



Full length article

## Mechanical Engineering in Ancient Egypt, Part 46: Birds Statues (Duck, Ibis and Hen)

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### ABSTRACT

The ancient Egyptians produced statuettes for ducks, ibises and hens since the time of Naqada I and Naqada II. They produced statuette and figurines for those birds not only as birds but also as domestic applications such as amulets, jars, spoons, combs and cosmetic boxes. The designs and materials used are investigated with analysis of each item for dimensions, beauty aspects and present location (if known)

**Keywords:** Mechanical engineering; ancient Egypt; duck statues; ibis statues; hen statues

### 1. Introduction

This is the 46<sup>th</sup> paper in a scientific research aiming at presenting a deep insight into the history of mechanical engineering during the ancient Egyptians civilization. The paper handles the production of duck, hen and ibis statues and figurines during the Predynastic and Dynastic Periods of the ancient Egypt history. This work depicts the insight of ancient Egyptians to birds lived among them and how they authorized its existence through statuettes and figurines.

Clark (1955) in his paper about the sacred ibis presented a number of ibis statues and figurines including a faience inlay of the ibis on a perch from Late Period, wooden-bronze white ibis from Ptolemaic Period and faience statuette of Thot with ibis head from Late Period [1]. Smith (1960) in his book about ancient Egypt as represented in the Museum of Fine Arts at Boston presented a number of bird figurines including ducks from the Middle Kingdom, gold ibis from the New Kingdom and a wooden spoon in the shape of a duck and lady from the New Kingdom [2]. Coltherd (1966) in his paper about the domestic fowl in ancient Egypt outlined that there was no recorded mention of the domestic fowl in ancient Egypt before the Middle Kingdom (2134-1786 BC) [3]. Smith (1994) in his book about the country life in ancient Egypt presented a number of bird figurines including a small ibis [4]. Arnold (1995) in his study on Egyptian bestiary presented a number of bird statuettes including a perfume vessel in the shape

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of two trussed ducks from the Middle Kingdom, cosmetic vessels in the shape of ducks from the 18<sup>th</sup> Dynasty and Thoth statue from the Ptolemaic Period [5].

Fay (1998) in her paper about Egyptian duck flasks studied a number of duck-shaped flasks in display in the Metropolitan Museum of Art. The author presented flasks in the form of a pair of plucked ducks from the 17<sup>th</sup> Dynasty, flasks in the form of plucked ducks from the 18<sup>th</sup> dynasty, duck-shaped dish from the 18<sup>th</sup> Dynasty and 200 mm duckling flask from the 17<sup>th</sup> Dynasty [6]. Gunnarsson (2000) in his book about laying hens in loose housing systems outlined that the domestic fowl was mentioned in a poem inscribed in the tomb of 'Ay' dated to the reign of Akhenaten (1364-1347 BC) [7]. Janek (2013) studied the existence of three kinds of ibis species in ancient Egypt. He presented material evidence for the existence of each kind in Egypt [8]. Seawright (2017) wrote an article in Tour Egypt about animals and Gods of ancient Egypt. She presented a number of claimed Gods including Thoth in the form of an ibis [9]. Wikipedia (2017) wrote an article about 'ibis'. They outlined that ibises were reamed for sacrificial purposes where in the serapeum at Saqqara, archaeologists found the mummies of 1.5 million ibises [10].

## 2. Duck statues

The ancient Egyptians new ducks as a domestic bird from early times and authorized its existence among them through a number of statues and figurines extending from Predynastic to Late Periods as follows:

- The first example is a duck-shaped pottery vessel from Naqada II (3500 BC) in display in the Egyptian Museum at Cairo and shown in Fig.1 [11]. The designer used the cheap, local and easy to shape material available in his society, the Nile clay. He decorated the whole vessel using zigzag patterns (may be simulating the water surface in any water channel).
- The second example is a schist duck-shaped palette from Naqada II/Naqada III (3500-3200 BC) in display in the Louvre Museum and shown in Fig.2 [12]. The carver could show the details of s setting duck head, neck, wings and legs professionally more than 5200 years ago.



