

Mechanical Engineering in Ancient Egypt, Part 42: Statues of Bull, Ibex, Ram and Snake

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Abstract— The production of statues and figurines for pull, ibex, ram and snake in ancient Egypt is investigated in the paper. Examples of each animal production is presented showing material, dimensions and present location if known. The impact of each example on the evolution of mechanical engineering in ancient Egypt is outlined. Sophisticated technologies applied in the production of the presented examples are stated.

Index Terms— Mechanical engineering history, ancient Egypt, bull-ibex- ram- snake statues.

I. INTRODUCTION

The ancient Egyptians had outstanding sympathy and appreciation to some animals such that they took them as deities. This action was authorized through paintings and sculptures through a long time of the ancient Egyptian history. This research paper is going to focus only on statues of bull, ibex, ram and snake.

Wassell (1991) in her Ph.D. Thesis about ancient Egypt fauna studied animals in ancient Egypt including sheep, goats, cattle, fish and birds [1]. Arnold (1995) in her research paper about Egyptian bestiary presented an antelope head from the 27th Dynasty, a faience ibex from the 18th Dynasty, an ibex from Late 18th Dynasty, dish in the shape of a fish from the 18th Dynasty, faience cobra head from Late 18th Dynasty, bull's leg from Early Dynastic and ivory bull from Late Period [2]. Conway (1998) in her book about animal magic outlines the position of bull in ancient Egypt and how it was related to Ptah and Osiris. About ram, she said that the sacred ram of Mendes was believed to embody the essences of Ra, Sheperes and Shu. About cobra, she said that the cobra image is known from the pictures of the ancient Egyptian crown where it was set over the forehead of the Pharaoh [3]. Collins (2002) in his book about history of the animal world in the ancient Near East studied the animals in the Egyptian art and hieroglyphs, in the Egyptian literature, in the Egyptian religion and the culture use of animals. He presented a complete chapter about animals in the Egyptian Art and hieroglyphs written by Patrick Houlihan [4].

Hardwick et. Al. (2003) presented a sackler gallery of the Egyptian antiquities in the Ashmolean Museum from the First Dynasty to the Byzantine Period. They presented a cosmotoc spoon in the shape of a fish, an Apis bull from the 26th Dynasty and a sacred bull from the Late Period [5]. Kalof

(2007) in her book about animals in human history presented some artifacts from the 5000 BC to 500 AC Period. This presentation included a bull's head from 2800 BC, a man carrying a calf from 575 BC and a horse statue from 140 BC [6]. Guichard (2015), the curator of an exhibition held during the period 5th December 2014 to 9th March 2015 presented some of the ancient Egyptian artifacts displayed in the exhibition. This presentation included: comb with ibex hand from the 18th Dynasty, ibex statue from the Late Period, frog figurine from the New Kingdom, ram's head from the 18th Dynasty, bull statue from the Late Period and a bull palette from Naqada II [7].

Seawright (2017) wrote an article about animals and gods in ancient Egypt. She stated that according to the belief of the ancient Egyptians, they considered some animals as deities such as baboon, cat, cattle, cobra, crocodile, frog, hippopotamus, ibis, jackal, lion, pig, ram, snake and turtle [8]. Hassaan (2017) in his series of research papers about mechanical engineering in ancient Egypt presented a study about some animals statues and figurines in ancient Egypt such as: cats, dogs and lions [9], jackal, hippopotamus and crocodile [10], gazelle, baboon and hedgehog [11].

II. BULL STATUES

The ancient Egyptians registered their intimate relationship with bulls in the form of figurines and statues since an early time through the time of Naqada I followed by most of the Dynastic Periods up to the Late Period of the ancient Egypt history. Here are some of the examples:

- The first example is an ivory comb with a bull handle from the time of Naqada I (4000-3500 BC) in display in the Louvre Museum at Paris and shown in Fig.1 [12]. This is a wonderful mechanical design of ancient Egyptians from more than 5500 years ago. All the surfaces are smooth and well filleted not to harm the user. Also, the horns make a loop with the bull body forming a ring to hang the comb. The dimensions are not given !!.



