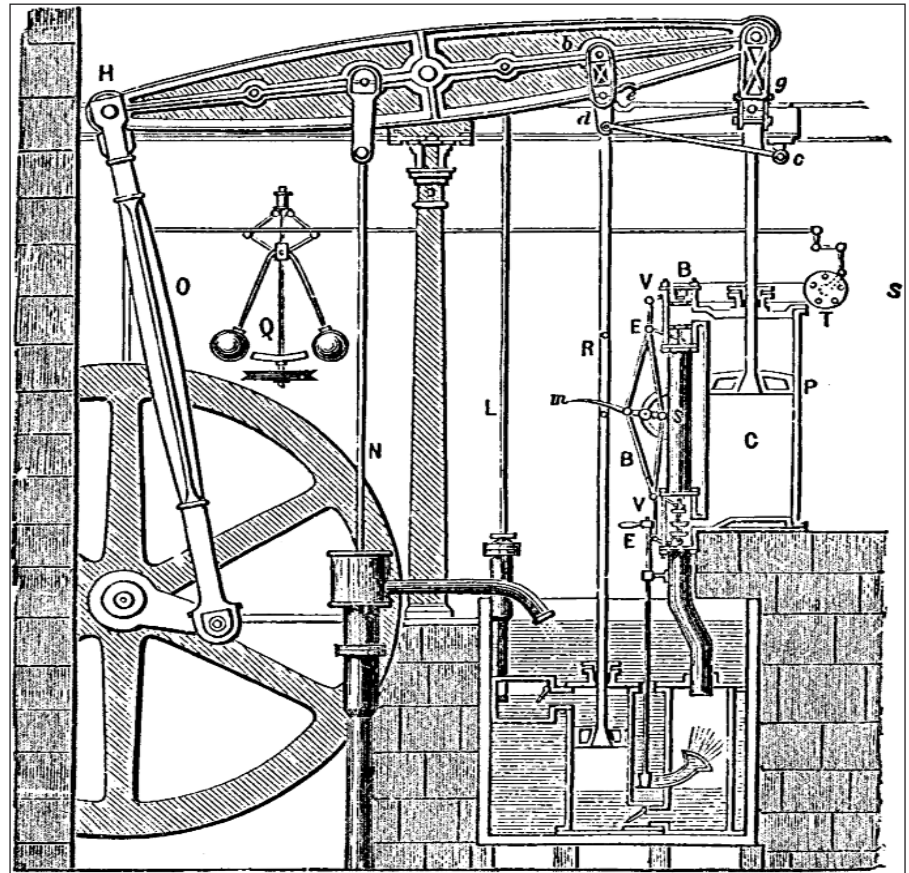


THE INDUSTRIAL REVOLUTION – FROM FARM TO FACTORY

IN 1700, BRITAIN WAS LARGELY A RURAL COUNTRY WHERE MOST PEOPLE LIVED OFF THE LAND. LITTLE HAD CHANGED IN THE PREVIOUS 500 YEARS, AND INCOME PER PERSON WAS ESSENTIALLY FLAT. BUT BY 1850 THIS SMALL ISLAND NATION HAD BECOME THE “WORKSHOP OF THE WORLD.” PER PERSON INCOME WAS SOARING, AND BRITAIN WAS PRODUCING ABOUT TWO-THIRDS OF THE WORLD’S COAL AND MORE THAN HALF OF ITS IRON AND COTTON CLOTH. BUSINESSMEN WERE COMING FROM ALL OVER EUROPE TO FIND OUT HOW AND WHY THE INDUSTRIAL REVOLUTION HAD TAKEN PLACE IN BRITAIN, WHY BRITAIN HAD A VIRTUAL MONOPOLY ON TEXTILES AND MACHINE TOOLS, AND HOW THEIR OWN COUNTRIES COULD MAKE THE SAME CHANGES AND BENEFIT FROM THE HUGE INCREASE IN WEALTH AND PROSPERITY THAT HAD SPREAD ACROSS THE BRITISH ISLES.

