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# The Industrial Revolution Begins

In the final decades of the 18th century, Europe (and the thirteen English colonies of North America) was the scene of important revolutions. In America, the colonies fought to separate themselves from the control of the English king, George III, and Parliament. In Europe, the great political upheaval called the French Revolution sent shock waves across the Continent as revolutionaries executed Louis XVI and his queen, and founded a republican form of government.

While these great political changes were altering the lives of millions of people in America and Europe, another “revolution” was taking place that changed the economies of Europe and the United States from agricultural to industrial.

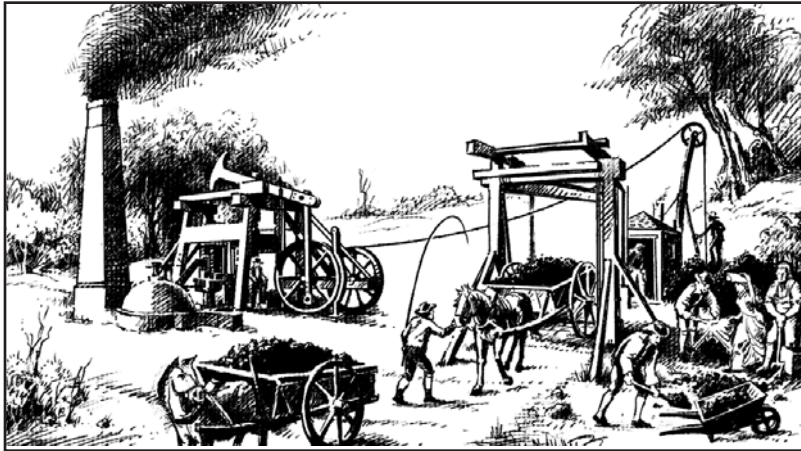
This Industrial Revolution caused great strains and even violence as economic systems shifted from hand field labor to artificial labor, the work done by machines. The changes brought about by this revolution began to take on speed around the mid-18th century.

When describing the changes brought about by steam power, the use of the word “revolution” may be misleading. Generally, a revolution takes place in a short period of time—within a generation at most. However, the Industrial Revolution spans several generations, and the changes it brought were gradual. What really occurred might better be called an evolution. However, when one looks at the dramatic impact of industrial trends on life in England, America, and the Continent, it is nothing if not revolutionary.

The center of the industrial revolution was England. Later, the United States—a country full of inventors, machinists, and tinkerers—caught the fever, only to be followed slowly by the other nations of Europe. In time, this industrialization

expanded throughout the world. The revolution hit its stride around 1815 and continued for the remainder of the 19th century. The great new power of this increasingly mechanical age was the steam engine, the cornerstone invention of this early industrial period. Originally built to pump water out of English coal and iron mines, this artificial power became the driving force for over a century.

Within decades of its invention, steam power was applied to mining, textile production, iron



smelting, and dozens of other industrial pursuits. By the early decades of the 19th century, the invention of the steam engine led to the invention of the railroad. Steam engines allowed for the invention of steamboats and later steamships, which

plied across the ocean, drastically reducing the time required to travel overseas.

While many factors played a role in the development of the industrial age, the Industrial Revolution was rooted in three factors: coal, iron, and steam. Steam engines were fired by coal that was produced in England in great quantities. Such machines and other mechanical devices of the age were crafted and forged out of iron. And the entire age was powered by the man-made and controlled energy of great steam engines.

The changes which began in the Industrial Revolution have really never come to an end. In some respects, the revolution had its roots thousands of years ago. Historians speak of an Iron Age in human history. This age began around 1000 B.C. when ancient peoples began making tools and weapons out of iron. Today, the Iron Age endures as we continue to rely on this important metal (a constituent of steel), and the effects of the Industrial Revolution continue to alter modern economies, making further ripples in the industrialized world.

## Great Britain Leads the Way

There are reasons why the Industrial Revolution began in England during the last quarter of the 1700s. In earlier centuries, England had become the leading commercial power in the world. By the early 18th century, British trade overseas made England wealthy. During the wars of the century, especially the Seven Years War, England gained control of many overseas colonies. By mid-century, one of England's primary trade rivals, France, had lost control of India and Canada to the British. English sea captains commanded great trading ships, which could be found all over the world.

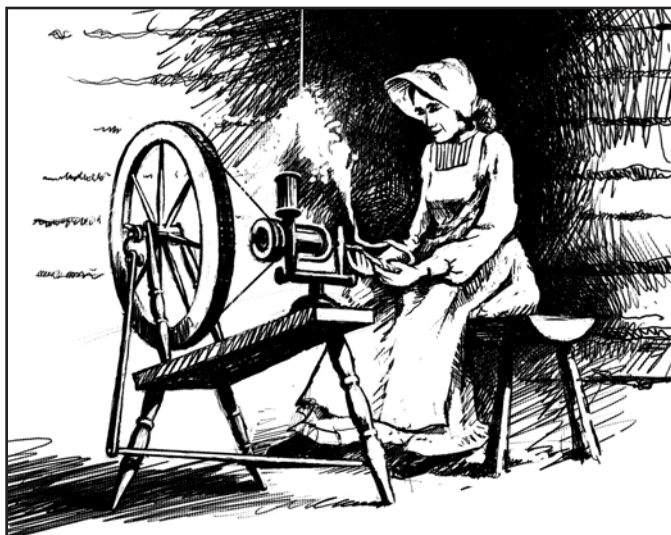
But by the second half of the 18th century, England was beginning to experience serious problems at home on several fronts: the population of the British Isles was growing rapidly; England was starting to face serious shortages of wood; and the growing population was straining the domestic producers of cloth and clothing.