Fig.1 Ivory comb from Naqada I [12].

- The second example is an ivory bull's leg from the 1st Dynasty (2960-2770 BC) of 170 mm height in display in the Metropolitan Museum of Art at NY and shown in Fig.2 [13]. This furniture leg may be for a bed or a chair. The designer simulated the bull's leg because he knew that this design may carry a load of at least 1500 N which is more than enough for any bed where the factor of safety will be above 3. The simulated bull leg has a long roughened hoof, longitudinal veins and a pin for joining with the furniture frame.
- The third example is an ivory furniture leg in the shape of a bull's leg from the Early Dynastic Period (3100-2686 BC) in display in the Egyptian Museum at Cairo and shown in Fig.3 [14]. This design shows short roughened hoof, veins and bigger pin for joining with the furniture frame. In this design the mechanical engineer from more than 4700 years set this elaborated design for the leg to reduce the loading stresses in the leg compared with the design in Fig.2.

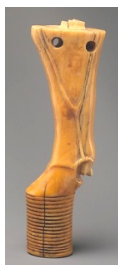


Fig.2 Furniture leg from 1st Dynasty [13].



Fig.3 Furniture leg from Early Dynastic [14].

- The fourth example is a bull head amulet from the 2nd Dynasty (2750-2649 BC) having a 32mm length in display in the Museum of Fine Art at Boston and shown in Fig.4 [15]. The eyes are marked in black as two concentric circles, the horns are shown as discs and the neck is recessed to hang the amulet.
- The fifth example is a wooden model for field ploughing using two bulls (or oxens) from the Middle Kingdom (2010-1961 BC) in display in the

Museum of Fine Arts at Boston and shown in Fig.5 [16]. The mechanical designer of the model used two bulls to increase the productivity of the ploughing process and one worker supporting the plough stem while one agriculture supervisor is supervising the ploughing process. This was one of the features of the ancient Egyptian civilization that helped them to build wonderful and successful civilization for thousands of years.



Fig.4 Bull head amulet from 2nd Dynasty [15].



Fig.5 Field ploughing from Middle Kingdom [16].

- The sixth example is a carnelian double headed bull amulet from Early 18th Dynasty in display in the Liverpool Museum at UK and shown in Fig.6 [17]. The designer marked the bull eyes in black. He used two heads to maintain keep the bull in a horizontal balance during use by maintain its balance around its center of mass. This is an innovative ancient Egyptian design from more than 3400 years.
- The seventh example is a bronze bull's head weight of 2 deben (181.4 g) from the 18th Dynasty (1550-1391 BC) in display in the Metropolitan Museum of Art and shown in Fig.7 [18]. This is a wonderful outstanding artifact produced by bronze casting in the 18th Dynasty. The finishing is perfect and the details of the face are very clear. The eyes may be inlaid. The flat horizontal neck-surface maintains the weight stable in a horizontal position.



Fig.6 Double bull head amulet from 18th Dynasty [17].



Fig.7 Bull head weight from the 18th Dynasty [18].

- The eighth example is a 115 mm length bronze bull statue from the 26th Dynasty (664-525 BC) sold in a Christies Sale in 25th October 2012 at London for 22,151 US\$ and shown in Fig.8 [19]. The designer showed the bull striding and could use the casting technology in ancient Egypt to produce such

complex shape with the head details (horns, ears, eyes etc.).

- The ninth example is a 205 mm height bronze bull from the 26th Dynasty (600 BC) in display in the British Museum and shown in Fig.9 [20]. The bull is shown carrying a solar disc between its horns, striding over a thick base. Again, this is a good example on the bronze casting technology during the Late Period of ancient Egypt.