In 1700, most British people worked the land. Living in villages surrounded by huge open fields, they produced grain and small amounts of livestock that provided a modest living. Most villagers cultivated a few



A sketch of one of James Watt's steam engines. The letter C indicates the steam-cylinder.

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strips of open field and supplemented their income by grazing cows, keeping fowl, and gathering fuel wood.

Wool was also an important source of income. Throughout Britain, peasants, farmers, and agricultural laborers worked on producing woolen cloth. The process required many steps: After sheep were sheared, the wool was sorted and cleaned and then combed to make yarn. The yarn was spun and woven. Women and children often did the sorting, cleaning and spinning; men did the combing and weaving — all in their own cottages.

Coal played an important part in life, especially after timber began to run out and charcoal (made from wood) was in short supply. Coal supplied heat to homes and fueled the furnaces that ▶

INDUSTRIALIZATION AND LABOR

This edition of *Bill of Rights in Action* examines industrialization and labor issues. The first article looks at the Industrial Revolution, which turned Britain into the first industrial nation and continues today in the developing world. The second article examines the Pullman strike, an 1894 labor dispute that spread throughout the United States. The last article traces the history of U.S. labor unions and looks at where they stand today.

World History: The Industrial Revolution

U.S. History: The Pullman Strike and Boycott

U.S. History: American Labor Unions: Yesterday and Today

Guest writer Lucy Eisenberg, Esq., contributed the article on the Industrial Revolution. Our longtime contributor Carlton Martz wrote the other articles.

produced iron for tools. Coal was mostly mined in agricultural areas, where miners would also grow oats and other crops. At the bottom of the mine shaft, coal was moved by men who pulled wooden sledges or by ponies tended by boys. In some mines, the wives and daughters of miners carried coal in baskets. When water seeped into the coal shaft, it was carried to the surface in a series of pots hauled by men or donkeys, or occasionally pumped by waterwheels or windmills. When coal reached the surface, it was transported in bags slung over the backs of horses — or in wagons on bumpy roads to the nearest river or port. Thus in mining, as in textile production and farming, work was done with hand tools and power was supplied by human or animal muscle (or in some cases by wind or running water).

New Inventions

By 1750, the first Industrial Revolution had begun, and Britain was changing from an economy based on farming, manual labor, and draft animals to machine-based manufacturing. Two important breakthroughs occurred: the invention of the steam engine by James Watt and a series of inventions that revolutionized the textile industry. New and better ways of making iron were also being developed.

A. Watt's Steam Engine

To mine more coal, Britain's coal industry needed to sink deeper shafts. But that depended on finding a way to pump out underground water. In 1702, Thomas Newcomen designed a steam engine to power pumps in coal mines. But Newcomen's engine was inefficient and consumed large amounts of fuel. Fifty years later, a young Scotsman named James Watt began experimenting with steam and came up a new two-cylinder steam engine. It increased the efficiency of the steam engine by a factor of five and saved 75 percent on coal costs. Watt formed a partnership with the owner of an ironworks and acquired a patent on his design. By 1776, the Watt steam engine was installed and working in coal mines to pump water. For the first time in history, coal miners did

not have to rely on water, wind, or human or animal muscle for power.

B. From Wool to Cotton

While the steam engine was being developed, big changes were underway in manufacturing textiles. Prior to 1750, most cloth produced in Britain was made with wool, shorn from the backs of sheep who grazed on country farms. Individual artisans processed the wool, spinning and weaving it in their own homes. No cotton grew in Britain, and most of the cotton cloth used in clothing was imported from India.

