**The "Flying Shuttle"**

Before the invention of the flying shuttle by John Kay in 1733, it was only possible for cloth to be woven up to a maximum of the width of a man's body, across his arms. This was because he had to pass the shuttle backwards and forwards, from hand to hand.

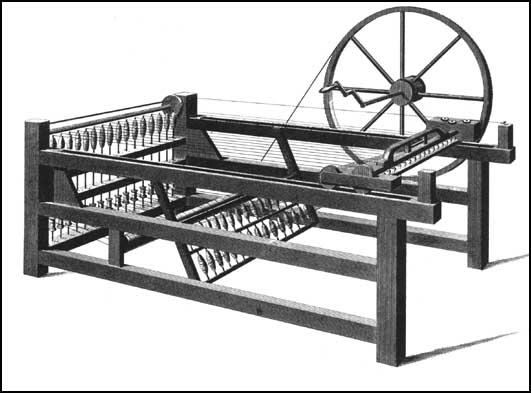
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| Flying Shuttle |
| Shuttle with bobin - released into the Public Domain by Audrius Meskauskas |

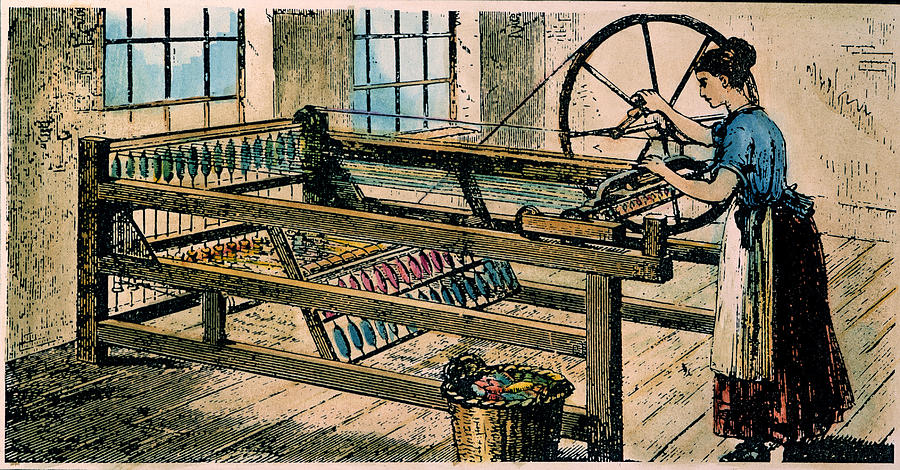
John Kay's invention allowed the shuttle, containing the thread, to be shot backwards and forwards across a much wider bed. The flying shuttle also allowed the thread to be woven at a faster rate, thus enabling the process of weaving to become faster. This greatly increased cloth production. Kay’s invention so increased yarn consumption that it spurred the invention of spinning machines

**Spinning Jenny**

The spinning of cotton into threads for weaving into cloth had traditionally taken place in the homes of textile workers - known as 'cottage industries'. But the 18th century saw the emergence of the ‘Industrial Revolution’, the great age of steam, canals and factories that changed the face of the British economy forever. In 1764, James Hargreaves’ ‘Spinning Jenny’ would revolutionize the process of cotton spinning. The machine used eight spindles onto which the thread was spun, so by turning a single wheel, the operator could now spin eight threads at once. This increased to eighty with improvements in the technology.

New ‘manufactories’ (an early word for 'factory') were a the result of new technologies such as this one. Large industrial buildings usually employed one central source of power to drive a whole network of machines. Richard Arkwright’s cotton factories in Nottingham and Cromford, for example, employed nearly 600 people by the 1770s, including many small children, whose nimble hands made light-work of spinning.





**1st water-powered factory**

**THE FIRST FACTORY?**  
Many of the textile machines were too large to be hand operated. Horses were used at first to attempt to operate these machines, but when this experiment failed, they harnessed the power of the water wheel.

