



MECHANICAL ENGINEERING IN ANCIENT EGYPT, PART 44: STATUES OF ELEPHANT, COW AND FISH

Dr. Prof. Galal Ali Hassaan*

Emeritus Professor, Department of Mechanical Design & Production, Faculty of Engineering,
Cairo University, Egypt.

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***Corresponding Author**

**Dr. Prof. Galal Ali
Hassaan**

Emeritus Professor,
Department of Mechanical
Design & Production,
Faculty of Engineering,
Cairo University, Egypt.

ABSTRACT

The objective of this paper is to investigate the development of mechanical engineering in ancient Egypt through the production of elephant, cow and fish statues. This study covers the design and production of statues and figurines from the Predynastic down to the Late Periods of ancient Egypt. The innovations in design and production of the analyzed statues are highlighted.

KEYWORDS: Mechanical engineering history, ancient Egypt,

Elephant statues, cow statues, fish statues.

INTRODUCTION

This is the last paper in a series of research papers presenting the animal statues production in the ancient Egyptian society. I presents the statues and figurines of three animals: elephant, cow and fish. The three animals are presented according to size not according to the date of their existence in ancient Egypt. Then the statues and figurines are presented according to sequence.

Anson, 1932 in his book about fishermen and fishing ways presented a chapter about fishermen of ancient Egypt, Palestine, Greece and Rome. He outlined that fish had been the normal food for those lived on the Nile banks or in its neighbourhoods. He added that the life of the Egyptian fishermen was reconstructed through the paintings in the Egyptian tombs.^[1]

Velde, 1991 in his paper about some Egyptian deities and their priggishness outlined that it

seems that the pig was a symbol to use as a representation of a god or goddess. He stated that the pig never reached the status of cat, dog and geese and there was no pig mummies were found in Egypt.^[2] Adams, 1998 in her paper about a discovery of a Predynastic elephant burial at Hierakonpolis of Egypt announced through excavations in the large settlement of Hierakonpolis the discovery of a 5700 years old elephant burial during the time of Naqada I.^[3] Lobbon and Liedekerke, 2000 in their paper about elephants in ancient Egypt and Nubia examined the presence of elephants in the ancient Nile valley where they were hunted and distributed to Egypt. Their study aimed at illuminating some of the deep roots of the human-elephant relations.^[4]

Mohammed, 2010 in his thesis about the marshes in ancient Egypt highlighted the most important birds, fishes and animals lived at marshes environments of Egypt during the Old Kingdom. He focused on products, industries and foods of plants, birds and fishes living in marshes and their role in supporting the ancient Egyptian economy.^[5] Basson, 2012 in his M. Phil. Thesis about the Goddess Hathor and the women of ancient Egypt presented Hathor in the form of a woman statue, a cow statue and as a capital.^[6] Rehren and Pernike, 2014 in their paper about the nature and origin of the metal work from Tel el-Farkha presented copper fish-hooks and harpoons dated to the Late 4th millennium having one, two and three barbs.^[7] Hagseth, 2015 in his thesis about Nilotic livestock transport in ancient Egypt studied the etymology of the cattle in ancient Egypt. He showed cattle transport boats from Old and New Kingdoms.^[8] Phillipps et. Al., 2016 based on assessment of faunal material from Fayum demonstrated the significance of fish above other species for all early to mid- Holocene occupations with the presence of wild ungulates in the earliest faunal deposits.^[9] Wikipedia, 2017 wrote an article about history of fishing pointing out that it is an ancient practice dated to at least 40,000 years. They presented a fishing hook made of bone and stated that ancient Egyptians used reed boats for fishing and used harpoons, hooks, lines, nets and baskets in the fishing operation.^[10] Hassaan, 2017 investigated the evolution of mechanical engineering in ancient Egypt through studying the industry of the animal statues in periods extending from the Predynastic down to the Late Period. He presented many examples of statues and figurines for cat, dog and lion.^[11] jackal, hippopotamus and crocodile.^[12] gazelle, baboon and hedgehog.^[13] bull, ibex, ram and snake.^[14] and horse, leopard, turtle and frog.^[15]

