

SCIENCE & TECHNOLOGY DEVELOPMENT IN ISLAM CIVILIZATION

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The Attitude of the Quran and the Prophet toward Knowledge

- Islam is a religion based upon knowledge for it is ultimately knowledge of the Oneness of God combined with faith and total commitment to Him that saves man. The text of the Quran is replete with verses inviting man to use his intellect, to ponder, to think and to know, for the goal of human life is to discover the Truth which is none other than worshipping God in His Oneness. The Hadith literature is also full of references to the importance of knowledge. Such sayings of the Prophet as "Seek knowledge from the cradle to the grave", (Hadith) and
- *"Verily the men of knowledge are the inheritors of the prophets", (Hadith)*
- have echoed throughout the history of Islam and incited Muslims to seek knowledge wherever it might be found. During most of its history, Islamic civilization has been witness to a veritable celebration of knowledge. That is why every traditional Islamic city possessed public and private libraries and some cities like Cordoba and Baghdad boasted of libraries with over 400,000 books. Such cities also had bookstores, some of which sold a large number of titles. That is also why the scholar has always been held in the highest esteem in Islamic society.

Integration of the Pre-Islamic Sciences

- As Islam spread northward into Syria, Egypt, and the Persian empire, it came face to face with the sciences of antiquity whose heritage had been preserved in centers which now became a part of the Islamic world.
- The result of this extensive effort of the Islamic community to confront the challenge of the presence of the various philosophies and sciences of antiquity and to understand and digest them in its own terms and according to its own world view was the translation of a vast corpus of writings into Arabic.
- As a result, Arabic became the most important scientific language of the world for many centuries and the depository of much of the wisdom and the sciences of antiquity. The Muslims did not translate the scientific and philosophical works of other civilizations out of fear of political or economic domination but because the structure of Islam itself is based upon the primacy of knowledge. Nor did they consider these forms of knowing as "un-Islamic" as long as they confirmed the doctrine of God's Oneness which Islam considers to have been at the heart of every authentic revelation from God.

Contribution toward Science

Astronomy

- ❑ integrated the astronomical traditions of the Indians, Persians, the ancient Near East and especially the Greeks.
- ❑ Many star names in English such as Aldabaran still recall their Arabic origin.
- ❑ The first to create an astronomical observatory as a scientific institution, this being the observatory of Maraghah in Persia established by al-Tusi.
- ❑ Many astronomical instruments were developed by Muslims to carry out observation, the most famous being the astrolabe. There existed even mechanical astrolabes perfected by Ibn Samh which must be considered as the ancestor of the mechanical clock.

Mathematics

- ❑ The first great Muslim mathematician, al-Khwarazmi, who lived in the 9th century, wrote a treatise on arithmetic whose Latin translation brought what is known Arabic numerals to the West.
- ❑ Al-Khwarazmi is also the author of the first book on algebra.
- ❑ The very name algebra comes from the first part of the name of the book of al-Khwarazmi, entitled *Kirah al-jahr wa'l-muqabalah*. Abu Kamil al-Shuja' discussed algebraic equations with five unknowns.
- ❑ The science was further developed by such figures as al-Karaji until it reached its peak with Khayyam who classified by kind and class algebraic equations up to the third degree.

Geometry

- ❑ The brothers Banu Musa who lived in the 9th century may be said to be the first outstanding Muslim geometers while their contemporary Thabit ibn Qurrah used the method of exhaustion, giving a glimpse of what was to become integral calculus.
- ❑ Many Muslim mathematicians such as Khayyam and al-Tusi also dealt with the fifth postulate of Euclid and the problems which follow if one tries to prove this postulate within the confines of Euclidian geometry.

Trigonometry



Abu Raihan **Al Biruni**

- ❑ Another branch of mathematics developed by Muslims is trigonometry which was established as a distinct branch of mathematics by al-Biruni.
- ❑ The Muslim mathematicians, especially al-Battani, Abu'l-Wafa', Ibn Yunus and Ibn al-Haytham, also developed spherical astronomy and applied it to the solution of astronomical problems.

Physics, Balance, Projectile Motion & Optics

- ❑ The measurement of specific weights of objects and the study of the balance following upon the work of Archimedes.
- ❑ Criticized the Aristotelian theory of projectile motion and tried to quantify this type of motion. The critique led to the development of the idea of impetus and momentum.
- ❑ The field of optics in which the Islamic sciences produced in Ibn al-Haytham. His main work on optics, the *Kitah al-manazir*, was also well known in the West as *Thesaurus opticus*.
- ❑ Solved many optical problems, studied the property of lenses, discovered the camera obscura, explained correctly the process of vision, studied the structure of the eye, and explained for the first time why the sun and the moon appear larger on the horizon.