Fig.8 Bronze bull statue from the 26th Dynasty [19].



Fig.9 Bronze bull statue from the 26th Dynasty [20].

- The 10th example is a 108 mm long wooden figurine of a bull from the Late Period (664-343 BC) sold by Christies in a Sale at NY on 5th June 2014 for 7500 US\$ and shown in Fig.10 [21]. The designer showed the bull standing on a base. Because wood is relatively a weak material, the designer used an innovative design idea to strengthen his product using a mechanical web underneath the bull between its body and the base. This was from about 2500 years ago. How great was the ancient Egyptian mechanical engineers. The hole in the bull's neck means that this artifact may be a large amulet in the form of necklace.
- The 11th and last example is a 178 mm height bronze bull from the Late Period (664-332 BC) in display in the Walters Art Museum and shown in Fig.11 [22]. This design has the same features as those in the designs presented in Figs.8 and 9.



Fig.10 Wooden bull statue from Late Period [21].

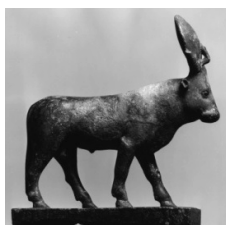


Fig.11 Bronze bull figurine from Late Period [22].

III. IBEX STATUES

Ancient Egyptians used the ibex as a symbol for strength and grace [23]. Its authority through statutory was authorized during a limited period from the 18th to the 21st Dynasties as depicted by the following nine examples:

- The first example is a 12 mm length faience figurine of an ibex from the 18th Dynasty (1550-1300 BC) in display in the Metropolitan Museum of Art and shown in Fig.12 [24]. The ancient Egyptian shaped this miniature figurine (12 mm length) either manually or using a mould. He could show all the ibex setting ibex in this very small space including the eyes, mouth, ears and horns.
- The second example is a 25.4 mm height quartz ibex figurine from reign of Amenhotep III, the 9th Pharaoh of the 18th Dynasty (1388-1350 BC) in display in the Metropolitan Museum of Art and shown in Fig.13 [24]. The designer showed the ibex setting and succeeded to give the head and back different color than the other parts of the ibex.



Fig.12 Faience ibex figurine from the 18th Dynasty [24]



Fig.13 Quartz ibex figurine from the 18th Dynasty [24].

- The third example is a wooden comb with ibex handle from the reign of Pharaoh Amenhotep III of the 18th Dynasty in display in Louvre Museum at Paris and shown in Fig.14 [25]. This is a wonderful artifact where the ancient Egyptian designer was succeeded to: select a proper material could sustain the environmental effects for more than 3350 years, simulate a beautiful ibex as a handle of the comb, set the ibex in a position giving enough height to catch easily the comb, smooth all the surfaces including the pins tips not to harm the user and set the comb pins on a circle-sector profile. The carving process of the wood was more than wonderful.
- The fourth example is an alabaster ibex of Tutankhamun, the 13th Pharaoh of the 18th Dynasty (1332-1319 BC) in display in the Egyptian Museum at Cairo and shown in Fig.15 [26]. This is a wonderful piece from the treasures of the young Pharaoh Tut. It was nicely carved from the alabaster stone, could show the details of the horn, ears, eyes, mouth, tail and hoofs. The horn, ears, eyes, mouth and hoofs are all shown in black color through inlay. The designer showed the ibex setting on a base and it seems that this is a jar or vase with its inlet-hole in the middle of the ibex-back. The cartouche of the king was inlaid on the shoulder of the ibex.



Fig.14 Comb with ibex handle from the 18th Dynasty [25]

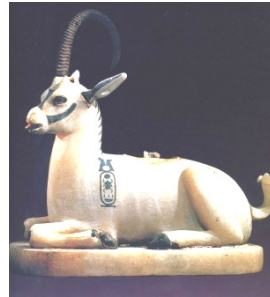


Fig.15 Alabaster ibex statue from the 18th Dynasty [26].