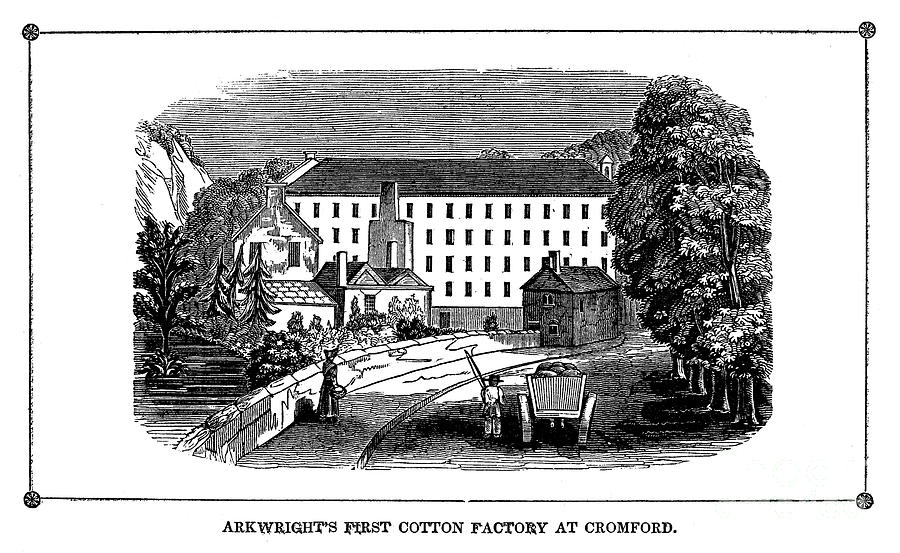
In 1771 the three men set up a large water powered mill factory on the banks of the River Derwent in Cromford, Derbyshire. Richard Arkwright's machine became known as the Water-Frame. It is the world’s first successful water spinning wheel.

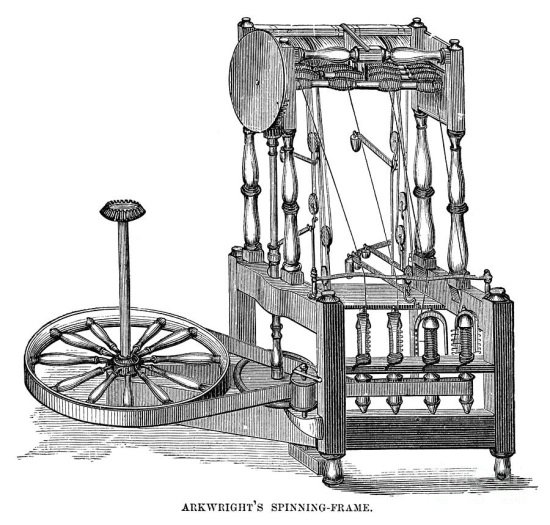
Arkwright brought together workers into one specialized workplace. There weren’t enough local people to supply Arkwright with the number of workers he needed so he built a large number of cottages close to the factory to bring in more workers. Arkwright preferred weavers with large families so that women and, especially their children, can work in the spinning-factory.

Arkwright was the first to use James Watt's steam engine to power textile machinery, though he only used it to pump water to the millrace of a waterwheel. From the combined use of the steam engine and the machinery, the power loom is eventually developed.



