

Muslim Engineers and Their Contribution to Modern Technology

by

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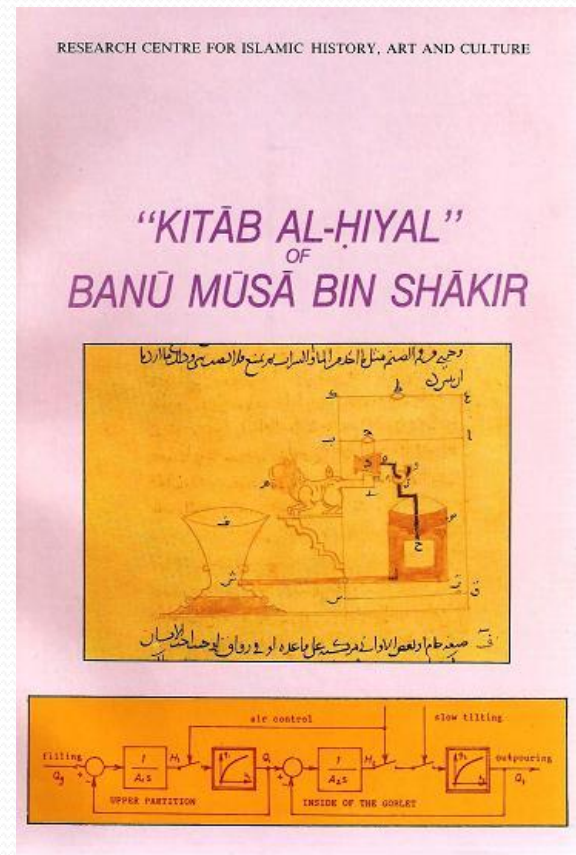
Simeon Genov (presenter)

Introduction

- Muslim civilization developed at a time in human history when numerous large territorial empires had been established in various parts of Afroeurasia. Long-distance trade, the spread of religions, and extensive recording of knowledge in writing had preserved a legacy of human ideas
- In order to increase trade and expand the economy, production of many goods and natural resources had to be increased. Construction of cities, roads, ports, dams, and bridges required planning and engineering. Muslim engineers were able to draw on the ideas already built up by earlier societies' efforts. They combined these ideas with new mathematical knowledge and tools to create machines, instruments and construction techniques that advanced human skill and knowledge.

The Banu Musa bin Shakir Brothers

- The brothers Banu Musa bin Shakir (ca. 850) were inventors and engineers from the eastern Muslim lands. They translated and wrote over 20 books on engineering. They described about a hundred useful mechanical devices in *The Book of Ingenious Devices*.



The Book of Ingenious Devices

- In engineering, there are certain mechanical components, or parts of machines, that have many uses. Examples of these components are: a device that controls the flow of liquids by opening and closing in a cycle, crankshafts and gears that transfer energy or regulate the speed and movement of the machine, a ratchet that stops the movement of gears in a certain direction, and parts that multiply the force of the machine. Some of these important milestones in engineering that are found in *The Book of Ingenious Devices* are shown for the first time in the history of technology. Some of them would not be seen in engineering works until 500-1000 years later in modern industry.

Al-Muradi of Andalusia

- Al-Muradi of Andalusia was an 11th century scientist who wrote *The Book of Secrets about the Result of Thoughts*, which contains the earliest description in Arabic of water clocks and other mechanical devices called automata. The book contains 31 models run by water wheels that regulate the intensity of flowing water. Nineteen of the devices are clocks. They use a component called a clepsydras, and the figures (often human or animal) ran by means of elaborate gear systems, lubricated by mercury. These innovations were not seen again in any society until the 13th century, when they were used in European clocks.

Al-Jazari

- Abū al-'Iz Ibn Ismā'īl ibn al-Razāz al-Jazarī (1136-1206) was an important Arab Muslim scholar, artist, astronomer, inventor and mechanical engineer from al-Jazira, Mesopotamia
- Due to his fundamental mechanical inventions, al-Jazari has been described as the "father of modern day engineering", and due to his invention of an early programmable humanoid robot, he has been hailed as the "father of robotics". Al-Jazari is considered just as important an inventor as Leonardo da Vinci.
- The most significant aspect of al-Jazari's machines are the inventive mechanisms, components, ideas, methods and design features which they employ.

