Al-Jazari — Mechanical Genius

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The following is a very brief overview on the life, work and achievements of Al-Jazari — the most famous mechanical engineer of his time. Now well more than 1,000 years ago, Al-Jazari brought Islamic technology to a culminant point.

Al-Jazari was the most outstanding mechanical engineer of his time (1136–1206). His full name was Badi' al-Zaman Abu-'l-'Izz Ibn Isma'il Ibn al-Razzaz al-Jazari — but he became better known as Al-Jazari. He was born in Jazira, the area lying between the Tigris and the Euphrates in Mesopotamia. Like his father before him, he served the Artuqid kings of Diyar-Bakir for several decades as a mechanical engineer. In 1206 after the year of his death, he completed an outstanding book on engineering entitled, Al-Jami' bayn al-'ilm wa-'l-'amal al-nafi' fi sinat'at al-hiyal (*The Book of Knowledge of Ingenious Mechanical Devices;* also known as *A Compendium on the Theory and Useful Practice of the Mechanical Arts*). It was a compendium of theoretical and practical mechanics. George Sarton (*Belgian-American chemist and historian, considered the founder of the discipline of history of science.*) wrote: "This treatise is the most elaborate of its kind and may be considered the climax of this line of Muslim achievement."(*Introduction to the History of Science*, 1927, Vol. 2, Pg. 510).

Al-Jazari described fifty mechanical devices in the book, in six different categories, including water clocks, hand washing device (wudhu' machine) and machines for raising water, etc. Following the World of Islam Festival, held in the United Kingdom in 1976, a tribute was paid to Al-Jazari when the London Science Museum showed a successfully reconstructed working model of his famous Water Clock."

Al-Jazari's book is distinctive in its practical aspect because the author was both competent engineer and skilled craftsman. The book describes various devices in minute detail, providing an invaluable contribution in the history of engineering. British charter engineer and historian of Islamic technology Donald R. Hill, who held a special interest in Al-Jazari's achievements, wrote:

> **"It is impossible to over-emphasize the importance of Al-Jazari's work in the history of engineering; it provides a wealth of instructions for design, manufacture and assembly of machines."**

Donald R. Hill translated into English Al-Jazari's book in 1974 — seven centuries and 68 years after it was completed by its author. Al-Jazari's encyclopedic treatise includes six main categories of machines and devices. Several of the machines, mechanisms and techniques first appear in this treatise, later entering the vocabulary of European mechanical engineering. Among these innovations, we mention the double acting pumps with suction pipes, the use of a crank shaft in a machine, accurate calibration of orifices, lamination of timber to reduce warping, static balancing of wheels, use of paper models to establish a design, casting of metals in closed mold boxes with green sand, etc. Al-Jazari also describes methods of construction and assembly in scrupulous detail of the fifty machines to enable future craftsmen to reconstruct them.

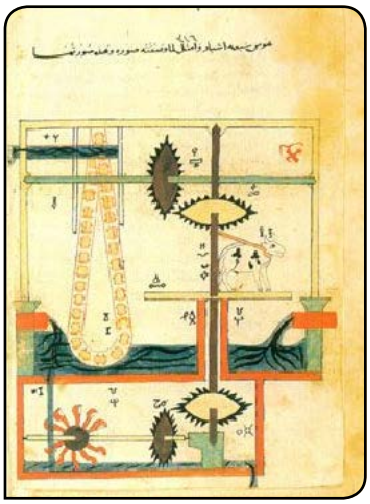

Illustration of Al-Jazari's hydropowered saqiya chain pump device, from his 1206 book — *The Book of Knowledge of Ingenious Mechanical Devices.*

And he was successful in that, for many of his devices were constructed following his instructions. The work by Al-Jazari is also unique in the way that other writers often fail to give sufficient details, because — amongst other factors — they were not craftsmen themselves, or if they were craftsmen, they could have been illiterate. Al-Jazari in this respect was unique, and this gives his work immense value. His book, Hill states, "is an absolute wealth of Islamic mechanical engineering."

In their paper on "Mechanical Engineering during the Early Islamic Period" (published in I. Mech. E, The Chartered Mechanical Engineer, 1978, pp. 79–83), C. G. Ludlow and A. S. Bahrani have raised the important point that it is more than likely that there is more on the subject in some of the thousands of Arabic manuscripts in the world libraries which have not yet been inspected closely, and obviously require looking into.

Hill, too, constantly raises the two major issues with respect to the history of engineering in general, and that of fine technology in particular. He first states the fact that the field, which is absolutely immense, is yet largely unexplored.

One of his concluding points states, "It is hoped that as research proceeds, firmer evidence for the transmission of Islamic fine technology into Europe can be provided." Hill also offers some hints for such transmission. The most likely route was Spain. Such fine technology could have followed the same route as the astrolabe (itself part of this fine technology.) Apart from Spain, there were other possible lands of transfer, e.g. — Sicily, Southern France, Italy, Byzantium and Syria during the Crusades. Hill is also right on a further point, i.e. — that what will be seen in this work is just a fraction of the whole process which, as with much else, has hardly been explored. (**Salim Al-Hassani** is *Emeritus Professor at the University of Manchester and Chairman of The Foundation for Science, Technology and Civilization, Manchester, UK.*) **PTE**

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