The Waterwheel at Arkwright's First Mill 1878 - Ford Madox Brown



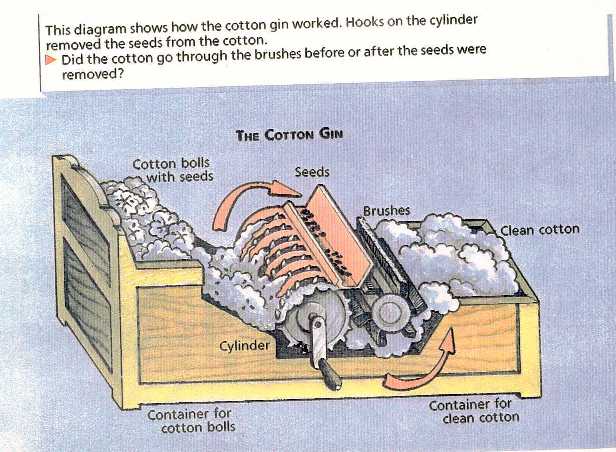


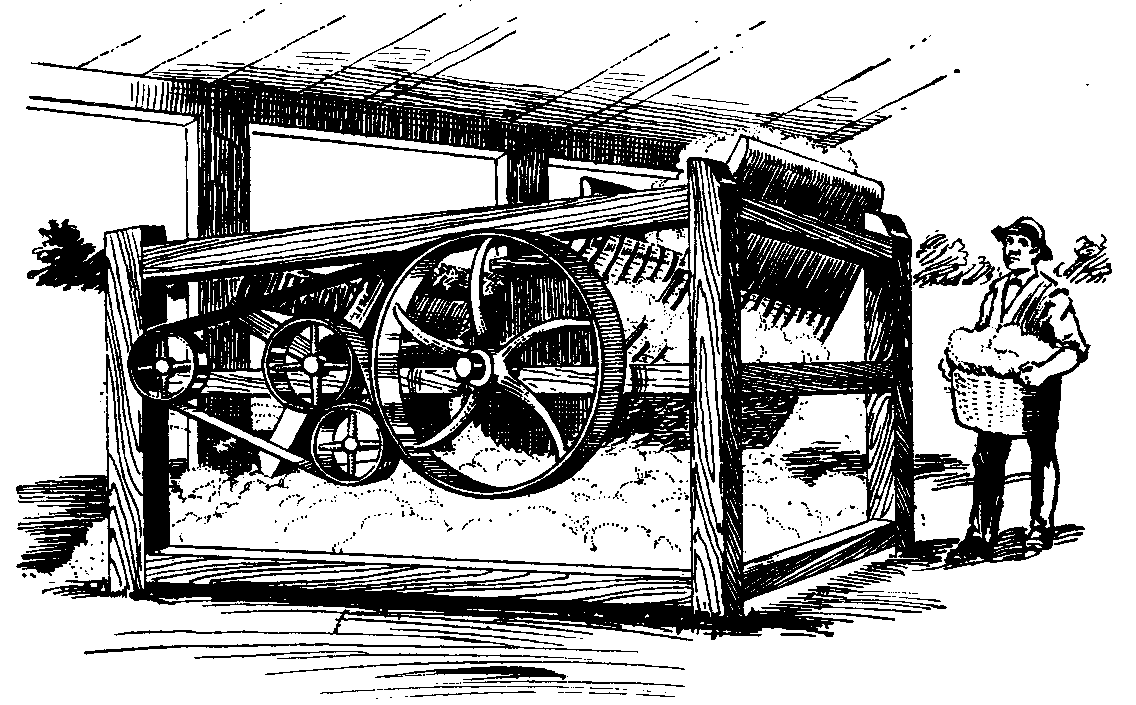
**1793: Eli Whitney – Cotton Gin**

In 1794, U.S.-born inventor Eli Whitney (1765-1825) patented the cotton gin, a machine that revolutionized the production of cotton by greatly speeding up the process of removing seeds from cotton fiber. By the mid-19th century, cotton had become America’s leading export. Despite its success, the gin made little money for Whitney due to patent-infringement issues. Also, his invention offered Southern planters a justification to maintain and expand slavery even as a growing number of Americans supported its abolition.

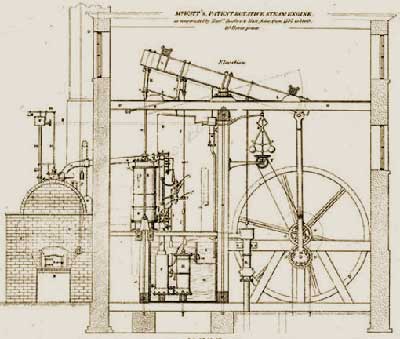
The invention, called the cotton gin (“gin” was derived from “engine”), worked something like a strainer or sieve: Cotton was run through a wooden drum embedded with a series of hooks that caught the fibers and dragged them through a mesh. The mesh was too fine to let the seeds through but the hooks pulled the cotton fibers through with ease. Smaller gins could be cranked by hand; larger ones could be powered by a horse and, later, by a steam engine.