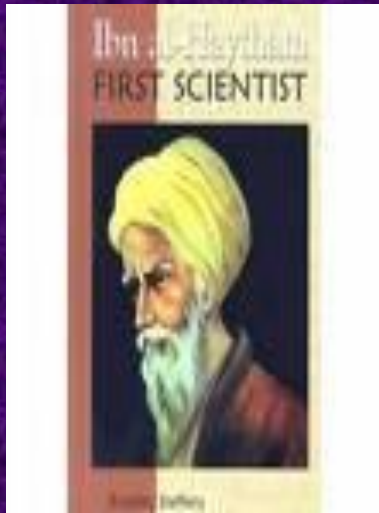
Medical Sciences

- ❑ The hadiths of the Prophet contain many instructions concerning health including dietary habits; these sayings became the foundation of what came to be known later as "Prophetic medicine" (al-tibb al-nabawi).
- ❑ The greatest of all Muslim physicians was Ibn Sina who was called "the prince of physicians" in the West. He synthesized Islamic medicine in his major masterpiece, al-Qanun fi'l tibb (The Canon of Medicine), which is the most famous of all medical books in history.
- ❑ It was the final authority in medical matters in Europe for nearly six centuries, he discovered many drugs and identified and treated several ailments such as meningitis but his greatest contribution was in the philosophy of medicine.

Chemistry

- ❑ The very name alchemy as well as its derivative chemistry come from the Arabic al-kimiya'.
- ❑ The main person in this was Jabir ibn Hayyan and Al-Razi
- ❑ certain chemical instruments such as the alembic (al-'anbiq) still bear their original Arabic names and the mercury-sulphur theory of Islamic alchemy remains as the foundation of the acid-base theory of chemistry.
- ❑ Al-Razi's division of materials into animal, vegetable and mineral is still prevalent and a vast body of knowledge of materials accumulated by Islamic alchemists and chemists has survived over the centuries in both East and West.

