Mechanical Engineering in Ancient Egypt, Part XXX: Mummy Masks Industry

Galal Ali Hassaan
Emeritus Professor, Department of Mechanical Design Production,
Faculty of Engineering, Cairo University, Egypt

Abstract—The ancient Egyptians started to manufacture mummy masks from the Old Kingdom onward. The development of mummy masks in ancient Egypt is investigated during a time span from Old Kingdom to Late Period. Samples of mummy masks during each period are presented and described pointing out their material and present location if known. The characteristics of each design are outlined showing the sophistication and glory of mechanical engineering during this era of the human being in general.

Keywords—Mechanical engineering; Ancient Egypt; Masks industry.

I. INTRODUCTION

This is the 30th paper in a scientific research aiming at presenting a deep insight into the history of mechanical engineering during one of the greatest civilizations in the world, the ancient Egyptians civilization. The paper handles one of the funerary practices practiced by ancient Egyptians during the Dynastic Periods of their history. That is the masks industry.

Furlonger (1998) considered the uses of the mask in ritual and theatre. She referred to masks used in death and burial with examples from Egyptian and Roman death masks including the mask of Pharaoh Tutankhamun of the 18th Egyptian Dynasty [1]. Bard (2007) wrote a book about the archaeology of ancient Egypt covering historical periods from Predynastic to Greco-Roman Periods. One of the illustrations she presented was the mask of Pharaoh Tutankhamun [2]. Pancaldo and Aboe (2010) described the ancient Egyptian cartonnage as a material made from layers of linen and papyrus coated with gesso, then painted and used for mask production and other funerary activities. They stated that cartonnage was used in Egypt in the Middle Kingdom, Third Intermediate, Ptolemaic and Roman Periods. They presented some mummy masks in display in Petrie Museum of UK from Middle Kingdom, Ptolemaic and Roman Periods [3].

Fernandez (2014) stated that the Egyptian funerary masks are important as an element by means of which evidences regarding the identity of their holders can be traced. He presented a number of masks in display in the National Museum of Antiquities at Leiden [4]. Wikipedia (2016) wrote an article about Pharaoh Tutankhamun golden mask in display in the Egyptian Museum at Cairo. They described its journey from the Pharaoh's tomb to the Egyptian Museum [5].

II. THE OLD KINGDOM

The Old Kingdom of ancient Egypt comprises from the 3rd to the 6th Dynasties over a time span from 2686 to 2181 BC [6]. There is a mummy mask of a man produced in the Old Kingdom from plaster in display in the Brooklyn Museum at NY and shown in Fig.1 [7]. The ancient Egyptian plaster is manufactured from calcium carbonate with clays, sand, and small amounts of anhydrite [8]. The mask is very primitive compared to the elaborated designed practiced in the other coming periods.
III. FIRST INTERMEDIATE PERIOD

The First Intermediate Period of Egypt ancient history comprises the 7th to 9th Dynasties over a time period from 2181 to 2055 BC [9]. Some of the mummy masks judging the evolution of masks industry in the First Intermediate Period of Egypt are presented below:

- Fig. 2 shows a mummy mask for Priest Henchef-Hotep who served in the temple of King Niuserre at Abusir (2216-2025 BC) in display in the Egyptian Museum of the University of Leipzig of Germany [10]. The mask was most probably manufactured from cartonnage extensively coloured showing the details of the face of the priest and his headdress and pectoral. The priest had a moustache and a short beard with a long front-tip. This is the first elaborated design of a mummy mask during the dynastic periods of ancient Egypt produced more than 4100 years ago.

- The second example of mummy masks from the First Intermediate Period is from Sedment of Egypt. They are two mummy masks of unknown material and location shown in Fig. 3 [11]. The two masks may be one for a man (to the left) and one for a woman (to the right). The man has a headdress and pectoral, while the woman had only a pectoral and minor effects on her head. The unknown identity and provenance of the masks may be for the un-authorized excavations by tombs robbery going on day and night in Egypt !!.

Fig. 1 Mummy mask from the Old Kingdom [7].

