TWO ILLUSTRATED PAGES ON AUTOMATA IN THE METROPOLITAN MUSEUM OF ART

by
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Introduction

The Meropolitan Museum of Art in New York possesses two leaves of a famous Arabic manuscript on "Automata", which are analyzed and discussed below.[1]

The first page represents a double-page illustration; the obverse and reverse miniatures depict an apparatus for raising water by animal power. The second page has a full page miniature representing an elephant clock.

The two illustrations are on paper, beautifully coloured and gilded, and both are clarified by technical alphabets and some Arabic sentences. These illustrations were copied from an earlier illustrated manuscript written by Abul-Izz Ismail ibn ar-Razzazz al-Jazari in 1206 AD. AI-Jazari's important book is concerned with mechanical devices and is called *Kitab fi Marifat al-Hiyal al-Handasiya,* "Book of the knowledge of Mechanical Devices". This book is also called *(Al-Jami bayna al-'ilm wal 'amal al-nafi' fi Sina' at al Hiyal* "Work that combines theory and practice and is profitable to the craft of ingenious contrivances." It was begun by Al-Jazari in 1206 at the request of the Artuqid Prince Nur al-Din Muhammad Qara Arslan, and finished under his son and successor Malik al-Salih Nasir al-Din Mahmud (1200-1222), who resided in Amid (Diyar Bakr) north Mesopotamia.[2]

Al-Jazari's book contains his practical knowledge of scientific methods which are illustrated. His work was partly based on the works of Archimedes and other Greek scientists and also influenced by other Arabic works such as Benu Musa.[3]

There is no doubt that there were many Greek books concerning such methods, also illustrated with drawings or diagrams. The idea of illustration and in many cases the physical elements of the picture were copied from classical sources by Arab scientists to clarify the text of a book, but in this case the illustrations show the influence of an Oriental background. The miniature was a style beloved by the Oriental Court and people[4] and this local tradition influenced works based on classical sources.

1. The two leaves are in the Islamic Department at the Metropolitan Museum of Art in New York, under the numbers: 56.121.II for the Apparatus miniature, and 57.51.23 for the Elephant-Clock miniature. For the latter see: Ettinghausen, R., *Arab Painting,* Skira, 1962, pp. 93.

2. Grube, E., *Muslim Miniature Painting from XIII to XIX century,* 1962, p. 9.

3. Wiedemann, E. and Hauser, F., *"Uber die Uhren im Bereich der islamischen Kultur," Nova Acta der Kais. Leopold, Halle* 1915, vol. I, Bd. 100.

4. Ettinghausen, (*Ibid*), p. 95.

Al-Jazari's work was greatly appreciated not only by the Artuqid Sultans but also by the Turks and Persians many centuries after its completion. Some of Al-Jazari's clocks were meant to be used in palaces or public squares.

Automata manuscripts can be found in many museums and libraries in the East and the West. The Top Kapi Sarayi Muzesi, in Istanbul, contains the earliest known manuscript of Al-Jazari's book dated 1206 AD. (602 H),[5] Library of Ahmet III No 3472. Many pages were taken from the manuscript of the Kevorkian Foundation some of which are in the Museum of Fine Arts, Boston, also the Cleveland Museum of Art and the Freer Gallery of Art in Washington D.C.[6]

The First Page:

Automata, 56.121.11

This double page illustration (Pl. XXIII-XXIV) is 11.5/8 in. high and 8.3/8 in. wide. The obverse and reverse miniatures represent a device for raising water from a well or stream by animal power. Both devices work on the same principle.

The obverse miniature shows a mule in a separate room at the top of the page. The mule moves round and round the upright to which it is attached.[7] This movement causes the horizontal toothed wheel below to revolve and interlock with the vertical toothed wheel (on the right--hand side of the miniature). This in turn, causes the horizontal rod, to which this wheel is attached to revolve. The upper horizontal rod carries four wheels, each of which is toothed only on one quarter of its circumference. The wheels are so arranged that the four sets of cogs point in four different directions. One revolution of the mule causes each of these four wheels to interlock in turn with the corresponding vertical wheel below it. Each section of the lower horizontal rod, consisting of four separately moving parts, is revolved in turn. The lower rod is attached to four scoops which dip into the water. Thus when the mule revolves, the wheels turn the rod attached to the four scoops and the scoops tip the water into the channels. The water flows along the channel to the area to be irrigated or into a special channel prepared to receive the water. The scoops are continuously filled and emptied in rotation.

