Mechanical Engineering in Ancient Egypt, Part XXVIII: Wooden Coffins Industry

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ABSTRACT: The objective of this paper is to investigate the development of mechanical engineering in ancient Egypt through wooden coffins industry in the dynastic periods. This study covers the design and manufacturing of wooden coffins in dynasties from the 2nd up to the 27th dynasties showing the type and characteristics of each coffin. The decoration and inscriptions of the wooden coffins in the different ages were highlighted.

Keywords – Mechanical engineering history, wooden coffins, dynastic periods.

I. INTRODUCTION
Ancient Egyptians experienced an outstanding mechanical engineering technology accumulated through thousands of years. The ancient Egyptian mechanical technology left amazing products and establishments survived for thousands of years. This is the 28th part in a research papers series aiming at exploring the evolution of mechanical engineering in ancient Egypt. It handles one of the fascinating products of ancient Egypt, the wooden coffin as a funerary product.

Johnson, Head and Green (1995) described the conservation of an ancient Egyptian polychrome wooden coffin dated 960-900 BC. They presented a qualitative analysis of the selection of materials from the coffin [1]. El-Hadidi (1998) stated that preserving the wood as it represents one of the main archaeological and antiquity items that left behind over the different historical eras. The aim of her research study was to find and apply suitable conservation techniques for two wooden coffins at the Egyptian Museum at the Faculty of Archaeology of Cairo University [2]. The Education Division of the National Gallery of Art at Washington (2002) issued a volume about the treasures of ancient Egypt. This volume included describing the coffin of Isis-em-akhibit and sarcophagus of Khonsu [3]. Andelkovic and Amoros (2005) studied the construction and wood identification of Nesmin coffin from the early Ptolemaic Period. They analysed the coffin lid, trough, tenon and peg. They discussed the coffin construction, decoration techniques and use of Tamarix wood in ancient Egypt [4]. Grajetzki (2006) investigated a coffin model of Teti from the Second Intermediate Period and in display in the British Museum. It is a wooden decorated coffin having a box and a lid. He studied all the inscriptions on the model and its various dimensions [5]. Coony (2007) presented a contextual approach to Egyptian funerary materialism. She considered a case study of funerary material, particularly coffins of the Ramesside Period and the 21st Dynasty. She stated that funerary objects, especially coffins were multifunctional, holding social economic and ideological meanings [6]. Lacovara (2007) studied fragment of rishi type coffin extracted in Giza and in display now in the Museum of Fine Arts at Boston and dated to the early 18th Dynasty [7]. Cooney (2012) worked on Theban 21st Dynasty coffins in museums with Egyptian collections: Italy including the Museo Egizio in Turin, the Museo Archaeologico in Florence, the Vatican collections in Rome and the Museo dell’ Accademia in Cortona. She examined more than 35 coffin sets and concluded that some coffins seem to have been used two or three times [8]. Bartos (2014) showed through the analysis of the excavated coffins from Tomb TT65 at Sheikh Abdel-Gurna examples of the reuse of the originally 18th Dynasty tomb during the whole Third Intermediate Period [9]. Bettum (2014) demonstrated the use of the nesting principle in in various contexts and explored the implications of nesting to coffin decoration, funerary rituals and the mythical environment of the Netherworld [10]. Mann (2015) studied four coffin sets from Bab el-Gasus cache of Egypt and now belonging to the collection of the Rijks Museum in Leiden. He looked for the construction techniques used, materials used, signature of the production workshop or artist and the features of the coffins [11]. Dodson (2015) stated that collection in the Medallhavsmuseet included coffins covering two millennia from the end of the First Intermediate Period to the Ptolemaic Period. During this time span, coffins transformed from simple decorated boxes to elaborately painted cases taking the shape...
of the mummy with a series nested within each other (in some cases) [12].

II. EARLY DYNASTIC PERIOD
The 18th dynasty had pioneers in all aspects of this period. The 1st and 2nd Dynasties over the time span 3100-2686 BC [13]. According to the University College London, elite burial of ancient Egyptians during the Early Dynastic Period was in wooden coffins such that shown in Fig.1 [14]. The trough takes the shape of a parallelogram and the lid has a domed shape and flat sides at its ends. The trough surface is not flat and there no clear decoration or inscriptions.