Images of the Scholars



IBN AL HAYTHAM



JABIR IBN HAYYAN



IBN SINA



AL-RAZI

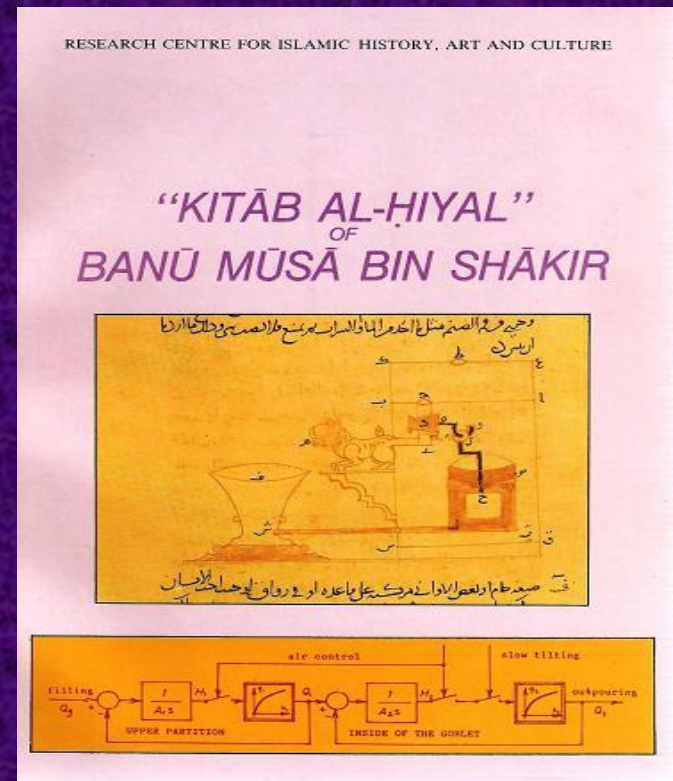
Contribution toward Technology

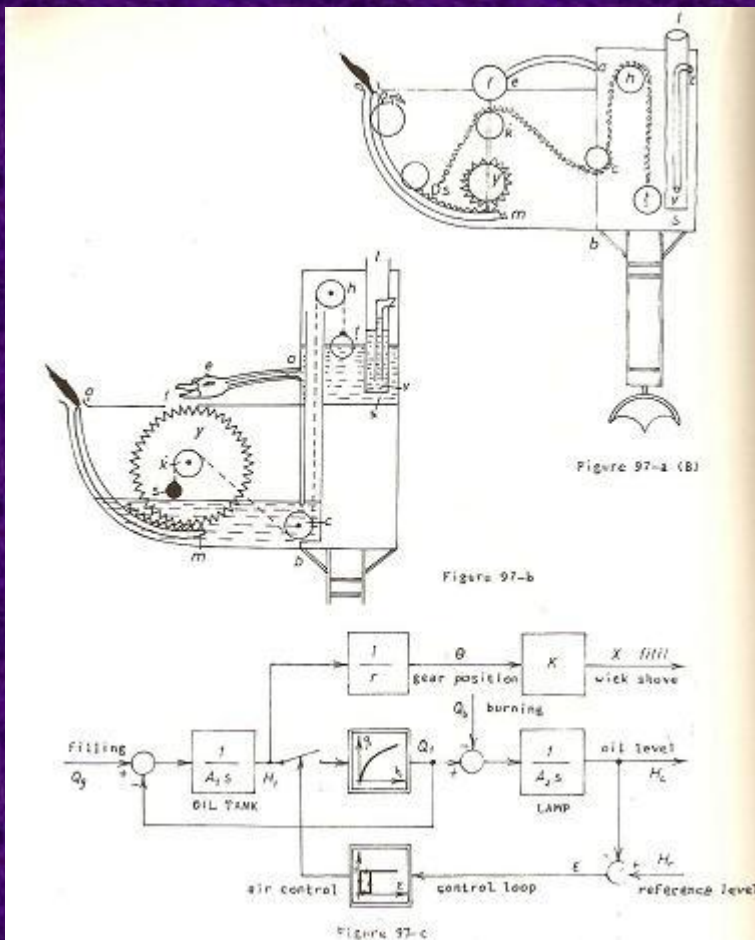
- ❑ Islam inherited the millennial experience in various forms of technology from the peoples who entered the fold of Islam and the nations which became part of Dar al-Islam.
- ❑ developed many forms of technology on the basis of earlier existing knowledge such as the metallurgical art of making the famous Damascene swords, an art which goes back to the making of steel several thousand years before on the Iranian plateau.
- ❑ Likewise Muslims developed new architectural techniques of vaulting, methods of ventilation, preparations of dyes, techniques of weaving, technologies related to irrigation and numerous other forms of technology, some of which survive to this day.

Some of Technology Development

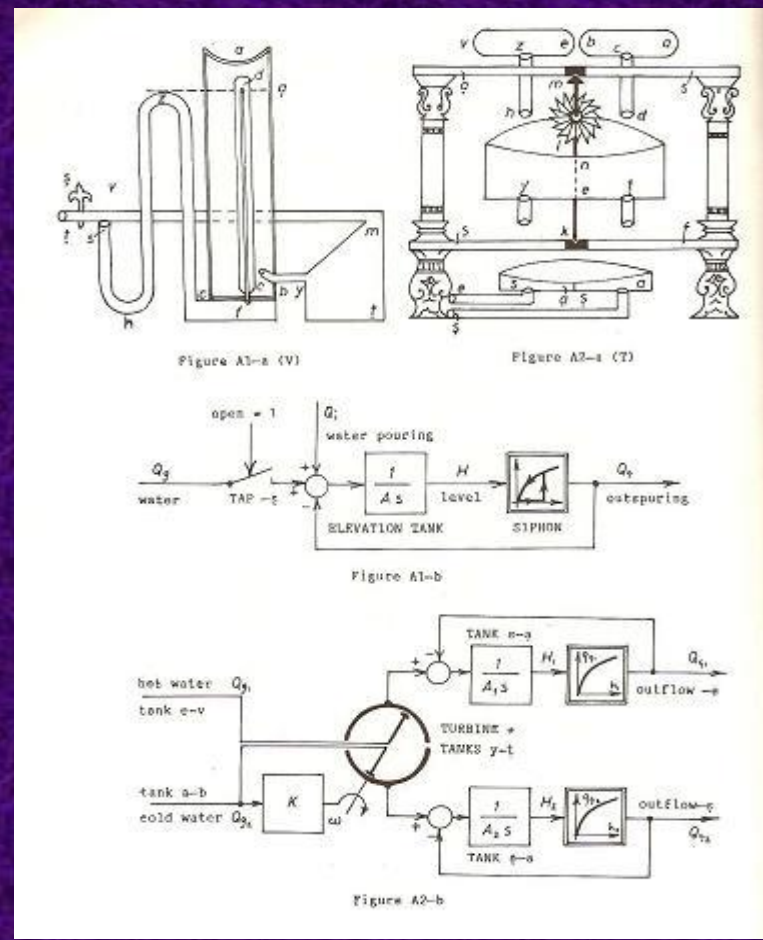
- The Mechanics of Banu Musa in the Light of Modern System and Control Engineering

