

Mechanical Engineering in Ancient Egypt, Part VII: Jewellery (Finger-rings up to the 18th Dynasty)

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Abstract— This research paper presents the seventh part in a series of papers published by the author investigating the development of mechanical engineering in ancient Egypt. The manufacturing of finger-rings in ancient Egypt is studied during the era between the predynastic period to the 18th dynasty of the new kingdom. The paper follows up the design techniques of the ancient Egyptians and how the finger rings are evolved from the simple form in the predynastic period to the complex designs in the 18th dynasty. Samples of finger-rings located in different museums in the whole world are presented indicating the relatively high technology in ancient Egypt and their application to design principles used in the modern societies.

Index Terms— Mechanical Engineering History, Ancient Egypt, Jewellery industry, Finger-rings.

I. INTRODUCTION

This is the seventh 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. Some of the papers handle the jewellery industry as one of the attractive ancient Egypt industries leaving actual samples manufactured from different materials that could survive for thousands of years. The study covers a time line from the predynastic to the late periods.

Kunz (1917) stated that the earliest uses of rings were for the impression of an engraved design or device as the sign-manual of the wearer as did the ancient Egyptians. He discussed the origin, forms and materials and manufacturing of rings [1]. Brunton (1928) declared that the Badarian ancient Egyptians produced finger-rings from plain ivory, bone or tortoiseshell and fish vertebra [2]. Payne (1993) presented a catalogue for the predynastic Egyptian collection in the Ashmolean Museum of Oxford including a separate part for the personal decoration and daily use such as finger-rings [3]. Ward (1994) followed up the use of scarab objects in Egypt over the ancient Egypt history from the old kingdom to the 18th dynasty [4].

Maravelia (2004) studied a non-faience finger-ring bearing a scarab in the Benaki Museum of Athens from the 22nd dynasty. The ring was a golden one with a lapis lazuli scarab enclosed in a golden fundu [5]. Troalen and Guerra (2009) presented a technological study of items of Egyptian jewellery

from the collection of the National Museums Scotland. Their study covered two finger-rings from the new kingdom [6]. Petrina (2014) presented an article consisting of four parts: selected material, piece of jewellery, selection of objects of unknown provenance and the largest jewellery hoard ever found in Egypt [7]. Hassaan (2016) investigated the mechanical engineering technology in ancient Egypt through studying the jewellery products: pectorals [8], necklaces [9], Bracelets [10], royal crowns and headdresses [11].

I. PREDYNASTIC PERIOD

The predynastic era of ancient Egypt extended from 6000 BC to 3150 BC [12]. Even through this very old and extended period, Egyptians new finger rings and manufactured them from metallic and non-metallic materials available in their hands such as copper, bone, tortoiseshell and fish vertebra [2]. Here are sample of their finger-rings production:

- Fig.1 shows an ivory finger-ring produced during the Naqada I-III period (3850-2960 BC) and located in the Museum of Fine Art at Boston [13]. The ring is corrugated from its outside surface and smoothed from all its edges as recommended by recent machine design experts.



Fig.1 Predynastic ivory finger-ring [13].

II. THE 12TH DYNASTY

This is one of the richest dynasties in the ancient Egypt history. It extended over the period 1991-1802 BC [14]. We have a number of finger-ring models from the 12th dynasty presented as follows:

- Fig.2 shown a finger-ring for princess Sithathor, the daughter of King Senwosret II [15]. It consists of a golden wire and a scarab manufactured from a number of semi-precious stones and located in a golden claws. The scarab is jointed by a revolute joint to the wire allowing a relative angular motion between the two parts.



Fig.2 Sithathor finger-ring [15].

- The second model is from the rein of King Senwosret III which is manufactured from a gold wire and claws with a scarab bezel. Its scarab is manufactured from amethyst and its claws is hinged to the wire allowing relative rotational motion as illustrated in Fig.3 [16]. It is located in the Metropolitan Museum of Art.



Fig.3 Finger ring from rein of Senwosret III [16].

- Fig.4 shows another finger-ring model from the rein of King Amenumhat III of the 12th dynasty [17]. It has the same mechanical design used in the models in Figs2 and 3. The scarab is manufactured from lapis lazuli and is one piece. It is in display in the Metropolitan Museum of Art.



