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The Engineer Of Progress Transform: James Watt ignited industrial steam power

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James Watt invented the first practical steam engine.

And changed the world.

As far back as the first century, men tried to use steam for power.

It took an additional 1,700 years for someone to invent a primitive steam engine to replace horses for hauling up water buckets when mines were flooded.

That's all it was good for.

In 1763, Watt looked into one of those engines to repair.

He realized he could make it more powerful, plus create something that could drive all kinds of other machines.

Finally, in 1776, he put together the right team to make the first modern steam engines.

These powered a revolution in manufacturing that was as important in changing world history as the American struggle for independence going on at the same time.

Way Up There

"He is No. 25 among the movers **and** shakers of history because his engine, of all the inventions that contributed to the Industrial Revolution, played the absolutely crucial role, without which it would have been vastly different," wrote Michael Hart in ["The 100: A Ranking of the Most Influential Persons in History."](#)

Watt (1736-1819) was born in the Scottish seaport of Greenock, where his father was a ship owner.

Watt's grandfather was a math teacher, **and** the boy showed early skills in that subject **and** mechanics. Often too sick to go to school, he was tutored by his mother.

"A few toys were given him, which were constantly in use **and** he often took them to pieces **and** constructed new ones, a source of great delight," wrote the steel titan Andrew Carnegie of his fellow Scotsman in ["James Watt."](#) "Mrs. Campbell, Watt's cousin **and** constant companion, recalled his interest in a steam kettle, holding now a cup **and** now a silver spoon over the steam, watching how it rose **and** catching **and** counting the drops. While in his boyhood, his father gave him a set of small tools **and** Watt soon revealed wonderful dexterity. He also learned much as an omnivorous reader."

At 19, James went to London to study how to make scientific instruments for a year, then in 1757 moved to Glasgow, Scotland, where the university needed someone to repair its equipment.

Wealth Of Material

His mentors were Adam Smith, the philosopher who would write "The Wealth of Nations," the landmark book on the free market, **and** the physicist Joseph Black.

The original British steam engine was invented by Thomas Savery in 1698 to take water out of tin mines, which flooded as they were tunneled thousands of feet under the sea — hence horsepower, the term Watt would invent to measure how many horses were replaced by an engine. Savery's device was weak **and** had to be operated by hand.

Thomas Newcomen created a better engine in 1712. As steam caused pressure in his cylinder to change relative to the atmosphere outside, a vacuum was created, causing the piston to pump. Savery's investors claimed infringement **and** took over Newcomen's invention.

Half a century later, Watt received a broken model of Newcomen's engine **and** tinkered with it over the next two years.

Married With Children

In the middle of this project, Watt married Peggy Miller. They would have five children, but she died in childbirth with the last one in 1772. Five years later, he married Ann MacGregor, with whom he would have two children.

"Watt saw the main weakness in Newcomen's engine, which was that its main cylinder had to be continually heated **and** cooled to create the vacuum, wasting a lot of energy in reheating," Bernard Carlson, author of the Teaching Co. DVD "[Understanding the Inventions That Changed the World.](#)" told IBD. "Watt found he could achieve the same result by squirting cold water into a separate container called a condenser, connected to the main cylinder by a pipe with a valve, which would draw off steam. As long as the steam condensed somewhere in the system, a vacuum would result. Watt's main cylinder was able to maintain its temperature so that the engine used a quarter as much coal to fire the boiler that kept it hot."

Watt later found that by connecting the rocking beam of his engine to a flywheel, he could create rotation. This let the engine drive other devices, such as for milling **and** weaving, notes Carlson.

Watt kept coming up with improvements, including:

- New gear for turning the flywheel efficiently.
- A gauge to monitor pressure.
- Throttle valve to control the power.
- A speed governor to keep it running at a constant pace.
- A compound engine to connect two or more engines.

In The Thick Of It

He sought partners to finance **and** market while he oversaw invention **and** production.

Black gave him money to build the first engines in 1765. John Roebuck, an ironworks owner, provided manufacturing.

Yet Watt's men couldn't make components precise enough to improve on Newcomen's engine. After eight years of struggling to produce a superior machine, he found someone with top skills: Matthew Boulton.

This new partner had the best ironworkers in the world at his shop in Birmingham, England.

The duo promptly founded Boulton & Watt **and** by 1776 had installed steam engines 24 feet tall.

Using a meter that Watt invented, they charged an annual payment equal to one-third of the value of the coal saved in comparison with the Newcomen engine.

"It took perseverance, propaganda **and** politicking to succeed, with rivals **and** pirates on every corner," wrote Ben Marsden in "[Watt's Perfect Engine.](#)" "It meant quick thinking, opportunism **and** cool nerves. They turned the steam engine from a glorified pump to the prime workhorse of the Industrial Revolution."

Watt's patents gave the firm a monopoly from 1775 to 1800 in Britain while installing 500 of the improving engine, spreading to textile mills, toolmakers, railways **and** ships. All the while, he **and** Boulton spent a fortune enforcing patents, settling the last lawsuit in 1799.

Watt retired rich the next year. The business was transferred to his **and** Boulton's sons. By 1824 the firm had produced 1,164 engines, **and** by 1851, Britain had half of all steam power in Western Europe.

"Watt's lesson is it's rare for an inventor to be a great general businessman, **and** he had the good sense to find someone who complemented his skills, providing the commercial acumen needed to turn his engine into the technological standard of the day," said **George Haley**, professor of marketing at the University of **New Haven** in Connecticut. "Too often, entrepreneurs refuse to give up control to others who can help them realize their dreams, **and** they end up failing."

In retirement, Watt created other equipment, including a machine that could copy sculptures **and** a press that copied letters.

He designed a steam locomotive, **and** rode one to visit the place of his birth in 1816. Trains **and** steamships would revolutionize world transportation for people, products **and** the military.

Three years later, he died at 83.

In 1889, the watt as a unit of energy was named for his feats.

"The real impact of the steam engine came when it was coupled with organizational innovation to produce a revolution in manufacturing," said Carlson, a professor of business history at the University of Virginia.

Living On

Watt's last workshop **and** many of his inventions are preserved in a permanent exhibition titled "[James Watt and Our World](#)" at the Science Museum in London.

A colossal sculpture of him by Francis Chantrey stands in St. Paul's Cathedral in London, created in 1834 at a cost of \$842,000 in today's money, wrote Marsden.

The plaque reads: "James Watt enlarged the resources of his country, increased the power of man, **and** rose to an eminent place among the illustrious followers of science **and** the real benefactors of the world."

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