Then within 50 years, a series of inventions transformed the textile industry. The invention in 1733 of a "flying shuttle" made weaving much faster, and cotton thread was in short supply. Then a "carding" machine was invented in 1748. It converted raw cotton buds into a continuous coil of cotton fiber. The carding machine was improved by Richard Arkwright, who became known as the "Father of the Industrial Revolution." In the mid-1760s another invention, called the "spinning jenny," allowed a single operator to spin dozens of threads at once. Arkwright then invented another method of spinning — the water frame. It used water to power a machine that produced an even stronger thread than the spinning jenny. By 1780, a cotton "mule" had been invented that combined the best points of the spinning jenny and the water frame. Cotton mills were built — powered by running water — and the process of preparing cotton for spinning was mechanized. In a short time, with Arkwright's spinning roller, a new industry was created based solely on cotton.

Between 1750 and 1800, the value of cotton goods exported from Britain increased more than a 100 fold — from almost 50,000 to more than 5 million English pounds. Cotton had overtaken wool in Britain's textile industry.

C. Making More, and Better, Iron

Britain had good supplies of iron ore and had been producing iron for centuries. But the furnaces used to produce iron were fueled with wood, and by 1700, many forests had been

cut down and timber was in short supply. One solution came in 1709 when Abraham Darby set up a coal foundry that used coke (which comes from coal) instead of charcoal to smelt iron ore into pig iron. Darby's technique made iron smelting more profitable, but it could only produce pig iron that was not as strong as wrought iron.

Forged in blast furnaces, wrought iron was used for important tools such as plows and hoes. In 1750, Britain was still importing wrought iron from Sweden. Two new inventions in the next 50 years transformed the industry. One used the Watts steam-engine instead of water-wheels to blow the blast furnace. The second was a new process for "puddling" and rolling that removed impurities caused by using coke and made bars of the native pig iron at least as good as Swedish iron. The puddling process was patented in 1783 and 1784.

By 1805, the output of British pig iron had more than quadrupled. The average blast furnace produced almost 1,500 tons, almost doubling previous output. Iron foundries were springing up all over England and Wales.

A Transportation System

By 1800, Britain had abundant fuel from coal, steam engines powered many machines, and foundries made high-quality pig iron that could be used to make tools. But a transportation system also was essential for the Industrial Revolution.

In 1700, English roads were the worst in Europe. But by mid-century, hundreds of new and better roads were being built by "Turnpike Trusts," which gave private groups the authority to build roads and charge tolls to recover their costs. Even good roads, however, could not carry coal and other bulky and weighty goods required by factories. Britain solved the transportation problem by building hundreds of miles of new canals linked to navigable rivers, which in turn accessed seaside ports.

In 1761 the Duke of Bridgewater financed a canal that brought coal from his mines to the up-and-coming town

of Manchester. A huge commercial success, the canal halved the cost of transporting coal and raw cotton.

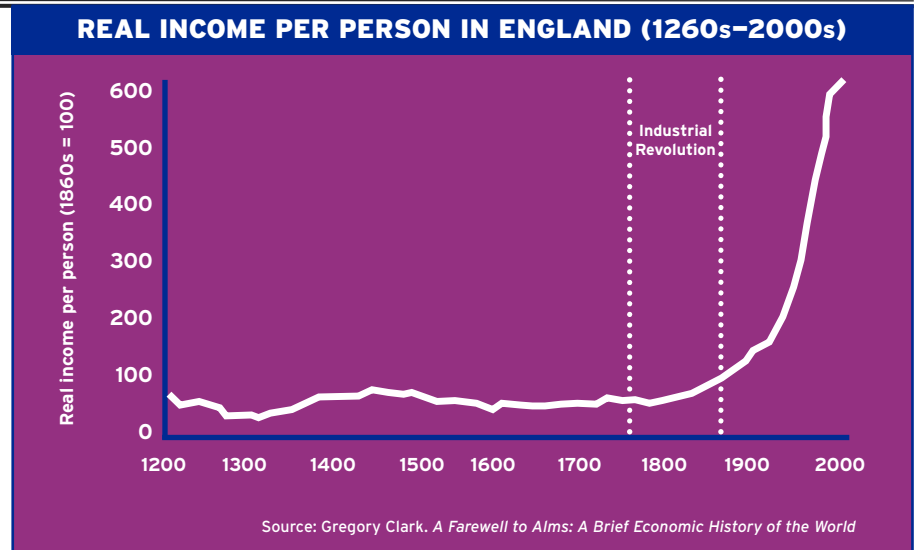
Fifty years later, the development of railroads revolutionized transportation again. In 1804, Samuel Homfrey financed a steam-powered locomotive that could haul 10 tons of iron from the ironworks. Less than 20 years later, the Stockton and Darlington Railroad was carrying both coal and passengers over a nine-mile stretch in one hour. And by 1830 a two-track railroad was built to provide cheap transportation for raw materials and finished goods — as well as passengers — between the port of Liverpool and the booming city of Manchester.