The miniature on the reverse of this page has the same elements but with only one scoop instead of four (Pl. XXIV).

A comparison of these two illustrations shows the advantages of the four-scoop device over the one-scoop device. Instead of having one mule working all day to irrigate, say, one acre, we can use the four-wheel apparatus to reduce the irrigation time to one quarter of a day, or alternatively to irrigate four acres in one full day. The mule in the reverse miniature looks tired whereas in the obverse miniature it appears active and strong.

5. Grube, (*Ibid*), p. 7.

6. The Kevorkian Foundation at New York City has a unique Automata manuscript which is dated 1315 A.D. It has about 100 pages, but unfornately it has never been published. There are several copies related to al-Jazari in Istanbul (Suleymaniye Library), but the original copy is in the Top Kapi Saray Museum Library no. A. 3472.

7. This type of mechanical illustrations is explained in the second chapter of the fifth section of al-Jazari's treatise.

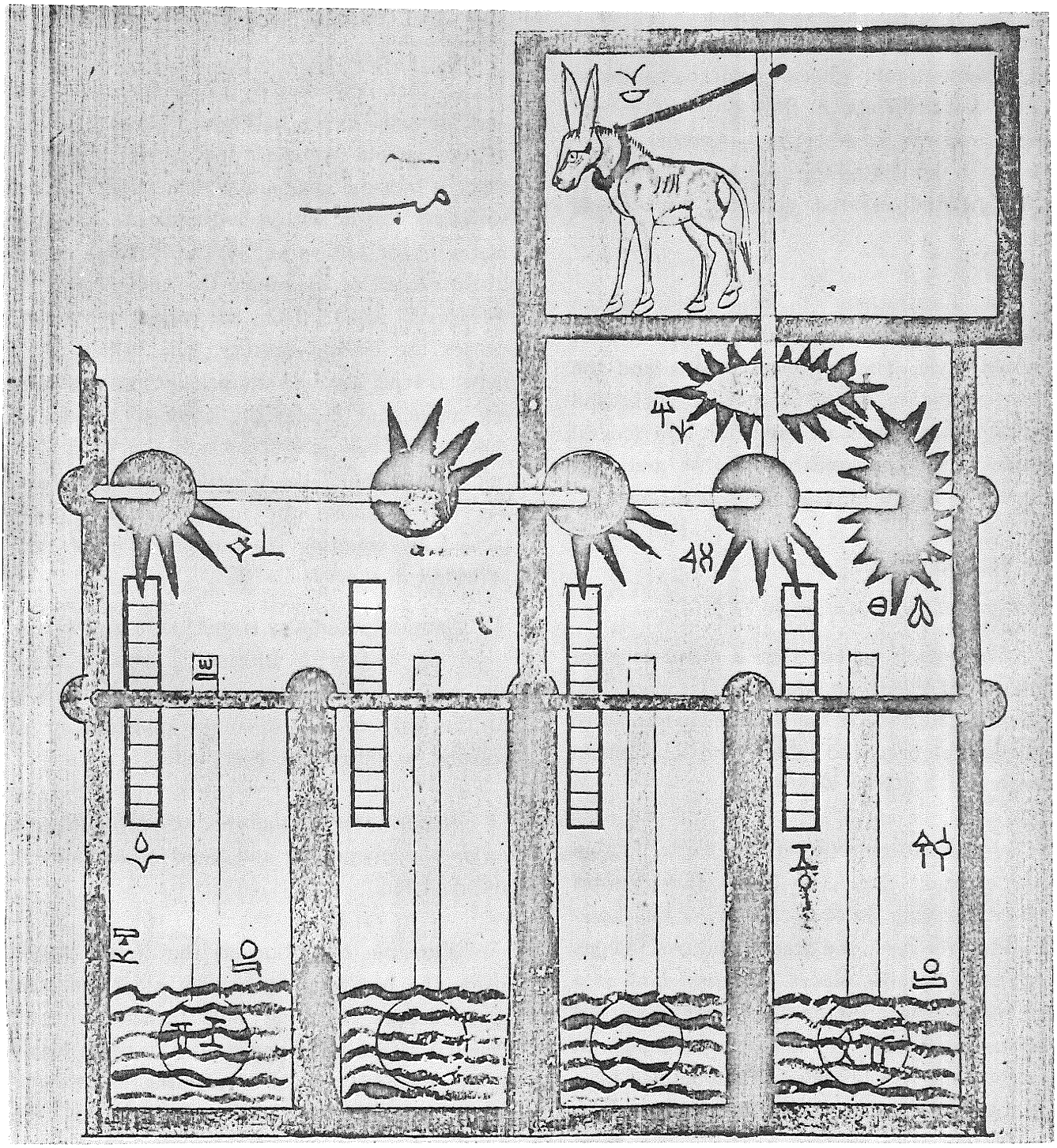

Fig:1 Miniature painting of the four-wheel apparatus. (Museum of Fine Arts, Boston).

A miniature in the Boston Fine Art Museum (Fig. 1) shows a four-wheeled device very similar to that described above. Both must have been copied from the same original. Another miniature also in the Boston Fine Art Museum (Fig. 2) shows a wind-powered appartus for raising water.

The illustrations in the Metropolitan Museum of Art represent the traditional Mamluki style. The technical details and the general rendering of the animals in these and the Boston miniatures are the result of a general attitude which appeared in the 13th and 14th centuries in Baghdad, Damascus and Cairo.

The Second Page:

The Elephant clock Automata 57.51.23

This page is taken from a manuscript of Automata (*Treatise on Mechanical Devices* by Al-Jazari). The obverse has a full page miniature on paper, coloured and gilded, and is 11.13/16 in. high and 7.3/4 in. wide.[8]