III. OLD KINGDOM
The Old Kingdom of ancient Egypt covers the 3rd to 6th Dynasties over a time span 2686 to 2181 BC [15]. According to the University College London, the box type coffin continued to be in use up to the end of the Old Kingdom [16]. In the 6th Dynasty, a standard box-type coffin was developed with two eyes symbol and one line of inscriptions as shown in Fig.2 from Tomb 421 at Sedment of Egypt [16].

IV. FIRST INTERMEDIATE PERIOD
The First Intermediate Period of ancient Egypt covers from the 7th Dynasty to the 9th Dynasty over the time span from 2181 to 2055 BC [17]. We have two examples of wooden coffins in this period detailed as follows:

- Fig.3 shows wooden coffin of Menkabu (2140-204BC) from the 9th - 10th Dynasties as displayed in the Fine Museum of Art at Boston [18]. It is of the classical coffin design practiced in the Old Kingdom with flat cover. The wood is covers by stucco and painted in brown with a longitudinal band including the inscriptions and two eyes under the right corner of the band. The inscriptions are neat and colored. The two eyes represent a crying human looking to the future coming in the afterlife. The coffin length is 1.95 m.

- The second example from the First Intermediate Period is a wooden coffin of the Commander and Scribe Ipi-ha-ishutef (2064 BC) found at Saqqara and in display in the Oriental Institute Museum at Chicago and shown in Fig.4 [19]. It is of the parallelogram design. The two eyes little bit below the inscriptions band, closer to the vertical centerline of the coffin.

V. MIDDLE KINGDOM
The Middle Kingdom of ancient Egypt covers the 11th and 12th Dynasties during a time span from 2000 to 1700BC [20]. The development of wooden coffins during this rich period will be illustrated through the presentation of six coffins from both dynasties 11 and 12.

- The first example of wooden coffins from the Middle Kingdom is for a child called
Myt from the 11th Dynasty (2051-2030 BC) during the reign of King Mentuhotep II in display in the Metropolitan Museum of Art at NY and shown in Fig.5 [21]. It is of the standard parallelogram type with flat lid, horizontal band for inscriptions and two eyes sign under the left end of the band. The inscriptions and eyes sign are written with light-blue painting. The coffin length is 1.95 m.

Fig.5 Coffin of Myt from the 11th Dynasty [21].

The second example of wooden coffins is from late 11th Dynasty-early 12th Dynasty (2010-1961 BC) belongs to Djehutynakht, in display in the Museum of Fine Arts and shown in Fig.6 [22]. It is of the standard parallelogram type manufactured from cedar and extensively decorated through painting by scenes from the book of dead and other scene for the deceased.

Fig.6 Coffin of Djehutynakht from the 11th-12th Dynasties [22].

The third example is a coffin from the 12th Dynasty for Nakht-ankh found at Beni-Hassan, in display in the Liverpool Museum at UK and shown in Fig.7 [23]. Again, it is of the standard parallelogram type with flat cover (not shown in Fig.7), inscriptions in a horizontal band all around the trough near its end and in vertical bands from the horizontal band to the bottom of the coffin. The two eyes are in the standard position assigned in the previous designs.

Fig.7 Coffin of Nakht-ankh from the 12th Dynasty [23].

- The fourth example is a painted wooden coffin from the 12th Dynasty (1981-1802 BC) belongs to Senbi, in display in the Cleveland Museum of Art and shown in Fig.8 [24]. It is similar to that of Nakht-ankh in Fig.7. It has a flat lid and may be manufactured in the same workshop produced Nakht-ankh coffin.

Fig.8 Coffin of Senbi from the 12th Dynasty [24].

The fifth example of wooden coffins in the Middle Kingdom is from the Late 12th Dynasty-Early 13th Dynasty (1940-1760 BC) for Khnumhotep in display in the National Museums Scotland and shown in Fig.9 [25]. This is a new coffin type taking the shape of a human (the decease). It is painted white with three lateral bands, longitudinal band and a head. The head simulates the decease during his life.

Fig.9 Coffin of Khnumhotep from the 12th-13th Dynasties [25].

VI. SECOND INTERMEDIATE PERIOD

The Second Intermediate Period covers the ancient Egyptian Dynasties from the 13th to the 17th Dynasties over a time span from 1802 to 1550 BC
The development of wooden coffins through this intermediate period is investigated through the presentation of four coffins from the 13th and 17th Dynasties.