An Industrial World

By 1800, Manchester had become Britain's leading industrial city. A hundred years earlier, Manchester was only a small town, with a population of approximately 10,000. Then, in 1783, Richard Arkwright built a steam-powered cotton mill in Manchester, and within in a few years, new mills with steam-driven machinery dotted the area. By the turn of the century, the cotton industry had exploded. In just 20 years — between 1780 and 1800 — imports of raw cotton increased from 6 million to 56 million pounds per year. Cotton mills sprouted up everywhere as did warehouses to store cotton and finished products. In 1806, the city center housed just over 1,000 warehouses, and 15 years later, this number had almost doubled. By 1821, the city contained 32 factories with 5,722 steam-powered weaving looms. Manchester was called the “warehouse city” and later became known as “Cottonopolis” and the world's first center of mass production.

People came from all over the world to see the new industrial world. Much of what they saw was ugly, because England had not figured out how to manage its growing population in cities (urbanization).

Manchester's population grew from 25,000 in 1772 to 455,000 in 1851. Heavy soot from burning coal



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blocked sunlight and blackened the city, as it did in other factory cities. Other problems arose — a lack of police protection, clean water, sewers, garbage disposal, and housing. Families lived in single rooms, and ragged children roamed the filthy streets. The factories paid reasonable wages for unskilled workers, but not enough to support a whole family. The workday was long, and the work was tedious. Many factories hired children as young as 6 years old. In 1835, Alexis de Tocqueville, a French political writer and historian, went to Manchester, which he called “the palace of industry.” He found a city with 30 or 40 huge six-story factories, where the “noise of furnaces (and) the whistle of steam fill the air;” where “300,000 human beings are ceaselessly at work” and where a few are wealthy and many are poor. Summing up, de Tocqueville wrote:

From the foul drain the greatest stream of human industry flows out to fertilize the whole world. From this filthy sewer pure gold flows, Here humanity attains its most complete development and its most brutish; here civilization works its miracles and civilized man is turned almost into a savage.

Why England?

By 1850, Great Britain was known as the “workshop of the world.” A small country in size and population,

it was producing about two-thirds of the world's coal and more than half of its iron and cloth. And while government representatives and businessmen from throughout Europe were touring Britain's industrial centers and sending home reports, the rest of Europe was still far slower than the British in industrializing.

Many explanations account for why the Industrial Revolution first took place in Great Britain. One factor that gave Britain an advantage over Europe was size. Most European countries were larger than Britain, their populations were more spread out, and their terrain was more rugged. Thus, their transportation costs for fuel and raw materials were higher.

Another factor was natural resources. Britain's ample supply of coal and iron ore helped power its industrial growth.

Britain also had good access to the sea. In Britain, no part of the country is more than 70 miles from the ocean, and many navigable rivers run through the country. The rivers and streams not only facilitated transportation, but also helped power the early cotton mills before the advent of steam engines.

Britain could also furnish the capital needed to build the new inventions that gave rise to a machine-based economy. The Bank of England, founded in 1694, provided ready access to lenders and borrowers. ▶

England also had a stable legal system, including a patent system that helped protect and propel new inventions. Inventors could patent their inventions, and others who used their inventions had to pay for the privilege. Inventors like Arkwright and Watt earned money from their patented inventions, and the details of how their inventions worked were well-known and stimulated further inventions. In countries without a patent system, the only way to protect an invention was to keep it secret.