This miniature represents a clock, known as the elephant clock[9] (Pl. XXV). It depicts an elephant carrying an elaborate tower-like howdah with three men, one dragon and two falcons arranged in specific places. The first man is a black mahout, wearing only white trousers and a narrow red scarf. He holds a stone-pick in his right hand and his head is surrounded by a typical Christian halo. Inside the howdah there is another figure holding a stick. The third figure is the bearded man who seems to be looking out of a window on the upper left of the howdah.

The clock is worked by a combination of man and animals. Every half-hour the bird on top of the cupola whistles and turns, while the mahout hits the elephant with his pick-axe and sounds a tattoo with his drumstick. The man in the upper left corner of the Howdah moves his arm and leg to induce the falcon below to release a pellet. This downward movement causes the dragon to turn. The little ball or pellet travels through the dragon and the turning movement causes the gong to be struck. Finally the ball is ejected into the little vase (placed just behind the mahout) where the observer can establish the number of half-hours passed, by counting the number of little balls collected in the vase.

Another possibility is that there was a large revolving dial, with alternating arcs of black and white, fixed on the top of the howdah.[10] As the dial turned, the colour appearing at an opening would change every hour.

Within this miniature several different styles of iconography and floral ornamentation are depicted.

With the exception of the figure seated inside the howdah, the figures, their features, eyes, beards, clothing and turbans are all Oriental in character and similar to those found in the Baghdad school of painting in Mesopotamia and Syria at the beginning of the thirteenth century. The scroll and palmette motif and the tasselled border of the saddle cloth is also oriental in style and similar designs can be

8. This illustrated page is a bequest of Cora Timken Burnett to the Metropolitan Museum of Art in 1957.
9. Ettinghausen, (*Ibid*), p. 95.
10. The late Prof. Ettinghausen has suggested this idea, as he thought that the dial is not represented in the miniature. *Arab Painting*, p. 95.