Before the invention of the cotton gin, the removal of cotton seeds was very difficult manual labor. By hand, 1 person could clean 1pound of cotton per day. Using Whitney’s hand-cranked machine, 1 person could clean 50 pounds of cotton in a single day.





**James Watt Patents the Steam Engine**

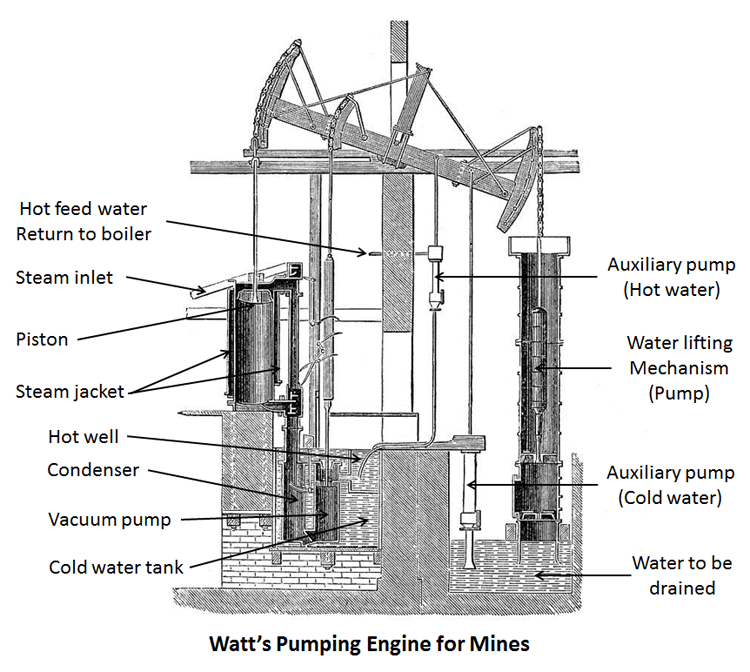
[](http://www.scotclans.com/wp-content/uploads/2013/11/watt.jpg)

*A WATT engine of 1787*

James Watt, the son of a merchant, was born on January 19, 1736, in Greenock. He worked as a mathematical-instrument maker as a teenager and soon became interested in steam engines, which were used at the time to pump water from mines. His interest took off in 1763 when he was given a Newcomen steam engine to repair. Watt realized that he could improve the engine’s efficiency by the use of a separate condenser. This made Watt’s engine 4 times more powerful than earlier designs.

Watt’s genius with invention was matched by his business expertise and entrepreneurial skills. His patent prevented any rival manufacture and the development of any further improvements to the Newcomen engine he had based his invention on so that the ‘Boulton & Watt’ company he had formed with his backer had a monopoly on production. The use of the steam engine in factories increases use of iron in factories and the use of coal for power.

Watt compared the output to the engine to the pulling power of horses formerly used in the mines giving rise to the ‘horsepower’ ratings still used in engines today.

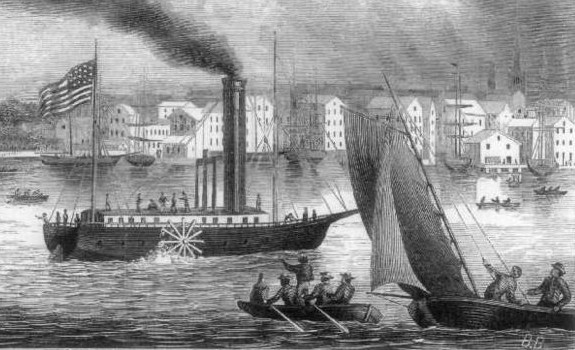


Robert Fulton Inventor of the Steamboat



## Born in Pennsylvania, inventor Robert Fulton's initial aspirations were to become a portrait painter. While studying art in London, Fulton's focus shifted to canals and shipbuilding. Though he started out designing steam-powered ships, Fulton ended up making a name for himself by constructing submarines for the British and French navies.