Elephant Statues

Elephants were living in ancient Egypt during the Predynastic Period because of the

sufficient rain, but in the Dynastic Periods, the climate became drier and the elephants moved south.^[16] According to Barbara Adams, excavations in Hierakonpolis of Egypt led to the discovery of a 5700 years old elephant burial (Naqada I Period).^[3] We have a number of examples of elephant palette, amulet and statue most of which are during the Predynastic Periods of ancient Egypt:

- The first example is a 139.7 mm length greywacke elephant shaped palette from Naqada I / Naqada II (3650 – 3300 BC) shown in Fig.1.^[16] The two eyes of the elephant are shown as an all-through hole, while there is another hole in the elephant back to hang the palette. The present location of this palette is not identified!.
- The second example is a 100 mm greywacke elephant-palette from Naqada I/Naqada II Period (3800-3300 BC) in display in the Pushkin State Museum at Russia and shown in Fig.2^[17]. The eyes are engraved in its head and a hanging hole is drilled in a specially prepared hole-support (Early mechanical engineering tradition indicating the broad thinking of the ancient Egyptian mechanical engineer).



Fig. 1: 139.7 mm Palette from Naqada I/II.^[16]



Fig. 2: 100 mm Palette from Naqada I/II.^[17]

- The third example is a 22.2 mm ivory amulet in the shape of an elephant head from Naqada I/Naqada II (3650-3300 BC) shown in Fig.3.^[16] The two eyes are inlaid in two different colors and the two tusks are turned internally towards the face front.
- The fourth example is a 35 mm height serpentine amulet in the shape of an elephant head from Naqada II (3500-3300 BC) in display in the Metropolitan Museum of Art and shown in Fig.4.^[18] The eyes are inlaid in two colors and the tusks are turned internally closer to the eyes of the elephant.



Fig. 3: Ivory amulet from Naqada I/II.^[16] Fig. 4: Serpentine amulet from Naqada II.^[18]

- The fifth and last example is a granite elephant statue existing in the Elephantine island of Aswan shown in Fig.5.^[19] The designer showed the elephant standing on a two levels stand in an open area. The dimensions nor the historical period are not identified.

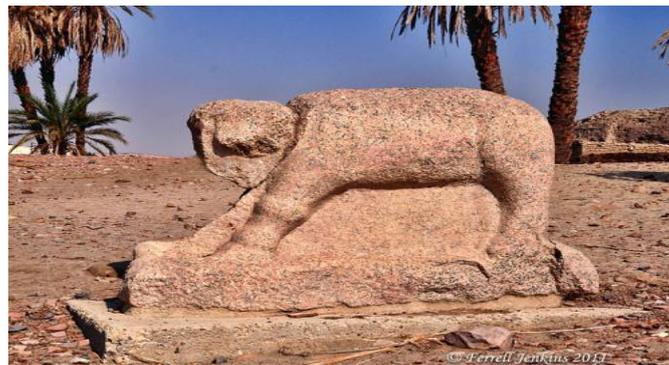


Fig. 5: Granite elephant statue from Aswan.^[19]

Cow Statues

Cow as a cattle member appeared in ancient Egypt since the 8th Millennium BC in the Fayum region.^[20] The cow was one of the oldest sacred animals in ancient Egypt. The cow Goddess was called Hathor meaning the house of Horus. She was illustrated by a flint model of as cow head and horns dated to the Predynastic Period and in display in the British Museum.^[21] Examples incorporating cow from ancient Egypt will be presented coving a time span from the 1st to the 26th Dynasties:

- The 1st example is a 0.635 m siltstone palette for King Narmer, the founder of the 1st Dynasty (3000-2920 BC) in display in the Egyptian Museum at Cairo and shown in Fig.6.^[22] The palette is headed by two figurines of Hathor cow, then carved scenes for the King smashing the head of Egypt's enemies. Even though siltstone is one of relatively hardest stones, the ancient Egyptian carver could carve it professionally and produce

wonderful clear scenes from both sides of the palette without breaking it (about 5000 years ago).

- The second example is a 1.73 m length cattle inspection painted-wood-model from the tomb of Meketre, the chancellor and high Steward during the reign of King Mentuhotep II (2061-2100 BC) and King Mentuhotep III (2100-2061 BC) in display in the Egyptian Museum at Cairo shown in Fig.7.^[23] Because ancient Egypt was a great empire, they left such authorizing registration of some important economical activities. It represents the canceller and high steward Meketre inspecting the cattle wealth in his state with complete team of scribes, supervisors and workers. Such artifacts illustrate the strength sides of the ancient Egyptian economy.