Fig.1 Duck-bottle from Naqada II [11]

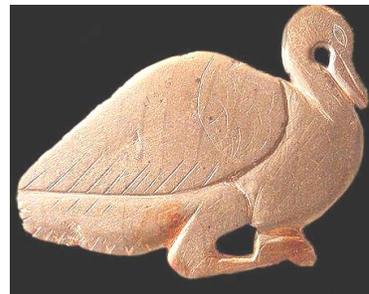


Fig.2 Duck-palette from Naqada II/III [12]

- The third example is a duck-shaped stone jar from the Naqada III Period (3200-3100 BC) in display in the Oriental Institute Museum of the University of California and shown in Fig.3 [13]. This 5000 years old product has a vital importance since it indicates the high technology of the carving process in this old era and the capability of the ancient Egyptian mechanical technician to select a proper material that gives this wonderful appearance and provide a jar with round hole and flat rim. The tradition of rounding all the surfaces is there not to harm the user. Besides, to carve the cavity inside the duck body is something not easy at all and indicated the high mechanical profession attained in this early period.
- The fourth example is a 1.12 m height wooden bearer statue with duck in her hand in display in the Metropolitan Museum of Art at NY and shown in Fig.4 [14]. The designer in this outstanding artefact showed the bearer catching the duck by her right hand through its wings. As clear in the zoomed image, the duck was nicely carved and coloured with multi-colours and patterns.
- The fifth example is a faience duck figurine from the 12<sup>th</sup> Dynasty (1991-1802 BC) in display in the Louvre Museum and shown in Fig.5 [15]. The designer used local available materials in the form of 'Egyptian faience' produced using a casting process [16]. The designer could produce a multi-coloured duck with completely round surfaces. The duck looks beautiful and stable in position.
- The sixth example is a 20 mm height silver amulet basket with two young ducks figurines on its external surface from Late 12<sup>th</sup> Dynasty – Early 13<sup>th</sup> Dynasty (1850-1775 BC) in display in the Metropolitan Museum of Art and shown in Fig.6 [17]. The two young ducks are shown facing each other with their beak touching each other. This product indicated the extension of the mechanical technology to silver casting more than 3790 years ago.



Fig.3 Duck-jar from Naqada III [13]



Fig.4 Bearer from the 12<sup>th</sup> Dynasty [14]



Fig.5 Duck figurine from the 12<sup>th</sup> Dynasty [15] Fig.6 Bearer from the 12<sup>th</sup> Dynasty [17]

- The seventh example is a 54 mm length wooden duck-shaped comb from the 17<sup>th</sup> – 18<sup>th</sup> Dynasties (1635-1458 BC) in display in the Metropolitan Museum and shown in Fig.7 [18]. The ancient Egyptian mechanical designer did not produce classical domestic products for specific objectives, but added to it motifs to increase its beauty and complexity. In the product in hand the designer made the comb-handle in the shape of a duck with motifs taking circular and straight patterns.
- The eighth example is an ivory duck-shaped cosmetic box from the New Kingdom (1550-1196 BC) in display in the Walters Art Museum at Baltimore and shown in Fig.8 [19]. This is a master piece in the ancient Egyptian mechanical engineering technology. The designer used the cosmetic box to simulate a duck. The box pool is within the duck body, the box cover is simply the two wings of the duck using a revolute joint for each wing allowing opening the box in two stages. The designer decorated the duck beak, head and wings with various decorating patterns especially the wings.