- The fifth example is blue ibex head from the 18th Dynasty in display in the Museum of Fine Art at Boston and shown in Fig.16 [27]. Most probably, this is a faience product and may be subjected to conservation leaving the different color tracing on the head and neck.
- The sixth example is a 320 mm height bronze ibex head casted in 1000 BC during the 21st Dynasty of the Third Intermediate Period in display in the Neues Museum at Berlin and shown in Fig.17 [28]. The eyes are inlaid in two colors (after casting or through the casting process). This is a difficult piece to cast because of the too many details of the horns, ears, beard and rough surfaces of the horns and neck. But the ancient mechanical engineers did it with their available casting technology.



Fig.16 Blue ibex head from the 18th Dynasty [27]



Fig.17 Bronze ibex head from the 21st Dynasty [28].

IV. RAM STATUES

The ancient Egyptians appreciated the ram animal to the extend to worship from as early the Predynastic Period [29]. Statues manifesting this appreciation are concentrated in the Third Intermediate and Late Periods as depicted in the

following examples:

- The first example is a 158 mm height bronze ram head from the Third Intermediate Period (1070-664 BC) in display in the Metropolitan Museum of Art and shown in Fig.18 [30]. There is an inlay around the eyes and the designed could show a small beard under the ram's chin.
- The second example is Ram's head amulet from Memphis during the 25th Dynasty of the Third Intermediate Period (775-653 BC) in display in the Brooklyn Museum and shown in Fig.19 [31]. The ram head was carved from jasper and other black material. Then designer shoed the ram with long horns and with two cobra on its forehead. The surface of the head is very smooth and shining.



Fig.18 Ram's head from the 3rd Intermediate Period [30]



Fig.19 Jasper ram's head from the 25th Dynasty [31].

- The third example is a golden ram's head from the 25th Dynasty (770-657 BC) of 42 mm height in display in the Metropolitan Museum of Art and shown in Fig.20 [32]. The designer showed the two horns turned behind the ears taking the shape of a question mark and one cobra on the forehead of the ram. The horns are corrugated and the cobra is exactly in between. Definitely this piece was manufactured using the casting process. To build a mold for such a complex design, it is not something easy. However the ancient Egyptian Engineer did it more than 2660 years ago.
- The fourth example is a wooden ram's head from the 25th Dynasty (760-660 BC) in display in the Museum of Fine Art at Boston and shown in Fig.21[33].



Fig.20 Golden ram's head from The 25th Dynasty [32]



Fig.21 Wooden ram's head from the 25th Dynasty [33].

This example reflects the intelligence of the ancient Egyptian artist depicting his ability to use cheap material (here wood) to produce difficult pieces with high quality and sustaining the environmental effects for thousands of years.



- The fifth example is a granite ram statue protecting Taharqa, the 4th Pharaoh of the 25th Dynasty (690-664 BC) in display in the British Museum and shown in Fig.22 [34]. The designer showed the ram setting on all its legs with Pharaoh Taharqa between its front legs and under its chin as a symbol for protection (as they believed). Using the hard stone granite the ancient Egyptian carver could produce such a complex design easily including the Pharaoh statue. The dimensions are not given !.



Fig.22 Granite ram's statue protecting Taharqa [34].

- The sixth example is a 145 mm clay ram's head from the 27th Dynasty of the Late Period (500 BC) and shown in Fig.23 [35]. This another example of using available cheap raw materials in manufacturing magnificent products such this one having all the details of the ram's head in a highly professional manner.



Fig.23 Clay ram's head from the 27th Dynasty [35].