The cover page of the book Kitāb al-hiyal

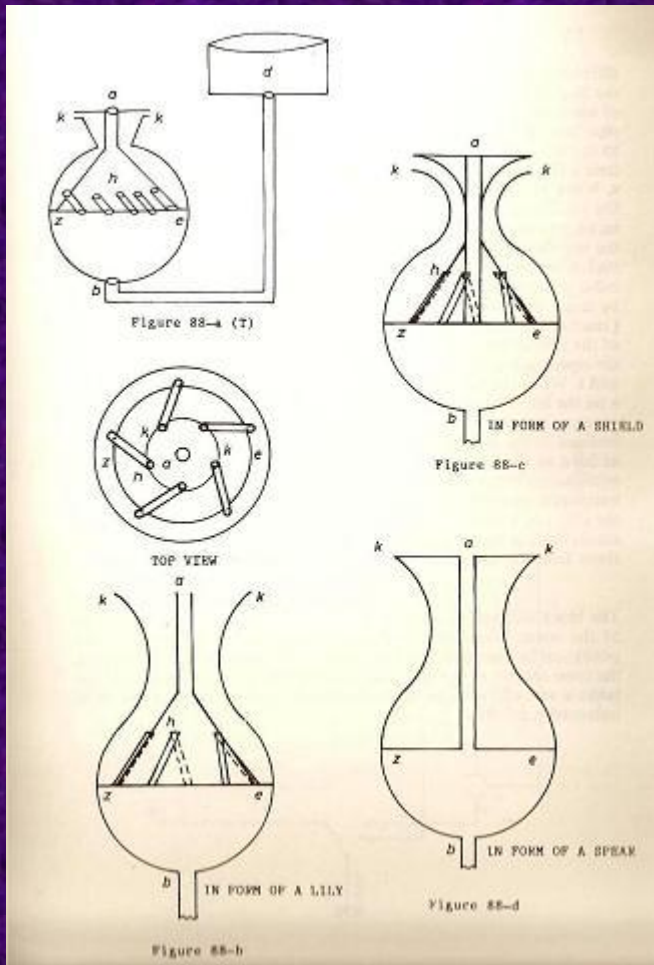




An oil lamp in which the wick is automatically regulated and the oil level automatically controlled.



A1 is a fountain operated by an elevation tank
 A2 is a construction with two outlets which, changing mutually and periodically, pours out hot and cold waters.



A Fountain from which the waters spurts out in the shape of a lily, or in the shape of a shield.



Last page of the manuscript copy of *Kitāb al-hiyal* kept in the Library of Topkapi Palace Museum A 3474.

Automation and Robotics in Muslim Heritage: The Cultural Roots of al-Jazari's Mechanical Systems



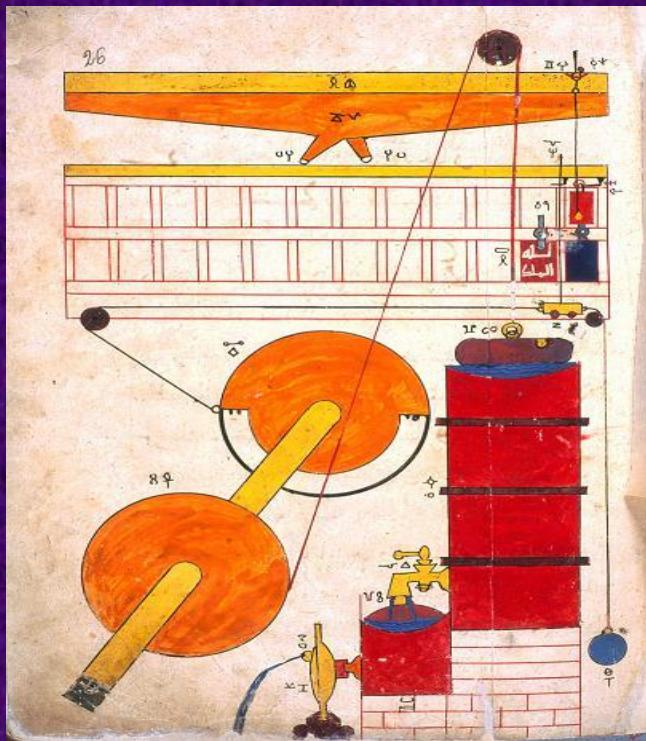
Elephant clock of al-Jazari, from a MS copy of his treatise *The Book of Knowledge of Ingenious Mechanical Device*