Fig. 2 Mummy mask of Herishef-Hotep from First Intermediate Period [10].

Fig. 3 Two mummy masks from the First Intermediate Period [11].
IV. MIDDLE KINGDOM

The Middle Kingdom of ancient Egypt comprises the 11th and 12th Dynasties over a time span from 2000 to 1700 BC [12]. We have four examples of mummy masks from the Middle Kingdom outlining the evolution of masks industry during this period.

- The first example is for a prince from the 11th Dynasty found at Asuit of Egypt and shown in Fig.4 [13]. The mask is manufactured from cartonnage painted to demonstrate the prince face, Nemes headdress, diadem and pectoral. The prince had a moustache and a short beard like too many Egyptians nowadays.

- The second example of mummy masks from the Middle Kingdom is from Late 11th/Early 12th Dynasties for a High Official (2000-1980 BC) shown in Fig.5 [14]. It is of the same design school as that in Fig.4 but with elaborated coloured pectoral.

Fig.4 Mummy mask of a prince from the 11th Dynasty [13]. Fig.5 Mummy mask of a High Official from the 11th/12th Dynasties [14].

- The third example from the Middle Kingdom is for an unknown lady in display in the Brooklyn Museum of NY and shown in Fig.6 [15]. It is manufactured from cartonnage and coloured to simulate the lady face nicely and accurately showing her coloured headdress.

- The fourth and last example of mummy masks during the Middle Kingdom is for an unknown man shown in Fig.7 [16]. It is of the same design stile of the other examples of the same period. Again, a lot of data are missing because most probably those artefacts are sold by tombs robberies. The moustache and beard demonstrates the fable of the Asiatic Hyksos effect on the art during the Middle Kingdom [16].
V. SECOND INTERMEDIATE PERIOD

This period comprises the ancient Egyptian Dynasties from 13th to 17th over a time span from 1802 to 1550 BC [16]. There is one example of mummy masks during this period of ancient Egypt history. It is for Queen Satdjehuty, wife of King Seqenenre Tao of the 17th Dynasty and mother of Princess Ahmose [17]. The mask is in display in the British Museum and shown in Fig.8 [18]. It is manufactured from cartonnage and decorated by gold leafs on her face, headdress and necklace [19].

VI. NEW KINGDOM

The new kingdom of ancient Egypt comprises the Dynasties from the 18th to the 20th over a time span from 1069 to 1570 BC [20]. This is the most powerful and wealthy period in
Egypt ancient History. Therefore, we expect great development of the mummy masks industry during this period as will be illustrated in the following presentations:

18th Dynasty:

- Fig.8 shows a mummy mask of a young woman from the 18th Dynasty (1570-1300 BC) displayed by the Virtual Egyptian Museum [21]. It is manufactured from cartonnage and has an overall height of 0.66 m. The mask presents the woman having a serious pose, wide eyes and wearing a Nemes headdress.

- The second example of mummy masks of the 18th Dynasty is for a man (1550-1295 BC) shown in Fig.10 [22]. It has a neat design with very quite face, nice Nemes headdress and elaborated multi-coloured pectoral. The painting is still excellent and shining after more than 3300 years.

- The third mummy mask example is for Hatnefer, mother of Senmut the State Official during the rein of Pharaoh Hatshepsut who lived during the reign of Pharaoh Thutmose II, the 4th Pharaoh of the 18th Dynasty (1492-1473 BC). It is in display in the Metropolitan Museum of Art at NY and shown in Fig.11. It is manufactured from cartonnage, gold leafs, alabaster, obsidian and ebony. [23].

- The fourth example of mummy masks in the 18th Dynasty is manufactured from incrusted wood and in display in the Louvre Museum at Paris and shown in Fig.12 [24]. Even, the mask is manufactured from a brittle material such as wood, the ancient Egyptian artist could simulate the decease face accurately and indicatively. The mask is coloured with brown-yellow, blue and black paints.
- The fifth mummy mask example is for Merit, wife of the architect Kha who was in service during the reigns of Pharaohs Tuthmosis III, Amenhotep II, Tuthmosis IV and Amenhotep III (1479-1388 BC). Her mask is in display in the Egyptian Museum at Turin and shown in Fig. 13 [25], [26]. It is manufactured from linen cartonnage stuccoed and covered with gold leaf and inlaid with semi-precious stones and glass [27].