- Fig. 10 shows a wooden coffin from the 13th Dynasty for Nakhtkhnum (1802-1640 BC) in display in the Metropolitan Museum of Art [27]. It is of the parallelogram design, painted and extensively decorated by symbols and inscriptions in horizontal and vertical bands.

- The second example of wooden coffins in the Second Intermediate Period is for Hekaib-Hapy from the 13th Dynasty (1640-1550 BC) found at Thebes, in display in the Metropolitan Museum and shown in Fig. 11 [28]. It is of the parallelogram design as this of Nakhtkhnum of Fig. 10 but with less decoration inscriptions.

- The third example is from the 17th Dynasty for the King Nebkheperre Intef of Thebes during the period 1571-1560 BC in display in the British Museum and shown in Fig. 12 [29]. It is of the human-shape design appeared in the end of the 12th Dynasty. It is manufactured from wood and layer of gesso which was painted.

- The last example is a wooden coffin from the Late 17th Dynasty Early 18th Dynasty (1580-1479 BC) for Puhorsenbu which is in display in the Metropolitan Museum of Art and shown in Fig. 13 [30]. The coffin is a wonderful artifact manufactured from wood, covered by a layer of stucco, then painted to simulate the decease in a wonderful way seeming that it is a photographic shot taken by a digital camera. However, they did not have this technology but they had their own 3500 years old technology which produced articles still amazing the whole world till now.

VII. NEW KINGDOM

The New Kingdom of ancient Egypt covers the Dynasties from the 18th to the 20th over a time span from 1570 to 1069 BC [31]. The New Kingdom is the richest and strongest period in the ancient Egyptian history. It is expected to find
outstanding wooden coffin designs in the three dynasties of the New Kingdom compared with other ones.

- The first example of wooden coffins in the New Kingdom is from the 18th Dynasty. It is the outer coffin of Queen Ahmose Merit-Amun, wife of Pharaoh Amenhotep I, the second Pharaoh of the 18th Dynasty. The coffin is in display in the Egyptian Museum at Cairo and shown in Fig.14 [32]. The coffin is a wonderful piece of artifacts manufactured from cedar, inlayed and painted with colors simulating the Queen holding a symbol in each hand while her both hands are on her chest. It is of the human-shape type emerged in the end of the 12th Dynasty. The details of the Queen face are amazing displaying the serious look and strong character of the Queen.

- The second example is for the middle coffin of Yuya, a courtier during the 18th Dynasty in display in the Egyptian Museum at Cairo and shown in Fig.15 [33]. The three nested coffins of Yuya were of the human-shape design. Even Yuya was just a courtier, his coffins show how rich he was. The coffin in hand is manufactured from wood, coated by stucco, painted, decorated by gold and silver foils and inlaid with colored glass. The headdress is inlaid by alternate bands of gold and silver, the hands are covered by gold foil holding a symbol in each hand [33].

- The third example from the 18th Dynasty is a wooden coffin lid for Ladi Teti, the Servant of the Great Place at Thebes (1580-1479 BC) in display in the Brooklyn Museum and shown in Fig.16 [34]. The lid takes the shape of Teti wearing a headdress of alternate yellow and black bands, putting her hands on her chest, inscriptions in a vertical bounded band and wearing a Tunic dress decorated by bird wings. The artist simulated Teti as a serious Egyptian Ladi.

- The fourth example of wooden coffins in the New Kingdom is from the 19th Dynasty. It is for Khonsu, the son of Sennedjem (artist worked in the decorations of the Royal Tombs during the reign of Pharaohs Seti I and Ramses II). The nested coffins of Khonsu were found in the Tomb of his father Sennedjem and in display in the Metropolitan Museum of Art and shown in Fig.17 [35]. Khonsu had two nested coffins, the outer of them is shown in Fig.17. It is of the classical human-shaped one emerged in the end of the 12th Dynasty. It is decorated by alternate colors in yellow and black for his headdress and scenes for some gods and goodness of ancient and for himself with his wife. It is produced from wood, gesso, paints and varnish and has 2 m length [35].
Fig.17 Outer coffin of Khonsu from the 19th Dynasty [35].