Fig.7 Duck-comb from 12<sup>th</sup> – 13<sup>th</sup> Dynasties [18] Fig.8 Duck-box from New Kingdom [19]

- The ninth example is a ceramic vessel in the shape of a young duck from the 18<sup>th</sup> Dynasty (1400 BC) in display in the Royal Ontario Museum of Canada and shown in Fig.9 [20]. Both designer and producer could manufacture this complex design from clay and then put it in fire at temperatures up to 800 °C to change it to ceramic [21]. The hole of the vessel has a thin medium length neck with rim, the handles are from the sides near the shoulders of the neck, the beak is little bit above the level of the hole entrance. The spout of the jar is the duck beak.
- The tenth example is a 247.7 mm length wooden duck-shaped cosmetic spoon from the 18<sup>th</sup> Dynasty (1353-1336 BC) sold by Christie in 4 June 1999 (lot 225) and shown in Fig.10 [22]. The unit represents the top mechanical technology in wood carving. The spoon consists of two parts. The spoon handle taking the shape of a lady, the spoon pool taking the shape of duck body (one part) and a spoon cover taking the shape of duck head, neck and the top part of its body (one part). The designer showed the lady extending her hands and supporting the duck body. The body of the duck is decorated by certain motifs and the duck eyes and beak are marked in different colours than the neck. A lot of work took place in carving the woman face with her headdress. All the surfaces are completely rounded following the well established mechanical design tradition in ancient Egypt.



Fig.9 Duck-vessel from 18<sup>th</sup> Dynasty [20]      Fig.10 Duck-box from New Kingdom [22]

- The eleventh example is an ivory duck-shaped cosmetic dish from the reign of Akhenaton – Tutankhamun Pharaohs (1353-1327 BC) in display in the Metropolitan Museum of Art and shown in Fig.11 [23]. The designer showed the dish in the shape of a trussed duck with cover for the dish-pool. Most properly the designer used a revolute joint to swivel the cover over the pool using two small pins near the end of the cover. Even though the material used was an ivory, however, the designer presented three colours in this unit. He showed the duck turning its neck and head towards the dish cover.
- The twelfth example is an ivory duck-shaped cosmetic box from the 19<sup>th</sup> Dynasty (1292-1189 BC) and shown in Fig.12 [24]. The dimensions and present location are not assigned. Again, this is a wonderful piece in which the designer used an ovoid cover with revolute joint and a pin for cover holding. The duck is turning its head towards the cover in its middle. The surfaces are rounded and decorated by motifs specially the duck-head

and body. The cover was perforated by eight circular holes either for decoration or for ventilation (if they are all through). The eyes are marked by a circular band. In general the design and production of the box are more than wonderful.

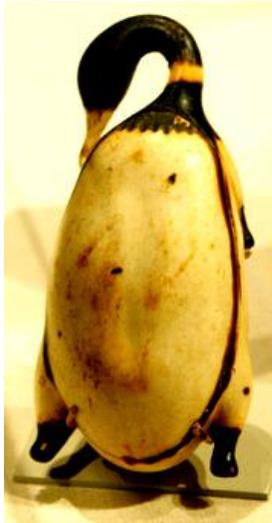


Fig.11 Duck-dish from 18<sup>th</sup> Dynasty [23]

Fig.12 Duck-box from 19<sup>th</sup> Dynasty [24]

- The thirteenth example is a golden bracelet for Ramses II, the 3<sup>rd</sup> Pharaoh of the 19<sup>th</sup> Dynasty (1297-1213 BC) in display in the Egyptian Museum and shown in Fig.13 [25]. The designer decorated the bracelet by two young ducks beside each other on its top. The used two heads and one body with lapis lazuli duck-back. He showed the ducks turning their heads towards their back. The duck-eyes were marked and the whole surface of the bracelet was decorated by motifs of very fine design and application.
- The fourteenth example is a leg of a funerary bed with duck statue from the reign of Shebitka, the 3<sup>rd</sup> Pharaoh of the 25<sup>th</sup> Dynasty (721-707 BC) shown in Fig.14 [26]. No more data are given such as material, dimensions and present location !. The bed-leg was decorated by the duck which was designed setting on the foot of the bed-leg looking little bit to its left as shown in the zoomed image of Fig.26.