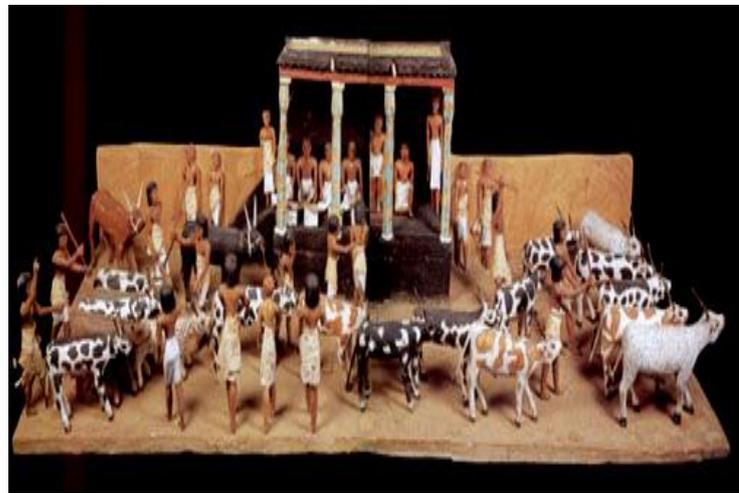


Fig.6: Palette of King Narmer of the 1st Dynasty.^[22] Fig.7: Cattle model from the 11th Dynasty.^[23]

- The third example is an 0.47 m length carved and painted wood model of birthing cow from the 11th Dynasty (2000 BC) in display in the Royal Ontario Museum of Canada and shown in Fig.8.^[24] The 4020 years old model is a wonderful piece in design and production. Two workers are looking after the birthing process. One man with the cow mother and the other with the cow baby. The coloring is more than fantastic.
- The fourth example is wooden model of a cattle stable from the tomb of Meketre dated to the reign of Amenemhat I, the 1st King of the 12th Dynasty (1981-1975 BC) having a dimensions of 0.725x0.57x0.285 m and shown in Fig.9.^[25] The stable model is a registration for the industrial engineering in the ancient Egyptian society. It consists of two partitions. Each partition houses a number of cows with separate door (clear only in one of the partitions when the door is open and the workers are servicing the cows. The other cows are eating without any disturbance. How great they were !!.



Fig. 8: Birthing cow from the 11th Dynasty.^[24]



Fig. 9: Cattle stable from the 12th Dynasty.^[25]

- The fifth example is a stone Hathor statue in the Hathor chapel at temple of Thutmose III, the 6th Pharaoh of the 18th Dynasty (1479-1425 BC) at Deir el-Bahri of Luxor shown in Fig.10.^[26] The designer showed the cow striding and protecting the Pharaoh by its head and body.
- The sixth example is a 0.355 m height calcite head of a cow statue from Deir el-Bahri (1450 BC) during the 18th Dynasty in display in the British Museum and shown in Fig.11.^[27] The cow head was carved professionally and laid by lapis lazuli.
- The seventh example is a wooden cow head from the tomb of Amenhotep II, the 7th Pharaoh of the 18th Dynasty (1425-1398 BC) in display in the Egyptian Museum at Cairo and shown in Fig.12.^[28] The designer showed the cow with short horns and used inlay for the eyes, eyebrows and horns. The wood was carved and painted to give the wonderful pose of the cow depicted in Fig.12.
- The eighth example is a gilded and stuccoed wood funerary bed in the shape of two sacred cows from tomb of Pharaoh Tutankhamun (1332-1323 BC) from the 18th Dynasty in display in the Egyptian Museum at Cairo and shown in Fig.13a.^[29] Each side represented a sacred cow with a complete head having two horns and a solar disc between them, a body, one front and rear leg and a curved tail. The bed is decorated by geometric shapes repeated in contours on the cow face, body and legs. A part of such decoration is illustrated in the zoomed image shown in Fig.13b.^[30]



Fig. 10: Hathor chapel from the 18th Dynasty.^[26]



Fig. 11: Calcite cow head from the 18th Dynasty.^[27]