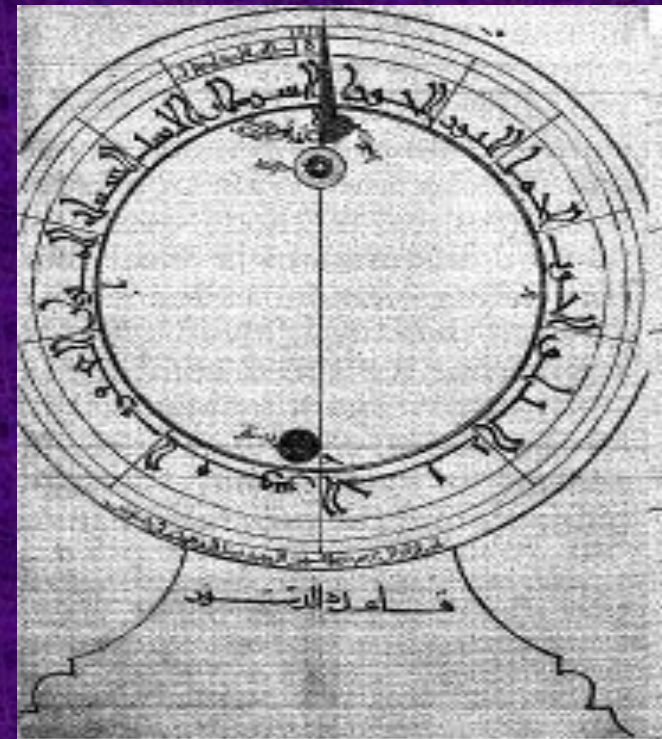
Figure 3: 3D-model of the al-Jazari's elephant clock, recreated by FSTC Ltd.

Pioneers of Automatic Control Systems

The theory of automatic control systems is an idea closely related to feedback concept. A system is a combination of components that act together and perform certain objectives. In a feedback system the output signal is fed back in order to increase or reduce the input signal.