- The fifth example is again from the 19th Dynasty which is an outer coffin found in the Tomb of Sennedjim (may be for Sennedjem himself) shown in Fig.18 [36]. The coffin is a master part in the art of the ancient Egyptians. It is highly decorated through very accurate design and production of the Sennedjem-shaped coffin. His headdress is elaborately decorated through its colors and scenes, his ornament and dress. He is holding a symbol in each hand. His face reflects how serious he was.

Fig.18 Outer coffin of Sennedjem from the 19th Dynasty [36].

- The sixth example of wooden coffins in the New Kingdom is an outer coffin for Lady Henutmehyt from the 19th Dynasty, found in Thebes, in display in the British Museum and shown in Fig.19 [37]. Her coffin is produced from wood covered by gold leaf and decorated by scenes, inscriptions and symbols. She is not holding any symbols in her hands, but extending her fingers and putting her hands on her chest. Her headdress is long and decorated by yellow bands and scenes. The details of her face show that she may be of a relation with Sennedjem (Fig.18). The coffin length is 1.87 m.

Fig.19 Coffin of Henutmehyt from the 19th Dynasty [37].

- The seventh example of wooden coffins in the New Kingdom is from the 20th Dynasty. It belongs to Panehsy, the Viceroy of Kush during the reign of Pharaoh Ramses XI in display in the National Museum of Antiquities at Leiden (Holland) and shown in Fig.20 [38]. Again, this is one of the wonderful wooden coffins manufactured during the reign of the last Pharaoh of the 20th Dynasty (1107-1078 BC). It is of the human-shape design and fully painted and decorated with scenes and inscriptions.

Fig.20 Coffin of Panehsy from the 20th Dynasty [38].

- The last example from the New Kingdom is again from Late 20th Dynasty and in display in the Metropolitan Museum of Art and shown in Fig.21 [39]. It is of the human-shape design, painted and decorated from both inside and outside and has a 1.91 m length. It is decorated by funerary scenes and the decorations are so neat and clear and have too many details specially on both surfaces. The artist did not show the hands of the decease.

Fig.21 Coffin from Late 20th Dynasty [39].

VIII. THIRD INTERMEDIATE PERIOD

The Third Intermediate Period covers the Dynasties from 21st to 25th over a time span from 1070 to 664 BC [40]. The development of wooden coffins during this historical period of Egypt is investigated through the presentation of 8 coffins as follows:

- Fig.22 shows a wooden coffin for the priest Amun Nes-pa-neb-imakh (1000-970 BC) from Thebes during the 21st Dynasty in display in the National Museum of Denmark [41]. The coffin is of the human-shape type and simulates the decease with full decoration of the coffin through
scenes of various designs and colors.

Fig.22 Coffin of Amun Nes-pa-nb-imakh from the 21st Dynasty [41].

- The second example is from Late 21st Dynasty (1000-945 BC) and belongs to Henettawy, a singer of Amun-Re in display in the Metropolitan Museum of Art and shown in Fig.23 [42]. It is of the human-type and simulates the singer with full decoration with funeral scenes with multi-colors. It is manufactured from wood, coated by a layer of gesso, painted, then a layer of varnish was applied. The coffin length is 1.91 m. The artist did not show the hands of the decease.

Fig.23 Coffin of singer Henettawy from Late 21st Dynasty [42].

- The third example is a wooden coffin for a child from Late 21st Dynasty- Early 22nd Dynasty (1070-712 BC) displayed in a sale at NY in 4th June 2008 for 18750 US$ and shown in Fig.24 [43]. It is of the human-type, manufactured from wood, gesso and paints. It is fully decorated by various scenes and inscriptions in two columns. The coffin length is 1.14 m and the face is for an old man. The artist did not show the hands of the decease.

Fig.24 Coffin of a child from 21st – 22nd Dynasties [43].

- The fourth example is from the 22nd Dynasty (800 BC) for priest Nespermnb in display in the British Museum and shown in Fig.25 [44]. The coffin is of the human-type and fully decorated with scenes and symbols in very shining colors showing too many details. The artist did not show the hands of the decease.

Fig.25 Coffin of Nespermnb from the 22nd Dynasty [44].

- The fifth example is from the period 760-660BC (23rd –25th Dynasties) for Nesmutaatneru in display in the Museum of Fine Arts and shown in Fig.26 [45]. The coffin is of the human-type and slightly decorated through inscriptions in two longitudinal adjacent bands. Again, the artist did not show the hands of the decease.