As a world power, Britain also enjoyed a world market for the goods it produced — as well as overseas sources of raw materials including cotton. In 1750, Britain's colonial possessions reached from North America and Canada to Australia and India and Africa. Trade with the colonies provided profit that could be invested in new inventions and new cities. As one historian put it, "the commercial frontier of Britain lay overseas." In the century from 1700 to 1800, sales to the West Indies and mainland colonies grew from 10 percent of British domestic exports to almost 60 percent. Britain, which used to import cotton cloth from India, was now exporting it to India — along with other products. In 1800, Britain had merchants ready to sell goods around the world. Its huge mercantile shipping force and a navy controlled the seas. As production soared, so did Britain's exports to its colonies.

Industrialization Continues

The transition from an agricultural economy, where farmers and villagers set their own routines, to the machine-driven routine of 12-hour shifts in huge factories, did not come easily to many British workers. Skilled textile artisans, put out of work by automated looms, began violent protests in 1811, burning mills and destroying factory machinery. The protestors, called Luddites, became so violent that the British army had to be called into action. But gradually the Industrial Revolution brought the common man more comfortable living conditions, better nutrition, and longer life.

In 1851 Queen Victoria and her husband, Prince Albert, hosted the great Crystal Palace Exhibition to display the wonders of manufacturing and industry. Six million visitors came from around the world to see the products of industrialization. England showed off hundreds of its great inventions: a huge hydraulic press, a printing machine, an adding machine, textile machines, and every kind of steam engine. Other European countries beginning to enter the industrial age sent exhibits, as did America which displayed a sophisticated new plow and a fast-firing revolver. The German iron and steel maker Krupp startled viewers with a two-ton block of cast steel.

Prince Albert saw the Great Exhibition as evidence of "a period of most wonderful transition, which tends rapidly to accomplish that great end to which indeed all history points — the realization of the unity of mankind." And indeed, at different times, and at different speeds, most of the world has industrialized.

The most recent example is China, whose rapid industrialization has amazed the world. Like British cities during the Industrial Revolution, many Chinese cities now suffer from pollution and rapid urbanization. But the wealth of China has grown tremendously.

Other parts of the developing world — countries in Asia, Africa, and Latin America — are still on the road to industrialization.

FOR DISCUSSION AND WRITING

1. What was the Industrial Revolution? How is it relevant to today's world?
2. Which invention do you think contributed the most to the Industrial Revolution? Why?
3. Why do you think the Industrial Revolution first took place in Britain?



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ACTIVITY

Agricultural Revolution vs. Industrial Revolution

The Industrial Revolution is frequently compared to another significant revolution in human history, the Agricultural Revolution (or Neolithic Revolution), which began around 10,000 B.C. Before the Agricultural Revolution, humans lived in small groups, hunted wild animals, and gathered food from plants growing in the wild. The invention of agriculture meant that people could grow their own food and stay in one place. People domesticated animals, and as food supplies grew, so did the population. The Agricultural Revolution led to towns, cities, and civilization. Society grew more complex. New classes arose — craftsmen, warriors, priests, leaders. New problems also arose, especially those associated with cities, e.g., disease and crime.

In this activity, students will decide which had the most positive effect on humans, the Agricultural Revolution or the Industrial Revolution.

1. Form small groups. During the activity, students should refer to the article and use information they have previously learned.
2. Each group should discuss and answer the following questions about both the Agricultural Revolution and the Industrial Revolution:
 - a. What were its benefits?
 - b. What problems did it cause?
 - c. How would human history be different if it had not occurred?
3. Then each group should discuss and decide which revolution had the most positive effect on humans.
4. Groups report back to the class, giving reasons for their decisions and discussing them with the class.