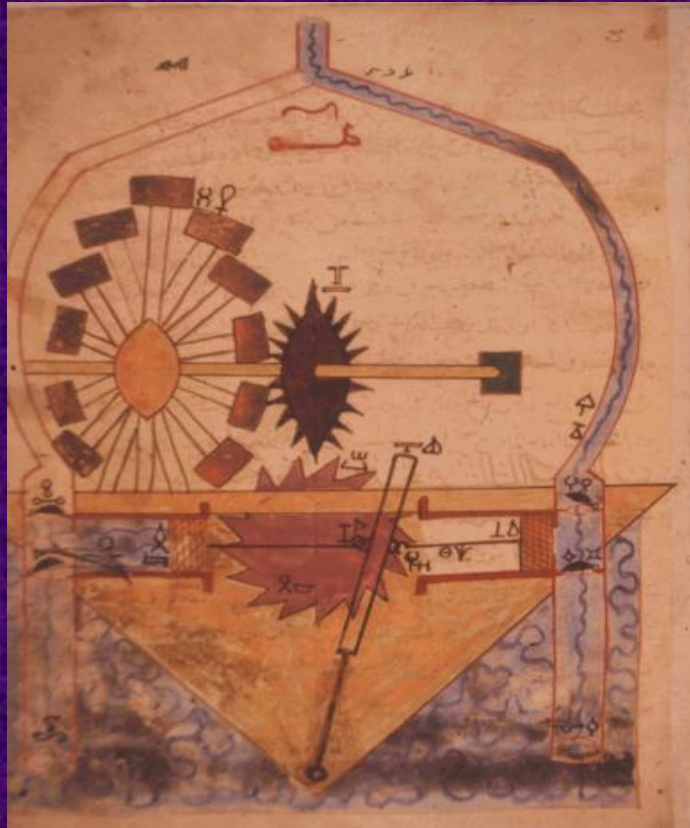


Rear view of the water clock mechanism



An example of a level control from Benu Musa's book titled Kitab al-Hiyal

The Reciprocating Pump of Al-Jazari

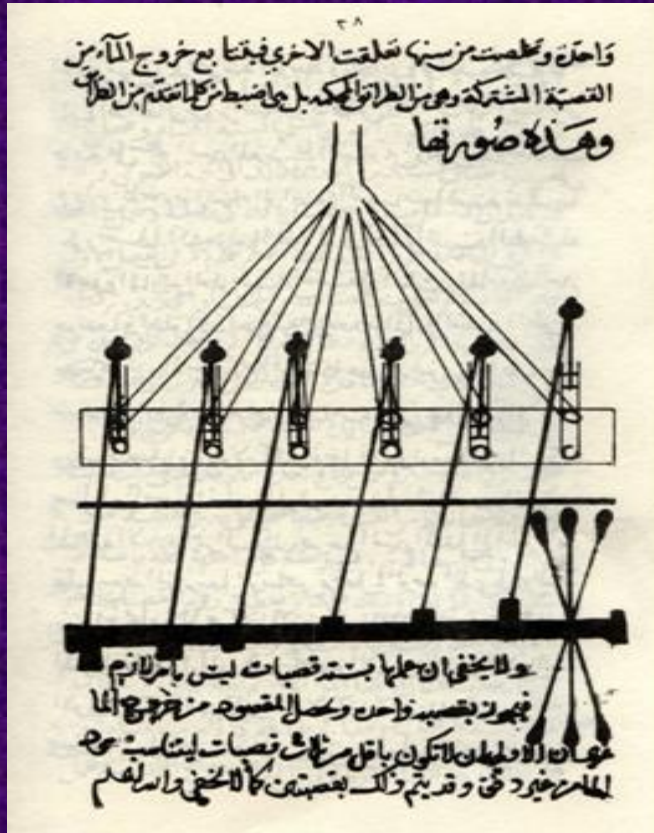


The reciprocating pump from Al-Jazari's manuscript.



3D Image of the reciprocating pump with a water wheel as the drive source

The Six Cylinder Pump of Taqi Al-Din



The six cylinder water pump from Taqi Al-Din's manuscript

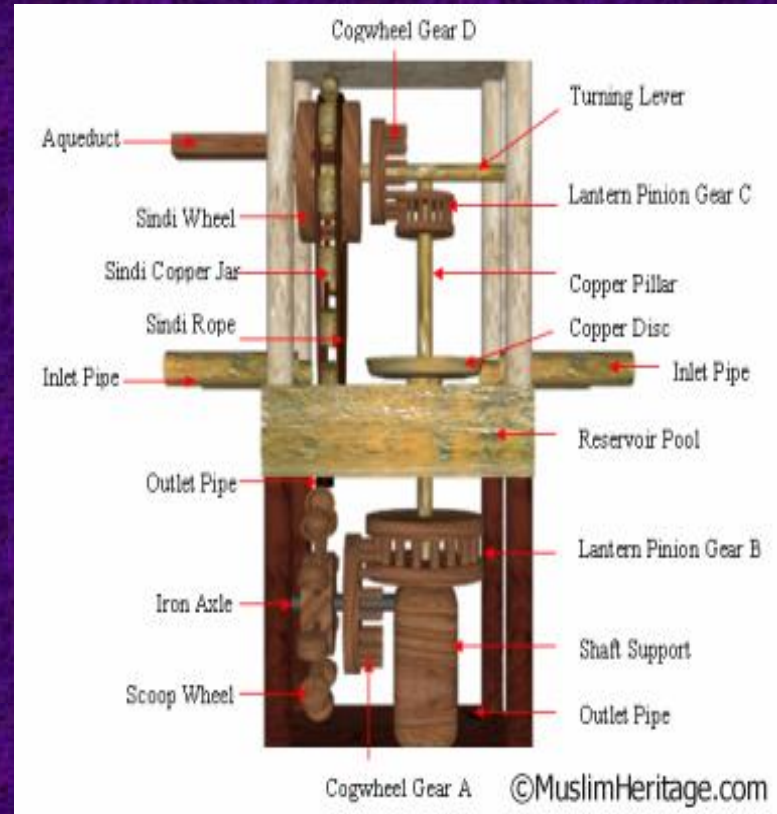


3D image of the six cylinder water pump

The third water rising machine of Al-Jazari



The reciprocating pump from Al-Jazari's manuscript.



3D image of Al-Jazari's third water raising machine

Introduction of Wind Power



Wind Mill of (634-44)

THE END

THANKS FOR THE
ATTENTION !!