JAMES NASMYTH: 'SHAPING' THE INDUSTRIAL REVOLUTION

Scottish engineer and inventor James Hall Nasmyth's is celebrated even today for his work in inventing the steam hammer and the shaper machine.

Source: Magic Wand Media

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Early Life

James Hall Nasmyth, a Scottish engineer and inventor, was born on August 19, 1808. Nasmyth is best known to historians of technology for inventing, or at least perfecting, the steam hammer, which became indispensable for forging large workpieces, and for inventing the shaper machine. While still in school in Edinburgh, Nasmyth showed an extraordinary mechanical inclination for building successful steam engine models. For two years he worked in the legendary Henry Maudslay's machine shop in London and subsequently moved to Manchester, where rapid industrialization was in progress. In 1836 he began to build his own foundry near the junction of the Bridgewater Canal with the newly opened Liverpool and Manchester Railway.

Inventing the steam forging hammer

Nasmyth revolutionized the Forging industry by harnessing the power of steam. His invention of the steam-powered forging hammer brought about a revolution in the Forging industry. This groundbreaking innovation allowed for the forging of significantly larger workpieces compared to the conventional mechanized hammers that were previously utilized.

Nasmyth and his French counterpart François Bourdon (1797–1865) invented the steam hammer independently but concurrently in 1839, both trying to solve the same problem of forging shafts and cranks for the increasingly large steam engines used in locomotives and paddle boats.

In Nasmyth's 1883 autobiography, he described how the need arose for a paddle shaft for the new transatlantic steamship SS Great Britain, with a 30-inch diameter shaft, larger than any that had been previously forged.

He came up with his steam hammer design, making a sketch dated November 24, 1839, but the immediate need disappeared when the practicality of screw propellers was demonstrated and the SS Great Britain was converted to that design.

Bourdon came up with the idea of what he called a 'Pilon' in 1839 and made detailed drawings of his design, which he also showed to all engineers who visited the works at Le Creusot owned by the brothers Adolphe and Eugène Schneider. However, the Schneiders hesitated to build Bourdon's radical new machine.

Bourdon and Eugène Schneider visited the Nasmyth works in England in the middle of 1840, where they were shown Nasmyth's sketch. This confirmed the feasibility of the concept to Schneider and, in 1840, Bourdon built the first steam hammer in the world at the Schneider & Cie works at Le Creusot.

It weighed 2,500 kg (5,500 lb) and lifted to 2 m (6 ft 7 in). The Schneiders patented the design in 1841. Nasmyth visited Le Creusot, France in April 1842 and Bourdon took him to the forge department so he might, as Nasmyth said, 'see his own child'. And when he saw it, Nasmyth was said to have remarked 'there it is, in truth–a thumping child of my brain!'

After returning from France in 1842, Nasmyth built his first steam hammer in his Patricroft foundry in Manchester, England. In 1843, a dispute broke out between Nasmyth and Bourdon over the priority of the invention of the steam hammer. Nasmyth, an excellent publicist, managed to convince the industry that he was the first.

Inventing the shaper machine

Nasmyth is also credited with the invention of the shaper machine. He was inspired by the early planing machine which was invented in 1814-17 by Matthew Murray and Richard Roberts and intended for the economical machining of large components.

The planers' design was very basic: a bridge, carrying one or more toolholders and able to be elevated and moved from side to side was carried on uprights, bolted to a heavy cast iron base plate upon which there was a slide and a table that carried the workpiece or workpieces.

The introduction of the planing machine into factories helped in perfecting and economizing the production of the larger parts for machine tool manufacture but a considerable proportion of the smaller parts were still manufactured by hand using chisels and files.

This used to result in parts that were both inaccurate and costly. Nasmyth designed a simple and compact machine. In a planer machine, the tool is stationary and the workpiece travels back and forth under the tool. He designed the shaper machine so that the workpiece is held stationary while the cutting tool moves back and forth across the work.

In the shaper machine, a single-point cutting tool is rigidly mounted on the toolholder, which is mounted on the ram. The workpiece is held rigidly in a vice or clamped directly on the table.

The ram reciprocates and, thus, the cutting tool held in the toolholder moves backwards and forwards on the workpiece. In a standard shaper, cutting takes place during the forward stroke of the ram and the backward stroke remains idle. The forward and backward motion is obtained by 'Quick Return Mechanism' and the depth of the cut is adjusted by moving the tool downwards towards the workpiece.

A versatile genius

Nasmyth's steam forging hammer and the shaper machine became an important part of the Industrial Revolution. Besides steam hammers and shapers, Nasmyth also manufactured more than 100 steam locomotives, many small high-pressure steam engines, and a variety of pumps, hydraulic presses, and other machine tools.

At the age of 48, he retired from the foundry in order to devote himself to his hobby, astronomy. Even in the field of astronomy, Nasmyth's genius shone through. He developed the Nasmyth telescope, also called Nasmyth–Cassegrain telescope. It was a reflecting telescope which was a modified form of a Cassegrain telescope, with light reflected sideways to an eyepiece. He also wrote a book on astronomy titled - The Moon: Considered as a Planet, a World, and a Satellite.

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Tech Talks is a column by industry veteran and journalist Reji Varghese that talks about the latest advancements in Machine Tools, provides snippets from history, interesting facts, etc. about the Machine Tool industry.