Fig. 12: Wooden cow head from the 18th Dynasty.^[28]



Fig. 13: A Sacred cow-bed from the 18th Dynasty.^[29]



Fig. 13: b Face of the sacred cow of Tut's funerary bed.^[30]

- The ninth example is a gilded Hathor head from the tomb of Tutankhamun of the 18th dynasty in display in Luxor Museum and shown in Fig..14.^[31] The eyes are inlaid by lapis lazuli and the long curved horns are manufactured from copper while the face, ears and

part of the neck are gilded by gold. This mechanical design is very complex because of its 3D-nature and the corrugations in the ears and in the horns. The designer use four different materials in producing this wonderful unit: wood, copper, gold and lapis lazuli, All the head elements are assembled in a way to live for thousands of years without possibility of disassembly. It is the distinct caliber of the ancient Egyptian engineer and technician.

- The tenth and last example is schist statue for Hathor from the tomb of Psammetic III, the 6th Pharaoh of the 26th Dynasty (526-525 BC) in display in the Egyptian Museum at Cairo and shown in Fig.15.^[32]



Fig. 14: Cow head from Tut's tomb.^[31]



Fig. 15: Cow statue from the 26th Dynasty.^[32]

This is a very delicate complete statue for the Hathor cow carved from schist and professionally polished to give the very shining surface shown in Fig.15 with a very complex details for the face including a disk-feather-cobra crown between the long-curved-horns of the cow.

Fish Statues

Ancient Egyptians used different techniques for fishing: fish traps during the Predynastic Period, line and hook during the Old Kingdom and metal hooks with barbs during the 12th Dynasty.^[33] Others see that the spear, net, line and rod appeared in ancient Egypt around 3500 BC.^[34] Sample examples of fish representation in ancient Egypt during periods from

Naqada II to Third Intermediate Period will be presented here through statues and figurines:

- The first example is 105 mm length greywacke palette in the shape of a fish from Naqada II / 1st Dynasty (3500-2950 BC) in display in the Cleveland Museum of Art and shown in Fig.16^[35]. The contours of the 5000 years old palette were perfectly rounded even the tail following the well-established mechanical engineering traditions of surface filleting not to harm the user. The circular hole in the top-middle is for hanging. The designer used the eyes to provide an all-through hole.
- The second example is a slate cosmetic dish in the shape of a tilapia fish from Naqada III (3000 BC) in display in the Kunst Historischen Museum at Wien and shown in Fig.17.^[36] The designer used a round pool in the body of the fish for cosmetic use and rounded all the surfaces. He made the tail as a mean to hold the dish since in this application providing holes is not reasonable as was the case in the palette application of Fig.16.



Fig. 16: Fish-Palette from Naqada II/1st Dynasty.^[35]



Fig. 17: Fish-dish from Naqada III.^[36]

- The third example is an 83 mm length greywacke cosmetic dish in the shape of a fish produced in two parts during the time of Naqada III / 1st Dynasty (3000-2800 BC) in display in the Brooklyn Museum at NY and shown in Fig.17.^[37] The fish is inlaid with shell and black paste. The designer used guide pins in the lower part and holes (probably) in the upper part to assemble the two parts of the dish. It is not clear from the view if the black spot on the tail is a revolute joint for the two dish-parts or it is something else.
- The fourth example is an electrum fish-amulet from the 12th Dynasty in display (1938-1759 BC) in display in the Penn Museum and shown in Fig.18.^[38] The material nor the dimensions are not assigned. It is hanged using a ring (or hook) set in the fish mouth. The designer tried to display the details of the fish head, fins and tail which is split into two parts taking the V-shape.



Fig. 17: Fish-dish from Naqada III / 1st Dynasty.^[37]



Fig. 18: Fish-amulet from the 12th Dynasty.^[38]

- The fifth example is a gold fish amulet inlaid by green faience and a gemstone from the 12th Dynasty in display in the Walters Art Museum at Baltimore and shown in Fig.19.^[39] It is of the same type of fish simulated in Fig.18 except its decorations has exceptionally higher level and technology. It is inlaid by green faience, turquoise, carnelian, lapis lazuli and a black stone ^[39]. This is a master piece indicating the high production technology gained during the 12th Dynasty more than 3800 years ago.
- The sixth example is a gold fish amulet from the 12th Dynasty (1991-1802 MC) in display in the British Museum and shown in Fig.20.^[40] The designer used a green stone as the body of the fish and used gold sheet as a frame for the body and for all the fins and head. He used exceptionally large tail and top fin.