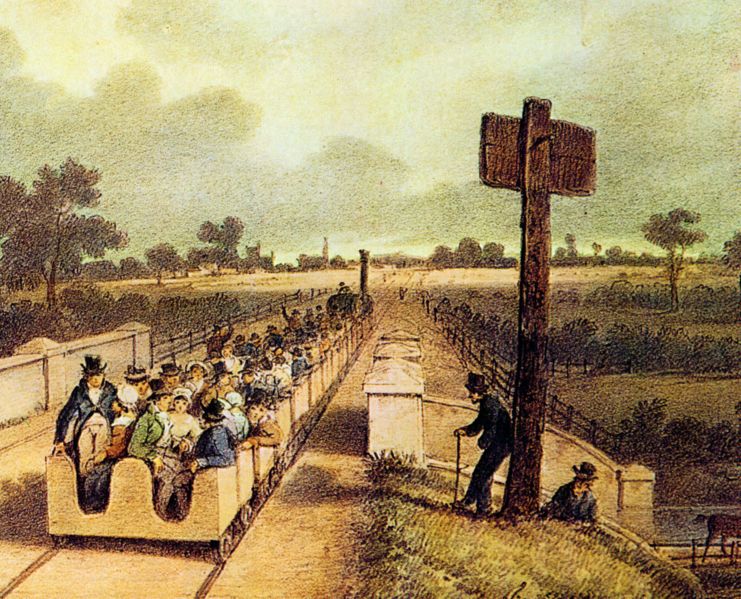
Upon returning to the US, Fulton went back to work on his idea for the steamboat invention. He took a special English steam engine, made some improvements to it, and tested models to develop the ideal shape. Ultimately, Fulton's ship, the Clermont, made its debut in 1807 – steaming upriver from New York to Albany. After obtaining his patent in 1809, Robert Fulton was soon running steamboat services on six major rivers and the Chesapeake Bay. Using Watt’s engine to travel on water made two-way river travel possible and travel on the high seas faster.



**Steam locomotive**

George Stephenson rose to fame from humble beginnings. He was born at Wylam in Northumberland in 1781, the son of illiterate working-class parents. His father worked in the Wylam colliery and so did young George from his early teens. He never went to school, but at 18 he was teaching himself to read and write (though writing would never be his strong suit) and was also getting basic tuition in arithmetic. He worked at various other collieries in the area in the early 1800s, including the one at Killingworth north of Newcastle, and developed such skill with engines that in 1812 he was appointed ‘engine wright’, or chief mechanic, at Killingworth. There in 1814 he built a locomotive called Blucher (often spelled Blutcher) in honour of the Prussian general, which could haul eight wagons loaded with 30 tons of coal at a speed of four miles per hour. Not content with that, he soon dramatically improved the engine’s steam system to give it greater pulling power. It was this that made Blucher the first fully effective steam railway locomotive.

Stephenson went on to devise an improved type of railway track and he built more locomotives for Killingworth and other collieries. He was becoming a respected figure and in 1821 he persuaded a businessman who was planning a horse-drawn railway from Stockton-on-Tees to Darlington in County Durham to order a steam locomotive for the line. In 1825 the engine, later called Locomotion, took 450 people 25 miles from Darlington to Stockton at 15 miles per hour. This was the first outing of the world’s first public passenger steam train. By 1830 Stephenson’s new locomotive, the Rocket, which could achieve a speed of 36 miles per hour, was operating on the Liverpool and Manchester Railway in Lancashire with other ‘iron horses’ built in the factory he had now opened in Newcastle. The railway age had begun and George Stephenson was its guiding spirit.



*The opening of the Liverpool-Manchester Railroad in 1830. The line became the world’s first inter-city railway and led to a huge wave of railroad building.*