V. SNAKE STATUES

The ancient Egyptians used the cobra from the earliest records as the patron and protector of the country, all the other deities and pharaohs (as they believed) [36]. They had a great appreciation to the snake through using its figurines and statues in different ways as will be illustrated in the

following examples starting from Naqada II of the Predynastic Period to the 21st Dynasty of the Third Intermediate Period:

- The first example is a clay snake figurine from Naqada II (4000-3500BC) shown in Fig.24 [37]. The ancient Egyptian designer made a disc-shaped base to support three snake figurines. One of them is absent. Its location indicates the design philosophy of the designer to produce the three snakes separately and then assemble them on the base. Outstanding design philosophy of the Egyptian mechanical engineer from more than 5500 years ago. Unfortunately, a lot of data about the unit are missing. Most probably, it is not located in the Egyptian Museum at Cairo. It may be in display in Petrie Museum at UK !!.



Fig.24 Clay snake figurine from Naqada II [37].

- The second example is a cobra figurines in the step pyramid at Saqqara of Egypt built by the architect-engineer Imhotep for King Zoser, the founder of the 3rd Dynasty (2667-2648 BC) shown in Fig.25 [38]. On this side of a specially prepared structure, Imhotep showed six cobra-stone statues raising their heads and looking forward, marking clearly their eyes as if they are ready to protect the site of the King's pyramid.



Fig.25 Cobra statues near the step pyramid of Zoser [38].

- The third example is a cobra figurine on the forehead of King Mentuhotep II, the 5th King of the 11th Dynasty of the Middle Kingdom in Deir el-Bahri of Egypt shown in Fig.26 [39]. This is a painted wall carving in the King's temple with the cobra exactly in the middle of the King's forehead.
- The fourth example is a statue of Neferhotep I. the 25th King of the 13th Dynasty of the Second Intermediate Period in display in the Archaeological Museum of Bologna, Italy and shown in Fig.27 [40, 41]. It was carved from the relatively hard stone, micrognauro and has a height of 350 mm [41]. The King is wearing the Nemes headdress with the cobra in the middle of his forehead.

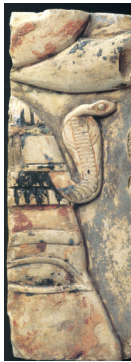


Fig.26 King Mentuhotep II
From 11th Dynasty [39]



Fig.27 King Neferhotep I from
from 13th Dynasty [40].

- The fifth example is a 90 mm height bronze cobra figurine from Thebes of ancient Egypt manufactured during the 17th Dynasty of the Second Intermediate Period (1640-1600 BC) in display in the Metropolitan Museum of Art and shown in Fig.28 [42]. This is another good example on the high technology of bronze casting in ancient Egypt. The head is looking forward and the tail is in its back and making a loop.
- The sixth example is a statue for Amenhotep II, the 7th Pharaoh of the 18th Dynasty of the New Kingdom (1425-1398 BC) in display in Kimbell Art Museum at Texas and shown in Fig.29 [43].



Fig.28 Bronze cobra from
the 17th Dynasty [42]



Fig.29 Amenhotep II statue
from 18th Dynasty [43].

The Pharaoh statue was carved from red granite and has a 1.03 m height. He is wearing the White Crown of Upper Egypt with cobra on the forehead of the crown.

- The seventh example is a head of Amenhotep III, the 9th Pharaoh of the 18th Dynasty (1388-1350 BC) in display in the Neues Museum at Berlin and shown in Fig.30 [44]. The Pharaoh is wearing the Nemes headdress and the Double Crown of Egypt with the cobra in the middle of the Nemes forehead.
- The eighth example is a 4 m height sandstone colossal statue for Akhenaten, the 10th Pharaoh of the 18th Dynasty (1351-1334 BC) in display in the Egyptian Museum at Cairo and shown in Fig.31 [45]. The designer showed the Pharaoh wearing a Khat and the Double Crown of Egypt with cobra on middle of the Pharaoh forehead above the Khat.



Fig.30 Statue of Amenhotep III
from the 18th Dynasty [44]



Fig.31 Akhenaten statue
from 18th Dynasty [45].