- The sixth example is for Courtier Yuya (1390 BC) father of Queen Tiye the Great Royal Wife of Pharaoh Amenhotep III in display in the Egyptian Museum at Cairo and shown in Fig. 14 [28]. It is manufactured from gilded cartonnage [29] where gold leafs are used to cover the cartonnage and semi-precious stones may be used to make the eyes and the eyebrows.

- The seventh example of mummy masks in the 18th Dynasty belongs to Tuya, wife of Yuya, singer of Hathor, mother of Queen Tiye and grandmother of Pharaoh Akhenaten. Her mummy mask is in display in the Egyptian Museum at Cairo and shown in Fig. 15 [30]. It is manufactured from gilded cartonnage and highly decorated through its Nemes headdress and pectoral using vitreous pastes, gold leaf and alabaster [31].

- The last example from the 18th Dynasty belongs to the young Pharaoh Tutankhamun, the 13th Pharaoh. His mask represents the top technology in the production of mummy masks. It is in display in the Egyptian Museum of Cairo and shown in Fig. 16 [32]. It has an overall mass of 10 kg and overall height of 0.54 m. It is manufactured mainly from gold inlaid with semi-precious stones and coloured glass paste. The eyes are produced from obsidian and quartz. The artist showed the Pharaoh with long beard and wearing his Nemes headdress with cobra and vulture on its front, large pectoral
and holding the crook and flail symbols in his hands [33]. The decorations of all the elements of the mask are extremely marvellous indicating the high technology of ancient Egyptians in this mechanical engineering aspect without computers or CNC machines.

Fig.15 Mummy mask of Tuya [30]. Fig.16 Tutankhamun mask [32].

19th Dynasty:
- The first example of mummy masks during the 19th Dynasty is for a Queen from the rein of Pharaoh Ramses II about 1200 BC shown in Fig.17 [34]. It is manufactured from wood and the yellow colour may indicate that it is gilded by gold leafs. It shows the Queen wearing an elaborated headdress of various carved decorations.
- The second example is a mummy mask for Karnefernefer from the 19th Dynasty (1295-1187 BC) in display in the St Louis Art Museum at Missouri and shown in Fig.18 [35]. It has an elaborated design manufactured from plaster, linen, resin, glass, wood, gold, and pigment. The mask shows its owner wearing a decorated Nemes headdress and a well decorated pectoral.

Fig.17 Mummy mask of a Queen from the 19th Dynasty [34]. Fig.18 Mummy mask of a lady from the 19th Dynasty [35].

- The third example from the 19th Dynasty is a wooden mummy mask from the period 1295-1187 BC shown in Fig.19 [36]. It is manufactured from wood showing the man
with a thin long beard and wearing a cap headdress of elaborated decorations of various colours. The main items in the decoration scheme are three large lotus blossoms suspended upside down from the first fillet just above the horizontal striations [36]. The decease face is wonderfully and accurately carved on wood as if it is produced by a CNC cutting machine.

- The fourth and last example from the 19th Dynasty is for a noble man manufactured from a painted wood in display in the Metropolitan Museum of Art and shown in Fig.20 [37]. He is wearing a Nemes headdress of various decorations.

Fig.19 Mummy mask of a man from the 19th Dynasty [36].

Fig.20 Mummy mask of a lady from the 19th Dynasty [37].

20th Dynasty:
- We have two example of mummy masks of the 20th Dynasty. The first one is a wooden mask from the end of the dynasty from the collection of Charles Pankaw (USA) shown in Fig.21 [38].
- The second example is a mummy mask from the 19th Dynasty in display in the Fitzwilliam Museum at UK and shown in Fig.22 [39].