Fig.4 Finger ring from rein of Amenumhat III [17].

- The last model from the 12th dynasty belongs to a person called Ha-ro-bes and it shown in Fig.5 [18]. It is from the same jewellery design school. The bezel is manufactured from carnelian and take the shape of a square plate hinged to the ring wire.



Fig.5 Finger ring of Ha-ro-bes [18].

III. THE SECOND INTERMEDIATE PERIOD

The second intermediate period covers the 13th to 17th dynasties. It is one of the weak periods in the ancient Egypt History. Some finger-ring models related to this period are as follows:

- Fig.6 shows a finger-ring for the sealer Khensu from the 13th dynasty [19]. It follows the same machine design school of the middle kingdom (the scarab, the wire, the revolute joint, the materials).



Fig.6 Finger ring of sealer Khensu from the 13th dynasty [19].

- Another model from the 13th dynasty is located in the Metropolitan Museum of Art and shown in Fig.7 [20]. It is similar to that of King Amenumhat III shown in Fig.4.



Fig.7 Finger ring from the 13th dynasty [20].

- The last model of finger-rings from the second intermediate period is from Louvre Museum of Paris. It is shown in Fig.8 [18]. Its stone depicts a child holding a scorpion. The bezel is from a steatite while its wire is from gold.



Fig.8 Finger ring from the 2nd intermediate period [18].

IV. THE 18TH DYNASTY

This is the first dynasty of the new kingdom. This dynasty reflects wealth and power of ancient Egypt. We expect to see new mechanical designs of finger-rings in this dynasty as illustrated below:

- Fig.9 shows a finger-ring for Pharaoh Amenhotep I located in the Petrie Museum of UK [21]. It is a solid one piece mechanical design different than that experienced in the middle kingdom and the second intermediate period. The bezel here took the shape of the Pharaoh cartouche.



Fig.9 Finger ring of Pharaoh Amenhotep I [21].

Fig.10 shows a finger ring carrying the Cartouches of Pharaohs Hatshipsut and Thutmose III located in the Metropolitan Museum of Art of NY [22]. It is manufactured from green jasper and gold. It is of the hinged design appeared in the middle kingdom. The bezel takes the shape of a square located in a golden claws.

Fig.10 Finger ring from rein of Hatshipsut and Thutmose III [22].

- Fig.11 shows a golden finger ring from the rein of Pharaoh Thutmose III located in the Louvre Museum of Paris [23]. It is manufactured from gold and lapis lazuli (for its bezel). Its mechanical design belongs to the middle kingdom period and its bezel takes a semi-elliptical shape with revolute joints.



Fig.10 Finger ring from rein of Thutmose III [22].

- Another model from the time of Pharaoh Thutmose III from the British Museum is shown in Fig.11 [23]. It is manufactured from gold and it is from the revolute-joints type appeared in the middle kingdom. The inscription on the bezel carries the name of the Pharaoh.



Fig.11 Gold finger ring from rein of Thutmose III [23].

- A third ring model from the rein of Pharaoh Thutmose III is located in the Metropolitan Museum of Art. It has a new feature which is using a mouse to decorate the ring instead of the scarab used in the 12th dynasty. It is shown in Fig.12 [24].
- The mouse was manufactured from glazed steatite while all the other parts are manufactured from gold. It follows the same mechanical design school of the 12th dynasty.



Fig.12 Mouse decorated finger ring from rein of Thutmose III [24].

- We are still with the rein of Pharaoh Thutmose III where we have finger-ring samples from the tombs of his three foreign wives as shown in Fig.13 (a) and 13 (b) [25] , [26]. The ring in Fig.13 (a) is manufactured from gold and its scarab is manufactured from glazed steatite. It follows the same mechanical design school of the 12th dynasty except the scarab has more details than any other previous design. So, the other model in Fig.13 (b) except the bezel is a plain elliptical surface with hieroglyphic inscriptions on its surface. It is manufactured from gold and lapis lazuli (the bezel).



Fig.13 (a) Scarab bezel finger ring of Thutmose III 3 foreigner wives[25].



Fig.13 (b) Elliptic bezel finger ring of Thutmose III 3 foreigner wives [26].