- The ninth example is a guardian Ka statue of Tutankhamun, the 13th Pharaoh of the 18th Dynasty (1332-1323 BC) in display in the Egyptian Museum at Cairo and shown in Fig.32 [46]. The designer showed the Pharaoh wearing a Nemes headdress with a big cobra on his forehead above the Nemes.
- The tenth example is a colossal statue for Meritamen, daughter and Great Royal Wife of Ramses II, the 3rd Pharaoh of the 19th Dynasty (1297-1213 BC) in display in Akhmim of Egypt and shown in Fig.33 [47]. This is a unique design utilizing the cobra in the Queen's Crown. The designer filled the whole collar of the crown with cobras over the whole circumference adjacent each other with small gap between them.



Fig.32 Statue of Tutankhamun

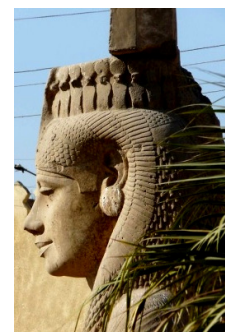


Fig.33 Meritamen statue

from the 18th Dynasty [46] from 19th Dynasty [47].

- The eleventh example is a statue for Seti II, the 5th Pharaoh of the 19th Dynasty (1203-1197 BC) in display in the Egyptian Museum at Turin and shown in Fig.34 [48]. The Pharaoh was shown wearing a Khat and one of the Crowns of ancient Egypt. The cobra was located in its classical position on the forehead of the Pharaoh over the Khat.
- The twelfth example is a golden mask for Psusennes I, the 3rd Pharaoh of the 21st Dynasty (1001-992 BC) in display in the Egyptian Museum at Cairo and shown in Fig.35 [49]. The designer showed the Pharaoh wearing a Nemes headdress with cobra on his forehead above the headdress.

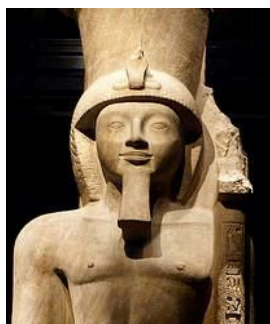


Fig.34 Statue of Seti II from the 19th Dynasty [48]



Fig.35 Psusennes I mask from 21st Dynasty [49].

VI. CONCLUSION

- The production of bull, ibex, ram and snake in ancient Egypt was investigated.
- This investigation covered a time span from Naqada I of the Predynastic Period to the 21st Dynasty of the Third Intermediate Period.
- The ancient Egyptians simulated some products to take the shape of a bull since very early times. This included a comb handle (Naqada I), a furniture leg (Early Dynastic) and amulets (2nd Dynasty). They produced ploughing models powered by bulls during the Middle Kingdom.
- They invented a double-bull-head amulets and a bull-head weight in the 18th Dynasty
- They produced bronze bull statues during the 18th, 19th and 22nd Dynasties.
- They produced wooden bull statues during the Late Period.
- They could produce a miniature figurines of a faience and quartz ibex in the 18th Dynasty.
- They produced wonderful alabaster ibex for Pharaoh Tutankhamun during the 18th Dynasty.
- They casted a complex bronze ibex head in the 21st Dynasty.
- They produced ram's heads and full ram statues during the Third Intermediate and Late Periods.

- They produced snake figurines since the time of Naqada II.
- They produced colossal cobra statues in the pyramid complex of King Zoser of the 3rd Dynasty.
- Since the Middle Kingdom most Kings and Pharaohs used the cobra as a protecting symbol set on their forehead above the headdress or crown.
- This action was practiced by Mentuhotep II (11th Dynasty), Neferhotep I (13th Dynasty), Amenhotep II (18th Dynasty), Amenhotep III (18th Dynasty), Tutankhamun (18th Dynasty), Seti II (19th Dynasty) and Psusennes I (21st Dynasty).

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