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Leaders & Success

## Henry Bessemer's Iron Will

J. BONASIA

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British inventor Henry Bessemer became a self-made millionaire from the many useful devices he invented over his long career.

Yet none were as crucial as the Bessemer process he created in 1856 to convert large amounts of iron into low-cost steel.

Steel makers still use furnaces descended from the Bessemer converter, says Lawrence Kavanagh, vice president for environment and technology at the American Iron and Steel Institute.

"The steel industry owes Bessemer a deep debt of gratitude," Kavanagh said. "Our technology today has deep roots going back to Bessemer's original ideas."

Bessemer (1813-98) was a self-educated inventor who pursued his ideas with hearty resolve. In large part, his converter machine and steel making process sparked the industrial revolution. They created the durable steel needed for bridges and buildings, along with shiny new fleets of planes, cars and railways.

Bessemer's work laid the foundation for modern industry, says **George Haley**, director of the Center for International Industry Competitiveness in Connecticut. He is also a professor of marketing at the University of New Haven.

"Steel was extremely expensive at that time," Haley said. "The Bessemer process meant you could make much larger quantities of steel at one time, both faster and cheaper, with fewer steps."

### On Board

The tycoon Andrew Carnegie made a fortune licensing Bessemer's breakthrough in America. Steel went into a U.S. transcontinental rail system. The Bessemer process remained popular until newer technologies, including open-hearth furnaces developed by William Siemens, emerged decades later.

During Bessemer's era, companies needed stronger steel to build rail lines and bridges, says Barry LePatner, a construction industry attorney and historian. For instance, five people died in 1847 when an iron bridge in England collapsed under the weight of a train.

"The Bessemer steel process allowed the railroad industry to grow across the U.S., and it greatly enhanced the Midwestern and Western states in terms of their commerce and development," LePatner said. "It also resulted in the first skyscraper being built in Chicago."

Bessemer was born in Charlton, England. The son of a metallurgist-typesetter father, he took an avid interest in the lathes and machines in his dad's workshop. He enjoyed casting medallions and trinkets to improve his mechanical skills.

In 1830, Bessemer's family moved to London. Henry was just 17 when he set up his own business making metal castings.

Despite lacking a standard education, Bessemer was confident of success. "Nature had endowed me with an inventive turn of mind," he wrote in his memoir, "and perhaps more than the usual amount of persistent perseverance, which I thought I might be able to use to advantage."

That perseverance guided Bessemer through a prolific career. One of his early inventions involved a saw to carve graphite for pencils. That made him enough money to marry and settle into Baxter House, his large home-workshop in London.

Over his career, he invented:

A way to emboss velvet.

A machine to extract juice from sugar cane.

A furnace to make sheet glass.

A system to compose typefaces, using a mechanism like a piano keyboard to arrange letter castings.

A steamship cabin that pivoted inside the hull to offset seasickness.

In the 1830s, Bessemer found a way to emboss stamps to prevent forgeries on title deeds. He thought his approach would be embraced by the British Stamp Office, which would have saved money through fraud prevention. Yet the agency declined to compensate him.

Undeterred, Bessemer pressed on. He studied the work of Louis-Jacques-Mande Daguerre, the French inventor of photography whom he admired. Daguerre had failed to get the proper patents for his daguerreotype invention, preventing him from earning royalties. That case inspired Bessemer to manage the business end of inventing as much as the scientific part.

Bessemer's first major success came in 1843 after buying some expensive gold-leaf paint for his sister's art project. Outraged by the high cost, he soon built steam engines to automate the labor-intensive process for making the bronze powder additives for gold paint.

Bessemer's ability to slash the price of this important commodity made him rich.

The Crimean War of 1853-56 in Europe stirred Bessemer's next project: a new type of cannon. It used spinning mortar shells that were more accurate than cannonballs. But weakness in the iron ore caused the cannons to explode.

Bessemer thought he could build better cannons, but first he had to invent a stronger grade of steel. After the British military rejected his concept, he persuaded French Emperor Napoleon III to fund the venture.

In 1855 and 1856, Bessemer earned patents for improvements in the manufacture of iron and steel. An American inventor, William Kelly, pursued the same concept, but Bessemer won the first patent for it.

Before the Bessemer process, no large-scale system was available to produce mass quantities of steel for building and manufacturing. Until then, most steel was derived from small batches of cheap ore known as pig iron. That smelting process was extremely difficult, so steel was mostly used to make small items such as tools and weapons.

Bessemer's steel converter was ingenious. He opened slots in the bottom of a large holding vat, where cold air could pass over the molten iron. Some experts said this step would cool the metal into useless blobs, thus ruining the product.

Bessemer studied the problem. He found that raising the temperature of the vat would cause the oxygen to ignite carbon and other impurities in the metal, burning them off and strengthening the steel.

This advance showed Bessemer's ability to shrug off critics. "I had an immense advantage over many others dealing with the problem inasmuch as I had no fixed ideas derived from long-established practice to control and bias my mind, and did not suffer from the general belief that whatever is, is right," he wrote.

The End

Bessemer set up a factory in Sheffield, England, where he made steel for decades. He died at age 85 in London. In his will, he was generous to his family, says Paul Bessemer, a descendant who lives in London.

Despite Henry Bessemer's stern appearance in old black-and-white pictures, he was "a very nice chap" by all accounts, Paul Bessemer said.

Henry Bessemer faced failure in his experiments, such as finding too much phosphorus in early supplies of iron. Yet with his "huge amount of determination," he overcame all obstacles and earned over 100 patents, according to Paul Bessemer.

"Sir Henry was very diligent with his experiments," he said of the man knighted in 1879. "He was willing for trial and error to work over time, based on a lot of tinkering around to get the results he was after."

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