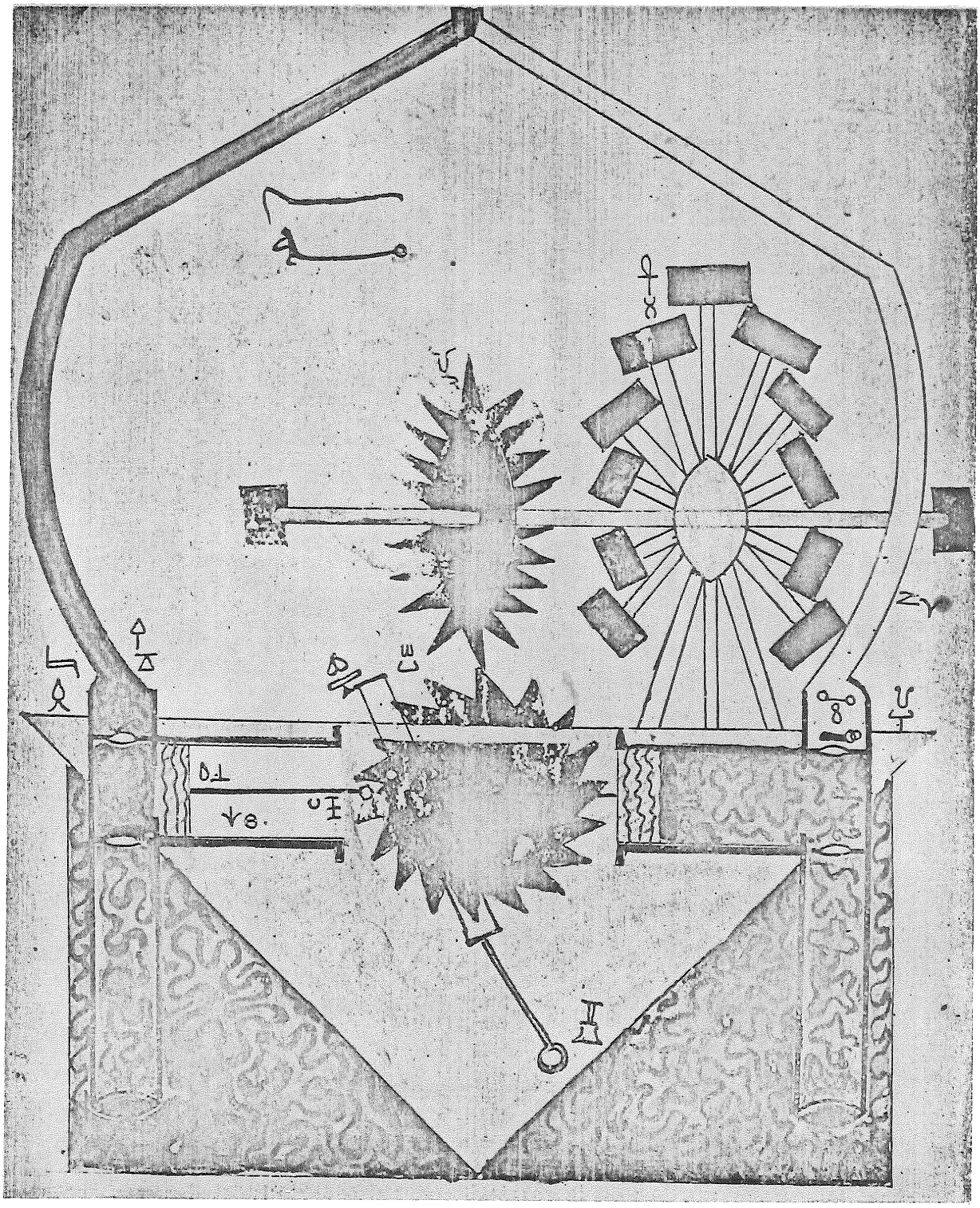

Fig: 2 Miniature painting of an apparatus working by a wind-mill, (Museum of Fine Arts, Boston).

Fig: 3 Miniature painting of a hand washing device. (Freer Gallery of Art, Washington D. C.).

seen in some illustrated pages of *Rasail Ikhwan as-Safa* (The Epistles of the Sincere Brethren)[11] produced in Baghdad in 1287 (686 H.).