Fig.26 Coffin of Nesmutaatneru from the 23rd –25th Dynasties [45].

- The sixth example is an inner coffin from the 25th Dynasty for priest Hor (700-680 BC) in display in the British Museum and shown in Fig.27 [46]. It is from the same design school of human-shaped wooden coffins extensively decorated by funerary scenes with multi-colors paints. The artist did not show the hands of the decease.

Fig.27 Inner coffin of Hor from the 25th Dynasty [46].

- The seventh example from the Third Intermediate Period is from the 25th / 26th Dynasties which is an inner coffin for
Died Mut (715-525 BC) in display in the North Carolina Museum of Art and shown in Fig.28 [47]. It is of the human-type design and extensively decorated all over the surface of the coffin.

Fig.28 Inner coffin of Died Mut from the 25th / 26th Dynasties [47].

- The last example is an outer coffin of Tabakenhonsu from the 25th Dynasty (680-670 BC) in display in the Metropolitan Museum of Art and shown in Fig.29 [48]. It is manufactured from wood, layer of gesso, then painted. The coffin is of the parallelogram type with domed lid. It is decorated by repeated scene of a deity and scenes in vertical adjacent bands.

Fig.29 Outer coffin of Tabakenhonsu from the 25th Dynasty [48].

IX. LATE PERIOD

The Late Period of the ancient Egypt history covers the dynasties from the 26th to the 31st Dynasties over a time span from 664 to 332 BC [49]. We have three coffin examples from this period from the 26th and 27th Dynasties.

- Fig.30 shows a coffin of Thothirdes from the 26th Dynasty (died between 768 and 545 BC) and in display in the Brooklyn Museum [50]. It follows the same coffin design school in the Third Intermediate Period where it takes a human-shape, decorated by scenes covering the whole surface and no hands emerging from the body.

Fig.30 Coffin of Thothirdes from the 26th Dynasty [50].

- The second example from the Late Period is a painted coffin from the 26th Dynasty (664-525 BC) in display in the Australian Museum and shown in Fig.31 [51]. The coffin is of the parallelogram type and decorated by scenes representing the decease with a number of ancient Egypt deities.

Fig.31 Coffin from the 26th Dynasty [51].

- The last example is a wonderful wooden coffin from the 26th – 27th Dynasties (525-343 BC) in display in the Michael Carlos Museum, Emory University, Atlanta and shown in Fig.32 [52]. Again, the coffin is of the human-shape design with wonderful decorations over a layer of plaster covering the wood. It is decorated by scenes of some deities and inscriptions in five horizontal adjacent bands.

Fig.32 Coffin from the 26th -27th Dynasties [52].

X. CONCLUSION

- This paper investigated the evolution of Mechanical engineering in ancient Egypt during the dynastic periods through the design and manufacturing of wooden coffins.
- The wooden coffins appeared in ancient Egypt since the Early Dynastic Period.
They designed and manufactured wooden coffins in two main shapes: parallelogram design and human-shaped design. The parallelogram design starting from the Old Kingdom had a flat lid, inscriptions within a horizontal band near the top of its trough and two eyes symbol under the inscription band towards its left edge.

Those characteristics continued in the First Intermediate Period, Middle Kingdom and Second Intermediate Period.

More inscription bands were added in the Middle Kingdom, Second Intermediate and Third Intermediate Periods.

Scenes from the 'Book of Dead' were added to wooden coffins during the Middle Kingdom.

Human-shape wooden coffins appeared during the 12th Dynasty of the Middle Kingdom simulating the deceased.

The human-shape design of wooden coffins continued during the Second Intermediate Period, New Kingdom, Third Intermediate Period and Late Period.

Extensive decorations of the human-shape coffins appeared from the New Kingdom onwards.

Decoration of the inner surfaces of the wooden coffin appeared in the New Kingdom.

Regarding the hands of the decease, two design took place: coffin with the two hands on each other on the chest and coffin without any hands appearing.

The ancient Egyptians designed nested coffins to bury their deceases (up to three nested coffins).

During the 18th Dynasty they produced wonderful coffins inlaid by gold and silver foils and semi-precious stones.

The coated the wooden coffin by gesso and used multi-colors paints and varnish to generate their coffin-decoration.

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