Fig.21 Mummy mask of a man from the 20th Dynasty [38].

Fig.22 Mummy mask of a lady from the 20th Dynasty [39].

VII. THIRD INTERMEDIATE PERIOD
The Third Intermediate Period covers the Dynasties from the 21st to the 25th over a time span from 1070 to 664 BC [40]. The development of mummy masks during this period is investigated through the following illustrations:

21st Dynasty:
- Fig.23 shows the mummy mask of Pharaoh Psusennes I, the 4th Pharaoh of the 21st Dynasty in display in the Egyptian Museum at Cairo [41]. It is manufactured from solid gold (either by carving or casting .. more research is required in this aspect). The Pharaoh is displayed with long thin beard, Nemes headdress and large pectoral.
- The second example from the 21st Dynasty is for Pharaoh Amenemope, the 5th Pharaoh of the dynasty. His mask is shown in Fig.24 which is manufactured from bronze inlaid by gold leaf [42]. Both Pharaohs Psusennes and Amenemope are wearing the Nemes headdress with more decoration schemes for Psusennes. He is displayed without beard and with small pectoral relative to that of Psusennes.

![Fig.23 Mummy mask of Psusennes I from the 21st Dynasty [41].](image)

![Fig.24 Mummy mask of Amenemope from the 21st Dynasty [42].](image)

- The third example of mummy masks in the 21st Dynasty is for a Queen displayed by the Virtual Egyptian Museum and shown in Fig.25 [43]. It is manufactured from a gilded cartonnage and extensively decorated by different scenes on her long Nemes headdress and extremely large pectoral.
- The fourth example is a mummy mask for General Wendjebauendjed, General and High Priest during the reign of Pharaoh Psusennes I in display in the Egyptian Museum at Cairo and shown in Fig.26 [44]. It is manufactured from gold and has a wonderful clear appearance of this important high official man.

![Fig.25 Mummy mask of a Queen](image)

![Fig.26 Mummy mask of Wendjebauendjed](image)
from the 21\textsuperscript{st} Dynasty [43]. from the 21\textsuperscript{st} Dynasty [44].

22\textsuperscript{nd} Dynasty:

- Fig.27 shows the gold funerary mask of Pharaoh Shoshenq II, the 3\textsuperscript{rd} Pharaoh of the 22\textsuperscript{nd} Dynasty (887-552 BC) in display in the Egyptian Museum at Cairo [45]. It is manufactured from thick gold sheet through hammering with glass paste for eyes and eyebrows with overall length of 260 mm [46].
- The second example of mummy masks in the 22\textsuperscript{nd} Dynasty is wooden mummy mask from Early 22\textsuperscript{nd} Dynasty (1075-716 BC) shown in Fig.28 [47]. The wood is carved to take the shape of the decease wearing a cap headdress.

25\textsuperscript{th} Dynasty:

- Fig.29 shows a wooden mummy mask from Late 25\textsuperscript{th} Dynasty (750-600 BC) [48]. The decease is wearing a cap headdress with eyes and eyebrows outlined using a black paste. This mask has an overall length of 332 mm and was sold in sale 9438 at NY in December 2015 for 1.45 million US $ [48].
- The last example from Early 25\textsuperscript{th} Dynasty is again a wooden mummy mask shown in Fig.30 [49]. The decease is wearing a cap headdress with horizontal bands. This mask was sold in 2013 for 52500 US $ [49].
VIII. LATE PERIOD

The Late Period comprises the 26th to 31st Dynasties of ancient Egypt over a time span from 664 to 332 BC [50]. The development of the mummy masks industry during this period will be investigated through the study of six masks as follows:

- Fig. 31 shows a wooden mummy mask from the 26th Dynasty of Egypt (664-525 BC) sold in a sale in NY for 36000 US $ [51]. Its overall length is 476 mm and its eyes and eyebrows are inlaid using bronze [51].
- The second example of mummy masks in the Late Period is a faience beaded mummy mask in display in Liverpool Museum of UK and shown in Fig.32 [52]. It is assembled from red, black, green and yellow beads and has an overall length of 285 mm. This is the first time for the ancient Egyptians to use faience beads in producing mummy masks. Much better faience beads mask from the same period is shown in Fig.33 [53]. It is manufactured from green, white and black beads producing a clear view for the decease face.
- The third example is a golden mummy mask from the Late Period (712-332 BC) in display in the National Museum of Warsaw and shown in Fig.34 [54]. The gold leaves are supported by plaster on canvas and the overall length of the mask is 280 mm. The mask shows the decease wearing a Nemes headdress and a pectoral.