Fig.13 Duck-bracelet from 19<sup>th</sup> Dynasty [25]

Fig.14 Bed-leg from 25<sup>th</sup> Dynasty [26]

- The fifteenth example is a 78 mm height faience trussed duck-perfume bottle from the 26<sup>th</sup> Dynasty (664-525 BC) in display in the Museum of Fine Arts at Boston and shown in Fig.15 [27]. The mechanical designer showed the bottle having a medium opening hole with rim and a single handle which is the duck neck. The decoration of the product was simple through a pattern of small objects with different orientation in black color.
- The sixteenth example is a bronze duck statue from the Late Period of Ancient Egypt (664-332 BC) and shown in Fig.16 [28]. This is may be a jar taking the shape of a duck because of the flat surface on the top back of the duck which may be the entrance hole.

Fig.15 Duck-bottle from 26<sup>th</sup> Dynasty [27]

Fig.16 Duck statue from Late Period [28]

### 3. Ibis statues

The ancient Egyptians new the ibis from very old times and authorized this knowledge since the time of Naqada II – Naqada III (more than 5000 years ago). This appreciation was to the extend to consider it as a sacred bird. Here, we present some of the ibis statues:

- The first example is an ivory vessel in the shape of a 130.2 mm height red breccia ibis-shaped vessel from Naqada II – Naqada III (3300-3000 BC) and shown in Fig.15 [29]. The designer showed the vessel in the shape of an ibis with the hole in the centre of the bird back with round rim and used the ibis neck and head as a handle for the vessel. Even though the breccia rock is one of the hardest rocks and it has an uneven fracture [30], the ancient Egyptian carver could produced this product having smooth shining surfaces and keeping the rounded surfaces everywhere more than 5000 years ago.
- The second example is a 184 mm length bronze and wood ibis statue from the 25<sup>th</sup> Dynasty (747-656 BC) sold in London in 26 April 2012 for 83,570 US\$ and shown in Fig.18 [31]. This is a sacred ibis manufactured from gilded wood (body) and bronze (head, neck, tail and legs). The designer showed a bronze statue for one of the 25<sup>th</sup> Dynasty Pharaohs kneeling and presenting offerings to the ibis.



Fig.17 Ibis-vessel from Naqada II/III [29]

Fig.18 Ibis statue from 25<sup>th</sup> Dynasty [31]

- The third example is a bronze and limestone statue for an ibis from the 26<sup>th</sup> Dynasty (664-525 BC) in display in the Egyptian Museum at Cairo and shown in Fig.19 [32]. The designer used limestone as a material for the ibis body to avoid using any coloring process and then used bronze to produce the head and legs. Here, the designer and producer could assemble the two different materials in a way to sustain environmental and use effects for thousands of years. This is an outstanding characteristic of mechanical engineering. They manufacture products to survive.
- The fourth example is a bronze ibis statue from the 26<sup>th</sup> Dynasty (664-525 BC) in display in the Los Angeles County Museum of Art and shown in Fig.20 [33]. In this design, the designer used a single material (bronze) casted in a complete striding ibis. He could show the claws of the ibis which certainly will complicate the model design. But he did it proofing the high casting technology in ancient Egypt.

Fig.19 Ibis statue from 26<sup>th</sup> Dynasty [32]Fig.20 Ibis statue from 25<sup>th</sup> Dynasty [33]

- The fifth example is a 130 mm height bronze ibis statuette with glass paste from the Late Period (664-332 BC) shown in Fig.21 [34]. This design is similar to that in Fig.20. However the designer showed the ibis running and used glass paste to protect the bronze material against rusting and give shining and smooth surfaces. The present location of the statuette is not assigned !.

- The sixth example is a calcite-bronze statuette of an ibis from the Late Period (664-332 BC) in display in the National Museums Scotland and shown in Fig.22 [35]. The designer showed the ibis standing and gave its body the white colour through using the calcite material while used the bronze material for the head, neck and legs. The designer succeeded to produce a stable product without any additional external support through selecting proper dimensions for the bird claws. This means that they were acquainted with the static force analysis of rigid bodies.



Fig.21 Ibis statuette from Late Period [34]



Fig.22 Ibis statuette from Late Period [35]

- The seventh and last example is a 330 mm height bronze and gilt wood statue of an ibis from the Late Period – Ptolemaic Period (664-30 BC) sold in 25 October 2012 in London for 166,336 US\$ and shown in Fig.23 [36]. The designer showed the ibis striding and used a gilt wood to simulate its body and bronze to simulate its head, neck and tail. He used glass to inlay its eyes.



