

## **JAMES WATT**

James Watt was the father of the industrial revolution.

### **EARLY YEARS**

James Watt was born in 1736 in Greenock, Scotland. He was an inventor, engineer and scientist. He came from a successful family. His grandfather taught mathematics, and his father was a carpenter, who built ships.

His mother was well-educated, and intelligent. She taught him to read, while his father taught him arithmetic and writing. He excelled at math, science and engineering at high school, but his language skills were less impressive.

As a boy, James Watt's health was often poor, and much of his learning took place at home, where he could watch the fishing boats coming into the port of Greenock and the big sailing ships bringing in tobacco from the Americas. One day, thanks to his inventive mind, ships like these would be powered by engines.

At eighteen, following the death of his mother, and a ship sinking that placed a financial burden on his family, James gave up his plans to go to university. Instead, he trained in London as a scientific instrument maker, specializing in mathematical and nautical instruments. Within two months, his skills were higher than others who had been in training for two years. His exceptional hand skills had previously been commented on by workers in his father's shipyard in Greenock.

After a year in London, he found work at Glasgow University, repairing instruments for the astronomy department.

### **MAKING FRIENDS, BUILDING KNOWLEDGE, AND DEVELOPING NEW SKILLS AT GLASGOW UNIVERSITY**

Watt's instrument work was so good that the university's professors wanted to keep him working there permanently, so they invited him to set up a workshop in the university.

The professors soon realized the young man in the workshop had a brain equal to their own. They began calling on him to discuss their work. Students of mathematics and physics found that Watt had learned more about their subjects than they had.

He also overcame his earlier poor language skills, teaching himself German and Italian in order to read more scientific literature.

At Glasgow University, James Watt became friends with Adam Smith, who founded the academic discipline of Economics and wrote *The Wealth of Nations*. He also became friends with the chemist Joseph Black, who discovered magnesium and, independently of Watt, invented the concept of latent heat.

In 1759, four years after his arrival in Glasgow, the 23 year-old James Watt became interested in steam machines.

This happened when another of his new friends at the university, Professor John Robison discussed with Watt the possibility of a steam-driven car. Although their ideas for the car were impractical, a seed had been sown in Watt's fertile mind.

Professor Robison didn't stand still either. He was the first person to publish an inverse-square law for electric forces, and he invented the siren.

### **THE COMING OF STEAM**

In 1763, aged 27, Watt came into contact with a working steam engine, the Newcomen engine. Professor John Anderson, who used the engine as a demonstration in his physics classes, needed it repaired. Watt did the repair, but was shocked at how little work the engine was able to do.

At that time, Newcomen engines had been used in Britain for 50 years, and no-one had found a way to improve them.

Watt decided that he could make a better engine. He thought about little else, and experimented in his workshop with water and steam in metal vessels.

After two years of experimenting and thinking, Watt had his Eureka moment.

Watt redesigned the engine. His idea was that air pressure would push the piston into a partial vacuum generated when steam condenses into liquid water. The steam turned into water in Watt's condenser, which was surrounded by cold water.

By the end of 1765, a 29-year-old Watt had built his first small-scale steam engine, featuring a separate condensing chamber, and a steam jacket. The start of industrial revolution was getting closer, but had not yet begun.

In 1769, aged 33, Watt patented his new engine.

### **FROM SMALL-SCALE ENGINES TO INDUSTRIAL SUPERPOWER**

Watt owned one of the most important patents in human history. He sold it to John Roebuck, whose factory went bankrupt.

Matthew Boulton of Birmingham bought the patent rights to Watt's steam engine.

In 1775, Watt celebrated his 39th birthday and began a highly successful 25 year partnership with Boulton. The partnership was a perfect combination of Watt's scientific and engineering ingenuity and Boulton's factory and commercial skills.

Eleven years after Watt built his first small-scale steam engine, his engines began to be installed to pump water out of mines.

News of the new super-efficient engines spread fast, and with the coming of Watt's steam engines, the industrial revolution began.

### **QUICK GUIDE TO JAMES WATT'S INVENTIONS AND DISCOVERIES**

James Watt:

- radically improved the steam engine, starting the industrial revolution
- continued to produce a stream of new ideas and inventions, which eventually resulted in an engine that needed 80% less fuel than earlier machines.
- invented high pressure steam engines able of even higher efficiencies, but the technology of the time was not able of operating them safely.
- introduced the word horsepower to describe an engine's power output. We now generally use watts to measure power, although engine power is still often rated in horsepower.
- was the first person to propose that water was made of hydrogen combined with oxygen.
- independently discovered the scientific concept of latent heat.
- invented the world's first copying machine – similar in function to a photocopier – to make copies of correspondence, pages of books, and pictures.

In 1764 he married a woman named Margaret Miller. The couple had 6 children but Margaret died after 9 years. Then in 1776 he married Ann MacGregor and they had 2 children.

Watt died on 19 August in 1819 and he was buried in Birmingham. Finally, in 1882 a unit of electrical power was named the watt in his honor.