at a time. People soon discovered that vast oil deposits lay deep beneath the earth. Before this time, people thought that oil only existed near the surface of the ground. Soon workers drilled wells that reached the deep oil deposits. The oil gushed out of the wells at an alarming rate, which made drilling for oil simpler. Extensive pumping to get the oil to the surface was not needed. These oil wells came to be called gushers.

Before the Civil War, making large amounts of steel was a long, expensive process. However, in the 1850s, a British inventor named Henry Bessemer developed an inexpensive way to make large quantities of steel. This method came to be called the Bessemer process. It involved pouring molten iron into a large container and then blasting the iron with air. This process removed impurities and changed the iron to steel. In 1864, U.S. steel companies began to use the Bessemer process, and by 1880, nearly all steel companies used it.

During the early 1900s, a new steel-making technique, the open-hearth process, would replace the Bessemer process. The open-hearth process had the advantage of being able to make steel from scrap metal. This process also allowed for control over the quality of the steel's chemical composition. However, in the mid-1900s, the open-hearth process was replaced by the basic oxygen process, which

is an enhanced, updated form of the Bessemer process.

## Producing Products

After the Civil War, production methods were also improved by using a highly organized and methodical approach. In factories, companies hired thousands of workers and gave each worker a specific task. For example, consider a company that makes chairs. One group of workers would make the legs, another group would make the backs, and a third group would make the cushions. This method of organizing workers was called division of labor.

Then, in the early 1900s, an automobile manufacturer named Henry Ford began using division of labor with the [assembly line](#). This process often involved workstations along a moving conveyor belt. The product would move along the belt, and at each station, a worker would add something to the product. Each worker repeated the same function over and over. By the end of the assembly line, the workers had completed making the product, in this case, an automobile.

Another innovation that became popular during this time was [scientific management](#). Scientific management was a way of improving workers' efficiency by eliminating unnecessary actions or tasks. The idea was pioneered by Fred W. Taylor, who studied how long it took factory workers to complete their tasks and determined which actions took too long or required unnecessary motions. Scientific management streamlined the production process by making sure each worker, tool, and task was absolutely necessary for the job.

Over time, companies that used steam-powered machines for production and manufacturing replaced them with gasoline-fueled machines and later, electrically powered machines. As a result, the U.S. factory system became more efficient and powerful. The retrieval of raw materials and the production of goods increased and improved. The movement from steam power to fuel power and electricity also strongly affected transportation.