Although the general concept of the elephant and howdah was originally Indian in character, the tower-like howdah depicted here is similar to the small chapels which appeared in the miniatures of al-Hariri's Maqamat showing Abu Zayd in Merv and Yemen[12] and dated 1235. However, the stone-pick is an Indian character.[13] It represented the Indian emblem of Saturn.[14]

The dragon is of Chinese origin.

The man seated inside the howdah and the floral palmette motifs are similar to those in the Freer Gallary and Boston manuscripts (Figs. 4-5) and show the influence of the Far East.

Classical sources are also in evidence. The upper part of the tower-like howdah is based on two Corinthian columns and the elephant is shown without any articulation in its legs. It was a classical belief that the elephant was jointless; a belief continued in Byzantine prototypes.[15]

The far eastern motifs in this miniature give an indication of its date. These motifs became dominant in Arab painting only after the Mongolian invasion of Mesopotamia and Syria in 1258.[16] The Mongolian artists who came from Central Asia introduced the Chinese and Indian iconography.[17] If the Automata manuscripts of Boston were copied from the original in the 14th. century,[18] that means they were copied after the Mongolian invasion, in which case it is possible to date this manuscript as a production of the 14th century.[19] However, the painter of this miniature had a different spirit in mind as there are international motifs inserted throughout this painting. Oriental, Chinese, Indian, Classical, Muslim and Christian (witness the halo which surrounds the mahout's head). Thus the Muslim painters were able to challenge the well established Iranian and Byzantine styles of pictorial patterns. The Muslim style became more apparent when the Abbasids left their influence on Christian manuscripts written within the Muslim world. A Chrstian manuscript executed in Mesopotamia for the members of the Jacobite Syrian Church in 1220, show "Christ's Entry into Jerusalem". This manuscript has been greatly influenced by the Mesopotamian school of painting known as the Baghdad School.[20] It has also been influenced to a certain extent by Byzantine models.[21]

A miniature in the Freer Gallery of Art in Washington (Fig. 3) dated 1315 and related

11. Ettinghausen, (*Ibid*), p. 98-99.
12. *Ibid*, p. 106, 107; Oriental Intstitute, Academy of Siences, Leningrad, *MS*. 523, p. 250, 256.
13. Thought mentioned according to al-Jazari specifications in his treatise.
14. Ettinghausen, (*Ibid*ı, p. 60, 96.
15. Ibid, p. 98, 99.
16. Hitti, Philip, *The History of the Arabs*, London, 1951.
17. Grube, E., *Muslim Miniature Painting*, p. 8, 9.
18. Coomaraswamy, Anada, *The Treatise of al-Jazari* on Automata, p. 8-9.
19. Ettinghausen, (*Ibid*ı. p. 95-96.
20. *Ibid*, p. 96, 97.
21. Grabar, André, *The Art of the Byzantine Empire*, 1966, p. 182; Grube, (Ibid), p.2.

Fig: 4 Miniature painting of the Elephant water Clock. (Freer Gallery of Art, Washington D.C.).

