ANATOLIA "THE LAND WHERE SCIENCE WAS BORN AND FLOURISHED"

AL-JAZARI

Born & Died: 1136 CE – 1206 CE
City: Cizre -Diyarbakır
Main Interest: Mathematics, Engineering
Notable Ideas: The father of "Engineering" and "Science of Robot"

LIFE

Al-Jazari was an Arab Muslim scholar and polymath who lived during the Islamic Golden Age. He was born in 1136 CE in the city (Cizre-Turkey)of Jazirat ibn Umar, which is what gives him the title of "Al-Jazari". He was a man of many talents; other than being a renowned scholar, he was also a skilled inventor, artist, craftsman and engineer. We don't know much about his life, other than the details he provides in his own books. He followed in the footsteps of his father and held the post of chief engineer at the king's palace.

WORKS

Al-Jazari was an artisan and was predominantly interested in the functional aspect of things which makes him more of an engineer than an inventor. He was a brilliant mechanical engineer, and built dozens of ingenious contraptions. His contraptions were always elaborate and ornate. He designed more than 50 different types of devices including clocks, fountains, hand washing devices, musical devices, machines for raising water etc. His most famous book, titled "The Book of Knowledge of Ingenious Mechanical Devices" was written in 1206 and presented to the Sultan as a gift. In it, he designed and described over a 100 mechanical devices, of which a great many were meant for entertainment value rather than to serve any practical purpose. For instance, he designed trick vessels which appeared to have water in them but when someone tried to drink out of them they were empty.
German scholars Wiedemann and Hauser published in German a series of seven articles in which they covered the six categories using the Bodleian copy [4].
The book describes in detail fifty devices (ashkal), which are grouped into six categories (anwa`):
1) ten water and candle clocks;
2) ten vessels and figures suited for drinking sessions;
3) ten pitchers and basins for phlebotomy and washing before prayers;
4) ten fountains that change their shape alternately, and machines for the perpetual flute;
5) five water raising machines;
6) five miscellaneous devices.
In his books, Al-Jazari gave step by step instructions about how to build any of the machines and devices described therein. His books are an invaluable store of knowledge about early Muslim engineering. They were unique and successful because unlike other authors, he had minutely described each detail of his machines and the instructions were so well organized that many future craftsmen were able to enjoy the benefits of his skill.
Some of his contraptions were so modern that it is hard to believe they were built eight centuries ago.
Donald R. Hill, the English historian who was an academic authority in the history of Islamic mechanics and engineering, wrote in Studies in Medieval Islamic Technology: "It is impossible to over-emphasize the importance of al-Jazari's work in the history of engineering. Until modern times there is no other document from any cultural area that provides a comparable wealth of instructions for the design, manufacture and assembly of machines

Figure 1: Picture of one of al-Jazari's automatic machines: a musical toy in the form of a boat. From a manuscript of his book copied in Syria in 715 H/1315 CE (opaque watercolour, ink and gold on paper)

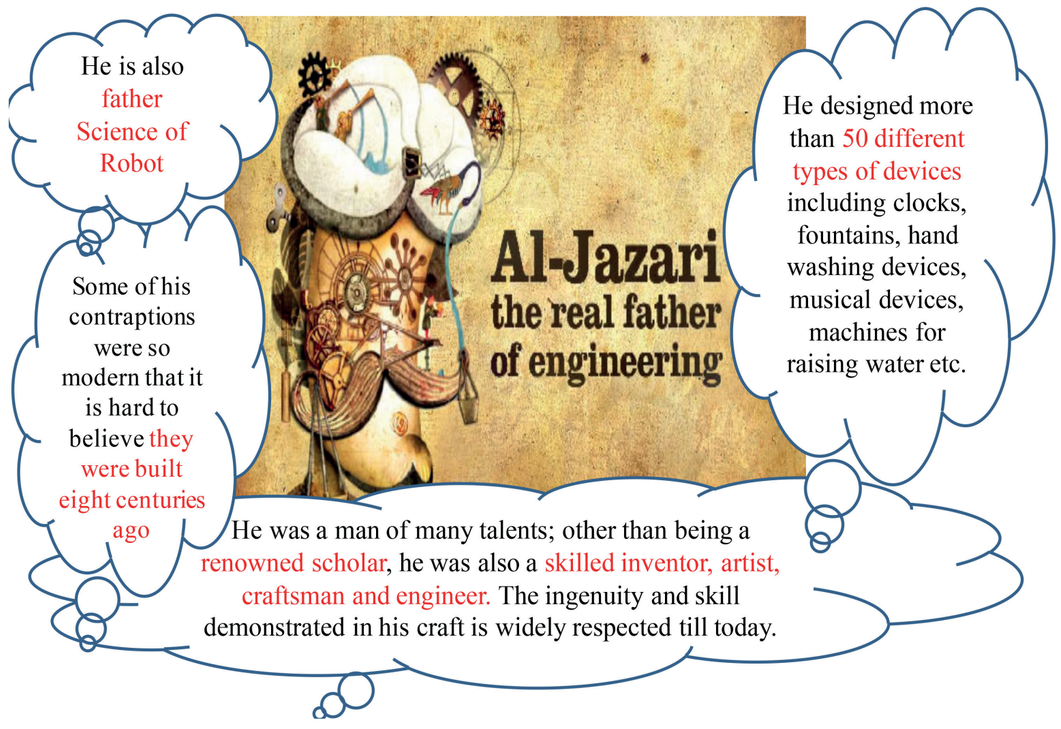

Figure 2: Drawing of al-Jazari's "Elephant Clock" depicted by Fakhr ibn 'Abd al-Latif on a leaf. Source: The Metropolitan Museum of Art in New York

One of the most significant inventions of al-Jazari was the famous elephant clock, consisting of a water-powered clock in the form of an elephant. The various elements of the clock are in the housing on top of the elephant. The various elements that compose this clock move and make a sound every half hour. This device is reminiscent of the elaborate clocks found on medieval town halls in Europe, which made the passage of time more entertaining with the performance of the moving figures.
The elephant clock of al-Jazari was the first mechanism to employ a flow regulator, which was used to determine the time when the clock strikes at hourly intervals. The hourly intervals were determined with the use of a small opening in a submersible float, which was calibrated to give the required rates of flow under different water rates.

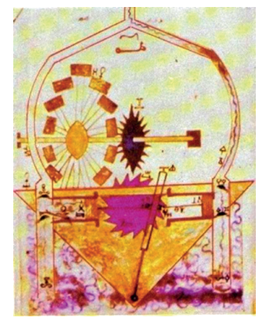

Figure 4: The reciprocating pump from al-Jazari's manuscript, Topkapi Palace Museum Library, Ahmet III 3472

Al-Jazari occupies an important place in the history of automata, automatic control, robotics and automated musical theaters. His pioneering work is duly acknowledged in most histories. The inventions of al-Jazari are a source of inspiration to modern designers such as the use of rolling balls to sound the hours on cymbals and operate automata.

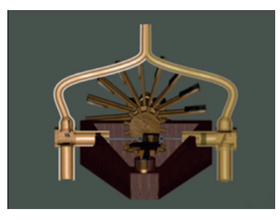

Figure 5: 3D-model recreated by FSTC of the reciprocating pump with a water wheel as the drive source. To see animation of the pump

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