Fig. 31 Wooden mummy mask from the 26th Dynasty [51].

Fig. 32 Faience beads mummy mask from Late Period [52].

Fig. 33 Faience beaded mummy mask From Late Period [53].

Fig. 34 Golden mummy mask from Late Period [54].
- The fourth example is a gilt cartonnage mummy mask with estimated sale price in 2014 of 1877 to 2500 US $ which is shown in Fig.35 [55]. The cartonnage is covered by gesso then decorated by gilding. The decease is shown wearing a Nemes headdress decorated by yellow thin strips. The overall length is 340 mm.
- The last example is a silver gilt mask from the 30\textsuperscript{th} Dynasty (380-343 BC) in display in the Colouste Gulbenkian Museum at Lisbon, Portugal shown in Fig.36 [56]. The mask shows the decease wearing a Nemes headdress without any decorations.

![Gilt cartonnage mummy mask](image1)
![Silver gilt mummy mask](image2)

**Fig.35** Gilt cartonnage mummy mask from Late Period [55].
**Fig.34** Silver gilt mummy mask from Late Period [56].

**CONCLUSIONS**

- The evolution of mechanical engineering in ancient Egypt through the study of the mummy masks industry was investigated.
- The characteristics of the ancient Egyptian mummy masks were presented.
- Samples of the ancient Egypt mummy masks were presented from the collections of national and international museums and also through some of them sold in sales in USA and UK.
- The study covered ancient Egyptian historical periods from the Old Kingdom to the Late Period.
- The first use of mummy masks appeared during the Old Kingdom of ancient Egypt.
- Elaborated designs of mummy masks started to appear during the First Intermediate Period more than 4100 years ago.
- They used plaster in manufacturing mummy masks in the Old Kingdom.
- They used cartonnage in manufacturing mummy masks in the First Intermediate Period.
- They produced mummy masks representing male Egyptians with moustache and beard only during the Middle Kingdom.
- They continued to use cartonnage during the Middle Kingdom, Second Intermediate Period, New Kingdom and Late Period.
- Mummy masks with pectorals were designed and produced starting from the First Intermediate Period and continued up to the Late Period.
- Gilded mummy masks with gold leafs started to appear from the 17th Dynasty onwards and continued up to the 22nd Dynasty.
- They used semi-precious stones in decorating some of their mummy masks.
- They used various materials in manufacturing their mummy masks such as: plaster, cartonnage, wood, gold, silver, bronze and faience.
- Wood mummy masks started in the 18th Dynasty and continued through the 19th, 20th, 22nd, 25th and 30th Dynasties.
- They used bronze in producing mummy masks during the 21st Dynasty.
- Mummy masks were designed with Cap and Nemes headdresses.
- They used faience beads during the Late Period to produce some of their mummy masks.
- They used silver gilt during the Late Period in the same time of using gold gilt.

REFERENCES


Culture


[34] Solarey, "Egyptian mummy mask for a Queen from the 19th Dynasty", http://solarey.net/egyptian-mummy-mask-of-a-queen/


BIOGRAPHY
Galal Ali Hassaan:
- Emeritus Professor of System Dynamics and Automatic Control.
- 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 190 research papers in international journals and conferences.
- Author of books on Experimental Systems Control, Experimental Vibrations and Evolution of Mechanical Engineering.
- Member of the Editorial Board of a number of International Journals including IJAETMAS.
- Reviewer in some international journals.
- Scholars interested in the author’s publications can visit: http://scholar.cu.edu.eg/galal