Fig.23 Ibis from Late Period-Late Ptolemaic Period [36]

#### 4. Hen statues

Breed of chicken was originated in ancient Egypt where representations and descriptions of domestic fowl first appeared during the New Kingdom of ancient Egypt [36]. However, hen-

shaped jars and figurines appeared during the Predynastic Periods (from 4500 BC) as will be illustrated in the following examples:

- The first example is a 140 mm pottery vessel in the shape of a hen from Naqada I -1<sup>st</sup> Dynasty (3850-2960 BC) in display in the Metropolitan Museum of Art and shown in Fig.25 [38]. The vessel opening is a hole in the top part of the hen with small round rim. The vessel is supported by 3-legs stand. All the surfaces are perfectly rounded following the mechanical design tradition not to harm the user.
- The second example is a greywacke palette in the shape of a hen from Pre-Naqada I (4500-4000 BC) in display in the Metropolitan Museum of Art and shown in Fig.25 [38]. The designer showed the palette as two hens back-to-back with heads in opposite sides and tails coming together. Even though the material used is one of the hardest stone in Egypt, the ancient Egyptian carver could produce this unit with very smooth surfaces and uniform profiles about a vertical centerline. .



Fig.24 Vessel from Pre-Naqada I [37] Fig.25 Palette from Naqada I/1<sup>st</sup> Dynasty [38]

- The third example is a 193.7 mm greywacke hen-shaped palette from Naqada I – Naqada II (3650-3300 BC) shown in Fig.26 [39]. The predynastic designer showed the bird standing (the legs are broken). The ancient Egyptian mechanical designer was acquainted by the mechanics of rigid bodies. He has to adjust the dimensions such that the bird is stable in the standing position by making the a vertical axis through the centreline of the bird claws goes through the centre of mass of the bird (otherwise, the bird will not be stable).
- The fourth example is a 95.3 mm height limestone jar in the shape of a squatting hen from Naqada II – Naqada III (3300-2900 BC) shown in Fig.27 [40]. The designer used a squatting hen as jar where he put the jar entry hole on the back of the hen with wide neck and small entry and rim. He used shell to make the eyes. This unit is an indication of the high technology of the carving process in ancient Egypt more than 4900 years ago.
- The fifth and last example is a greywacke hen figurine from Naqada I – 1<sup>st</sup> Dynasty (3850-2960 BC) in display in the Metropolitan Museum of Art and shown in Fig.28 [41]. The designer collected the two legs together in a conical shape with flat bottom to make it

possible to stand on this flat surface. Again, he applied his experience to make the hen stable.



Fig.26 Palette from Naqada I/II [39]



Fig.27 jar from Naqada II/III [40]



Fig.27 Hen figurine from Naqada II/1<sup>st</sup> Dynasty [41]

## 5. Conclusions

- i. The evolution of mechanical engineering in ancient Egypt through the study of the statues industry of duck, ibis and hen was investigated.
- ii. The ancient Egyptians started producing duck-based applications since Naqada II (5500 years ago).
- iii. They manufactured some products taking the shape of a duck such as: vessels, palettes, jars, statuettes, figurines, amulets, combs, cosmetic boxes, cosmetic spoons, cosmetic dishes, bracelets and funerary bed legs.
- iv. Materials used in producing duck statuettes and applications were: wood, pottery, faience, ivory, schist, bronze, silver and gold.
- v. They considered the ibis as a sacred bird and authorized its existence in ancient Egypt since Naqada II-Naqada III Periods.
- vi. The authorized the ibis through different products such as: vessels, statues and statuettes.

- vii. They used a number of materials in producing ibis statues and applications such as: wood, breccias, limestone, bronze and glass.
- viii. They produced hen-shaped applications and figurines such as: jars, vessels, palettes and figurines.
- ix. They used local materials in producing hen-shaped applications such as: pottery, limestone and greywacke.

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