The shortage of wood led to an increased reliance on coal as a fuel for heating stoves and fireplaces, and for blacksmithing and the smelting of iron ore. With this increased need for coal came an increase in mining.

By the 18th century, coal was difficult to mine close to the surface and miners were driven deeper underground. In these deeper mines, water seepage was a constant challenge. Something had to be done to solve the problem of the flooding of coal mines. The answer proved to be the invention of steam-powered pumps, which forced the water out of the mines.

As England relied increasingly on coal as a fuel, it began replacing wood in the smelting of iron ore. In early years, burnt wood, known as charcoal, was used to heat iron ore and remove the carbon impurities. By the 18th century, iron smelting plants began using coke—a hard, grayish material produced by heating soft coal in an airtight oven, removing the coal tar and coke gas—as the fuel for smelting iron. This trend only increased the expansion of England's coal-producing mines.

As for the problem of clothing the ever-growing population in 18th-century England, new machines were being invented to replace the old



system of cloth production. For centuries since the Middle Ages, England had been home to a great wool trade. English farms raised sheep, and their wool was regularly spun into thread and then woven into woolen garments and other items.

With the expansion of English trade to India, Egypt, and later the United States, a new material was introduced to England: cotton. Thousands of older women (known as spinsters) worked in their homes, spinning wool and now cotton into thread. But their production was starting to lag behind eighteenth-century population growth. Faster and more efficient methods of production were needed.

The old system (known as the *putting out system*) relied on businessmen providing the raw materials to women who worked out of their homes on their own spinning wheels. The drive to improve and increase cloth production was, therefore, pursued on two fronts—to build faster, more efficient machinery and to rehouse production—not in private homes, but in larger facilities. This, in time, led to the development of the factory system, another result of the Industrial Revolution.

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### *Review and Write*

Explain how England's problems with population, wood, and cloth production helped lead to the Industrial Revolution.

## A Revolution in English Textiles

England led the way for several generations in the creation and expansion of the Industrial Revolution. There are important reasons why Great Britain was a leader in this drive from dependence on agriculture to an increased reliance on industrialization.

For example, in the late 1700s, England was led by ministers and parliamentarians who were sympathetic to trade, commerce, and industrial expansion. England had ample amounts of raw materials at home, such as iron ore and coal. Labor was cheap. There were financial institutions, such as lending houses and banks that raised the needed capital to build factories, construct mills, purchase steam engines, and employ hundreds of workers.

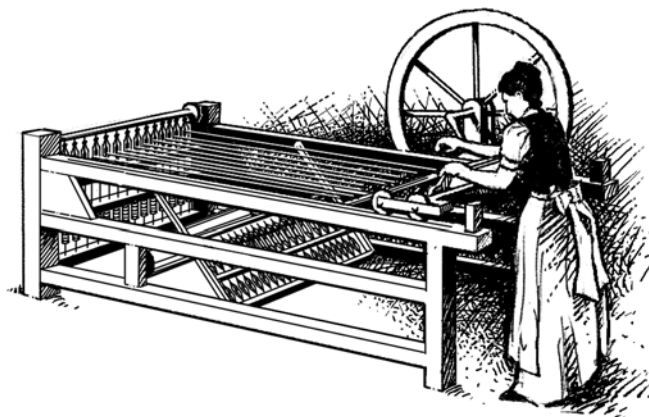
In addition, England had established extensive overseas markets by 1750. Such connections were necessary to serve as potential buyers for English textiles, iron, coal, and other items.

As has been emphasized on earlier pages, one source of the Industrial Revolution was found in the textile industry. The production of cotton thread, cloth, and clothing introduced into England in the 1600s led the way in transforming the means of production of cotton materials. These changes were brought on by a series of inventions and innovations.

In 1733, an English weaver from Lancashire, John Kay, invented the fly-shuttle, which allowed one workman rather than two to operate a hand loom. Short-sighted individuals decried Kay's innovation, claiming it would put weavers out of work. In time, angry mobs attacked and destroyed his home. (Kay later died in France in poverty.)

Kay's innovation did not catch on quickly, however. While his fly-shuttle improved the production of a single weaver, the real problem was in the production of thread. Typically, a one-man loom required the work of four to ten spinners to produce enough thread to keep one or two loom workers busy.

Within a generation, James Hargreaves, a carpenter, also from Lancashire, invented a spinning machine in 1765, which he patented in 1770. Rather than a single worker spinning thread on a single spinning wheel, Hargreave's new invention (called a *jenny* after his wife's name) allowed a single spinner



to spin eight threads simultaneously. Later models increased the number of simultaneously produced threads to 100! Acceptance of such a device by cloth workers was slow. (In fact, Hargreaves, too, had his house sacked and his first spinning jenny burned by angry spinners fearing for their jobs.)

Such devices revolutionized cotton thread production. By 1778, English spinners were busy working 20,000 spinning jennies. The jenny cut down on the number of hours required to produce cotton thread or yarn. For example, prior to the jenny, a hand spinner using a spinning wheel worked 1000 hours to produce 22 pounds of cotton yarn. With the early spinning jenny, the same amount of yarn required only 400 hours of labor. By 1830, using improved models, the time was reduced to 20 hours!

Later devices followed. In 1769, Richard Arkwright, a barber from Lancashire, patented the water-frame, which used water-powered rollers and spindles to make strong, but coarse, cotton thread. A decade later, another Lancashire tinkerer, Samuel Crompton, combined the spinning jenny and Arkwright's water-frame to produce strong and fine cotton thread.

Such machines revolutionized textile production in England. In the 1770s, England worked eight million pounds of raw cotton into thread and cloth. By the 1790s, the amount of cotton had increased to 37 million pounds. In 1815, England reached the 100 million pound mark, and, by 1830, English spinners and weavers were busy working 250 million pounds of raw cotton.