Fig. 19: Gold-fish-amulet from the 12th Dynasty.^[39]



Fig. 20: Gold-fish-amulet from the 12th Dynasty.^[40]

- The seventh example is a 21 mm length turquoise pendant from Late 12th / Early 13th Dynasties (1878-1749 BC) in display in the Metropolitan Museum and shown in Fig.21.^[41] The designer used the turquoise stone as a material for the fish body, gold as a material for the tail and fins and may be a third material for the frame surrounding the body and the integrated hook with it to hang the fish as an amulet or pendant.
- The eighth example is a gold fish amulet from the 11th - 14th Dynasties (2030-1650 BC) in display in the National Museum of Scotland and shown in Fig.22.^[42] This type of fish

is similar to that in Fig.18, but the designer used gold as the main material and stone inlay for the eyes. He showed professionally all the details of the fish body, tail, fins and head. This piece can be considered as a master piece in gold applications in ancient Egypt.



Fig. 21: Fish-amulet from the 12th -13th Dynasties.^[41] Fig. 22: Fish-amulet from the 11th -14th Dynasties.^[42]

- The ninth example is a wooden fish showing the cartouche of Intef VII, the 14th King of the 17th Dynasty (1580-1550 BC) in display in the Egyptian Museum at Cairo and shown in Fig.23.^[43] It is of the Tilapia fish which is relatively difficult to simulate because of its skin-peel and colors. The designer could professionally generate all the fish peels, tail, fins and head. The zoomed image in Fig.23 shows the King Cartouche as carved by the fish producer.



Fig. 23: Wood fish from the 17th Dynasty ^[43].



Fig. 24: Faience fish from the 18th Dynasty.^[44]

- The tenth example is a faience fish from the 18th Dynasty (1391-1335 BC) in display in the RISD Museum at Rhode Island, USA and shown in Fig.24.^[44] Even though, the designer selected a cheaper raw material for his fish-product, however he could use four different colors to produce a wonderful artifact which is a Tilapia fish. He used a different technique to present the peels of the fish skin while the designer of the same fish in Fig.23 selected more complex technique to present the fish-peel very close to reality.

- The eleventh example is a glass bottle in the shape of a Tilapia fish from the 18th Dynasty (1390-1336 BC) in display in the British Museum and shown in Fig.25.^[45] This is the top technology in glass production not only in the New Kingdom but also up to now !!. The production of the fish bottle is marvelous since there too many patterns with different colors (I counted four colors). This makes the high standard product design of this unit very difficult to bring it to reality. While I was working in part XVI of this series about glass industry^[46] I wrote to three international professors one from Glass Science, and one from Glass Technology and the third a former Ministry of Industry. Simply I sent to them a photo for a glass product from ancient Egypt of a similar quality to that one shown in Fig.25. I asked them: Is it possible to produce this product now ? and how much a prototype will cost ? .. Unfortunately, the first two professors replied that it is not their specialization. The third (minister of industry said: it is secret !!). The door is still open for the Egyptologists to answer such questions: How could the ancient Egyptians produce such a fantastic piece more than 2350 years with their technological facilities ?.
- The twelfth example a 181 mm length glazed steatite cosmetic dish in the shape of a Tilapia fish from the reign of Thutmose III, the 6th Pharaoh of the 18th Dynasty in display in the Metropolitan Museum of Art and shown in Fig.26.^[47] This stone fish is very similar to that of the wooden design of Fig.23 except the cartouche which carries the name of the Pharaoh (Thutmose III). The pool of the dish is from the other side.