Water-raising machines

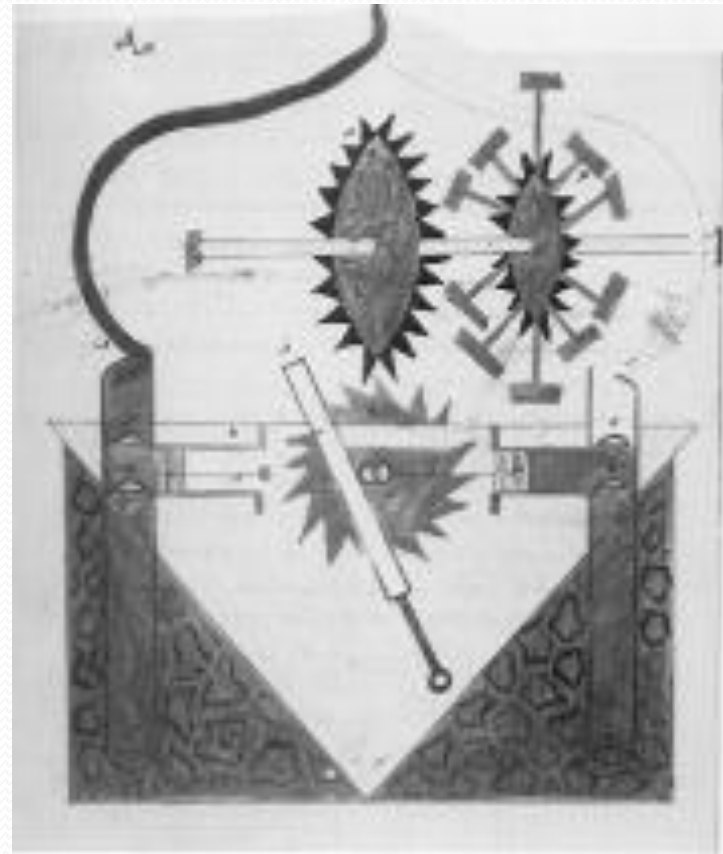
- Al-Jazari invented five machines for raising water, as well as watermills and water wheels with cams on their axle used to operate automata, in the 12th and 13th centuries, and described them in 1206. It was in these water-raising machines that he introduced his most important ideas and components.

Mechanisms and methods

- Al-Jazari's invention of the crankshaft (and the crank mechanism) is considered the most important single mechanical invention after the wheel, as it transforms continuous rotary motion into a linear reciprocating motion, and is central to modern machinery such as the steam engine, internal combustion engine (where it converts in the other direction) and automatic control.

Mechanisms and methods

- The connecting rod was also invented by al-Jazari, and was used in a crank and connecting rod system in a rotating machine he developed in 1206, in two of his water-raising machines: the crank-driven saqiya chain pump and the double-action reciprocating piston suction pump.



Automata

- Automated humanoid waitress - invented by al-Jazari to serve drinks at parties, driven by hydropower.
- Automated moving peacock - Al-Jazari invented the earliest automated moving peacocks, which were also driven by hydro-power.
- Al-Jazari invented the earliest known automatic gates, which were driven by hydropower. He also created automatic doors as part of one of his elaborate water clocks.

Automata

- Al-Jazari is credited with creating the earliest forms of a programmable humanoid robot in 1206. Al-Jazari's automaton was originally a boat with four automatic musicians that floated on a lake to entertain guests at royal drinking parties. His mechanism had a programmable drum machine with pegs (cams) that bump into little levers that operated the percussion. The drummer could be made to play different rhythms and different drum patterns if the pegs were moved around.

Automata

- An illustration of Al-Jazari's humanoid robots made by himself using miniature paintings



Taqi al-Din

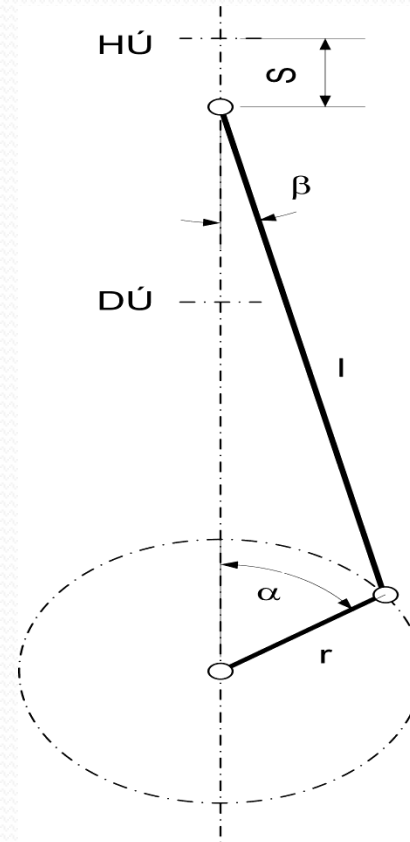
- Taqi al-Din Muhammad ibn Ma'ruf al-Shami al-Asadi (c. 1526 - 1585) was a major Turkish Muslim scientist, astronomer, engineer, inventor and philosopher.
- He is the author of several texts on astronomy, astrology, optics, and clocks.

Inventions in the field on engineering

- Steam turbine - In 1551, Taqi al-Din invented an early steam turbine as a prime mover for a self-rotating spit.
- Monobloc pump with six-cylinder engine - In 1559, Taqi al-Din invented a 'Monobloc' pump with a six cylinder engine. It was a hydropowered water-raising machine incorporating valves, suction and delivery pipes, piston rods with lead weights, trip levers with pin joints, and cams on the axle of a water-driven scoop-wheel.

Conclusion

- Muslim engineers thought of inventions and methods in many fields of engineering, most of which have contributed significantly to modern technology, especially in the field of water and mechanical engineering.





Thank you for your attention!