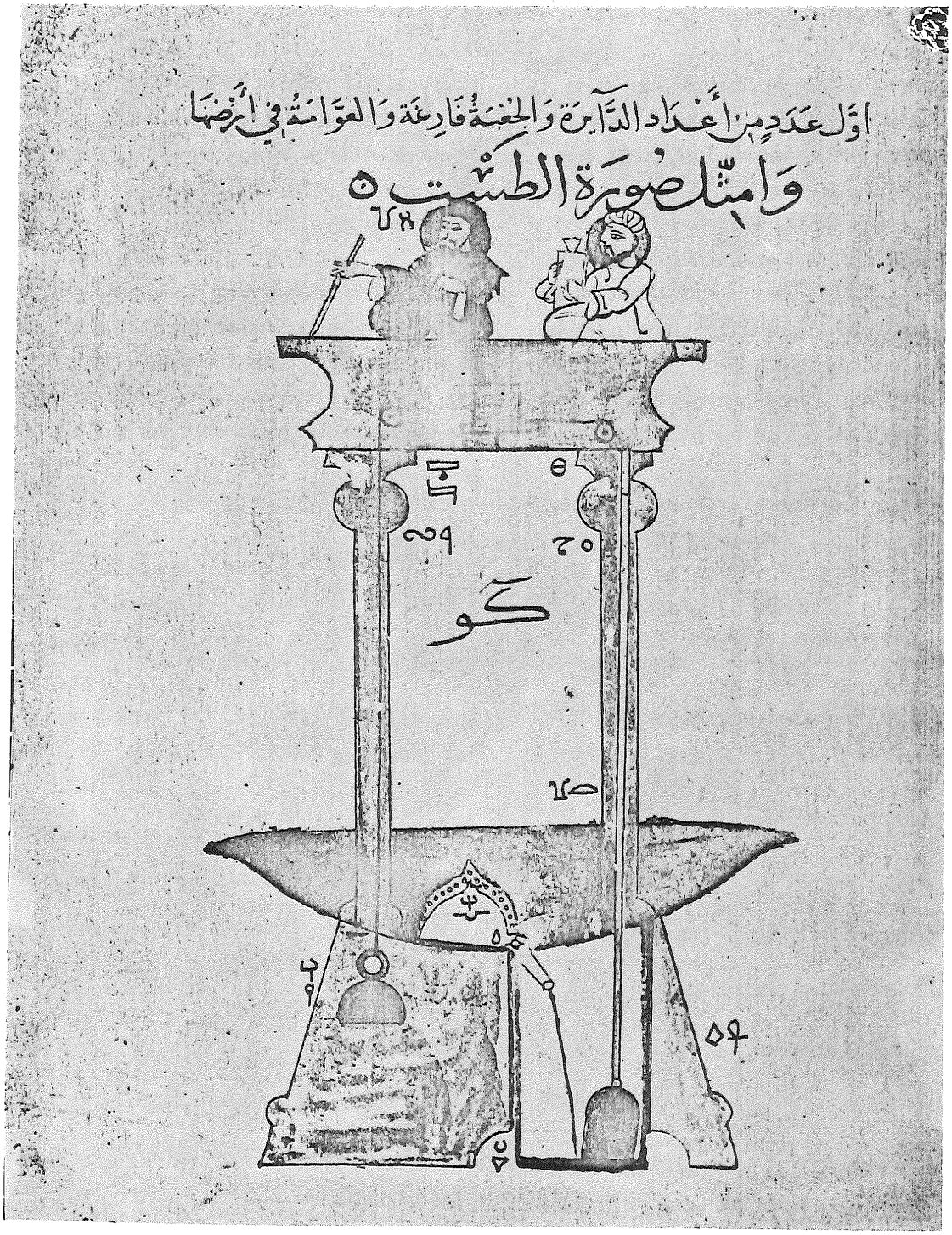

Fig: 5 Miniature painting of the basin with two scribes which is employed in phlebotomy, measuring the exact amount of blood taken from the body. (Museum of Fine Arts, Boston).

to Syria shows a water-pouring device. It is a copy taken from the same Al-Jazari source[22] Although the Boston miniature has great similarities with the elephant clock the figures are quite different There were probably two schools; one influenced by far eastern traditions and the other related to a local Syrian or Mesopotamian school. I believe our manuscript was painted by a painter influenced by the local school while the Boston and the Freer manuscripts were painted by painters of the far eastern school.

Arab painting was deeply influenced by the contacts the Seljuks had with the far east. Many far eastern elements were transmitted to the Mamluk realm where they merged with the local traditions in the 12-13th centuries in Iraq, Syria and Egypt.[23]

Muslim manuscripts on automata exerted a considerable influence on European craftsmen in the 16-17th centuries. Many Europeans used the scientific ideas of the Muslim civilization especially those concerned with clock construction, movable tables, as well as many other works based on automata.

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22. Atıl, Esin, *Art of the Arab World*, Smithsonian Institution, Washington D.C., 1975, p. 110; Ettinghausen, R., *Encyclopedia of the World Art*, (Automata-Islamic), vol. 2, p. 186.
23. Grube, E., *The World of Islam*, p. 109.