Fig. 25: Glass fish-bottle from the 18th Dynasty.^[45]

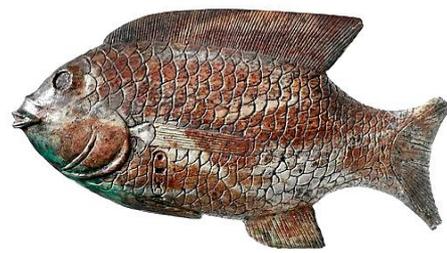


Fig. 26: Steatite fish-dish from the 18th Dynasty.^[47]

- The thirteenth example is a spoon in the shape of a fish from the New Kingdom (1543-1064 BC) in display in the Kunst Historischen Museum at Wien and shown in Fig.27.^[48] The dimensions and the material are not assigned. This design can serve as a dish or spoon. The designer designed the fish tail to act as a handle for the spoon by adjusting its dimensions to suit this purpose. The pool of the spoon was perfectly rounded from all sides with fillets at the tip not to harm the user (well admired mechanical engineering tradition in ancient Egypt).

- The fourteenth example is a 17 mm length faience fish-amulet from the New Kingdom / Third Intermediate Period (1550-664 BC) in display in the Metropolitan Museum and shown in Fig.28.^[49] The designer used a simple cheap material for this production. However, he succeeded to maintain the completely rounded surfaces and the shape of the fish in only 17 mm length.



Fig. 27: Fish-spoon from the New Kingdom.^[48]



Fig. 28: Fish-amulet from the NK / 3rd IP.^[49]

- The fifteenth example is a bronze sacred fish statue with a Crown of Isis from the 26th Dynasty of the Late Period (664-525 BC) in display in the Virginia Museum of Fine Arts and shown in Fig.29.^[50] The designer shoed the fish standing on a parallelogram-base on two fins and the tail to be stable. He used glass to inlay the fish and give it better appearance than if he used bronze alone. Definitely the ancient Egyptian mechanical design had the technology to perform this inlay and keep it for more than 2680 years.



Fig. 29: Fish-statue from the 26th Dynasty.^[50]

CONCLUSION

- This paper investigated the evolution of mechanical engineering in ancient Egypt through the production of statues and figurines for elephant, cow and fish.
- The study covered a time span from Predynastic to Late Period.
- The ancient Egyptians authorized the elephant in the form of palettes and amulets production since Naqada I.

- They used greywacke, ivory, serpentine and granite in producing their elephant-based pieces and statues.
- They started producing cow figurines since the 1st Dynasty within the palette of King Narmer.
- They produced complete models for cattles during the Middle Kingdom including cattle inspection, birthing and caring in specially produced stables.
- The ancient Egyptians worshiped the cow and built special chapels for it during the 18th Dynasty.
- They produced cow heads representing Hathor during the 18th Dynasty.
- They produced complete statues for the cow during the 18th and 26th Dynasties.
- They used painted wood, gilded wood, siltstone, calcite and schist in producing their cow statues and figurines.
- They appreciated the existence of fish around them from two directions and across their lands through the River Nile through simulating a number of fish types
- They manufactured some products taking the shape of Egyptian fish such as: palette during Naqada II / 1st Dynasty, cosmetic dish during Naqada III, amulets during 12th Dynasty, fish figurines during the 17th Dynasty, bottle during the 18th Dynasty, cosmetic dish in the 18th Dynasty, spoon during the New Kingdom and a sacred fish with Isis Crown during the 26th Dynasty.
- In producing those fish-based statues and figurines they used a number of local raw materials such as: wood, faience, glass slate, greywacke, turquoise, steatite, gold and electrum.
- They succeeded to simulate the Tilapia fish using various materials including glass and represented its skin-peel with wide range of precision.

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BIOGRAPHY

Galal Ali Hassaan

- Emeritus Professor of System Dynamics and Automatic Control.
- Has got his B.Sc. and M.Sc. from Cairo University in 1970 and 1974.
- Has got his Ph.D. in 1979 from Bradford University, UK under the supervision of Late Prof. John Parnaby.
- Now with the Faculty of Engineering, Cairo University, EGYPT.
- Research on Automatic Control, Mechanical Vibrations , Mechanism
- Synthesis and History of Mechanical Engineering.
- Published more than 220 research papers in international journals and
- Conferences.
- Author of books on Experimental Systems Control, Experimental Vibrations and Evolution of Mechanical Engineering.
- Chief Editor of the International Journal of Computer Techniques.
- Member of the Editorial Board of a number of International Journals including WJERT.
- Reviewer in some international journals.
- Scholars interested in the authors publications can visit.