- Now, we more to the finger-ring of Pharaoh Amenhotep II located in Liverpool Museum of UK and manufactured from pure gold as shown in Fig.14 (a) [27]. The bezel is inscribed from both sides and revolves completely through using revolute joints with the shank. Another version of this finger ring is manufactured from silver and has the same characteristics of the golden one of Fig.14 (a).
- The silver finger-ring is located in the Museum of Fine Art at Boston and shown in Fig.14 (b) [28].



Fig.14 (a) Golden rectangular bezel rectangular bezel finger-ring of Amenhotep II [27].



Fig.14 (b) Silver rectangular bezel finger-ring of Amenhotep II [28].

- Next is a sample of finger-rings from the rein of Pharaoh Thutmose IV shown in Fig.15 [18]. It is manufactured from Bronze and its bezel was manufactured from steatite. There are inscriptions from both sides of the bezel. The side shown in Fig.15 is for the Pharaoh holding the crook and bow with hieroglyphs.



Fig.15 Cartouche bezel finger ring from rein of Thutmose IV [18].

- Next is a distinct model from the rein of Pharaoh Amenhotep III which is a green-blue glazed composition finger-ring shown in Fig.16 [29]. It is consisted of one piece with its bezel designed to take the Pharaoh cartouche shape with a cobra beside it. The surfaces are all filleted not to harm the user.



Fig.16 Cartouche bezel finger ring from rein of Thutmose IV [29].

- Next are samples of finger rings from rein of Pharaoh Akhenaten, one of the richest Pharaohs of the 18th dynasty. The first model is a one piece solid finger

ring located in the Metropolitan Museum of Art and shown in Fig.17 (a) [30]. It is manufactured from gold, has an elliptic bezel, wide and thick hoop and deep inscriptions on the bezel top. Another solid mode of Akhenaten solid finger-rings is manufactured from silver alloy and located in the British Museum. It is shown in Fig.17 (b) [31]. The last sample here is a golden solid model belongs to Queen Nefertiti and located in the Louvre Museum at Paris. It is shown in Fig.18 where it has an elliptic bezel and deep inscriptions [18].



Fig.17 (a) Golden ring of Akhenaten [30].



Fig.17 (b) Silver finger-ring of Akhenaten [31].



Fig.18 Golden finger-ring of Queen Nefertiti [18].

- Now, we move to the era of the famous young Pharaoh Tutankhamun. We have a number of finger-ring models. The first model is displayed in the National Museum of Scotland and manufactured from a blue non-metallic material and consisted from a solid one piece as shown in Fig.19 (a). The inscriptions on its bezel represent the name of the Pharaoh [32]. It is molded in one piece, the hoop is curved and the inscriptions are deep on the top surface of the bezel. A third model of finger-rings of Pharaoh Tut is shown in Fig.19 (c) [19]. It belongs to the mechanical design school of the 12th dynasty. The bezel is semi-elliptical and manufactured from a semi-precious stone with inscriptions of the Pharaoh name. The hoop and claws are from gold. There is

two decoration cobra around the hoop and the bezel rotates about its horizontal centerline using revolute joints. The last model of Tut finger-rings is shown in Fig.19 (d) [19]. This is a completely a novel design from the 18th dynasty jewellery designers. The hoop consists of three round parallel gold wires tied together just below the bezel with decoration of semi-precious flowers. The bezel carries some symbols: a boat, a crescent, a solar disk and other objects not clear from the present view of the ring. There are small-diameter helical wires around the hoop covering almost half the hoop length. The last model of the young Pharaoh Tut is a solid one piece gold finger ring shown in Fig.19 (e) and located in the Metropolitan Museum of Art [34]. Its bezel has perfect elliptical shape, the bezel deep inscriptions is for the Pharaoh throne name and all the surfaces are filleted in a perfect design engineering way.



Fig.19 (a) Tutankhamun non-metallic ring [32].



Fig.19 (b) Glazed Tutankhamun non-metallic ring [33]



Fig.19 (c) Tutankhamun swivel ring [19].

Fig.19 (d) Tutankhamun complex ring [19].



Fig.19 (e) Tutankhamun solid ring [34].



The last samples presented in this collection is for the last Pharaoh of the 18th dynasty, Horemheb. There are three finger-rings of Pharaoh Horemheb located in the Louvre Museum of Paris. The three rings are from the swivel type designed in the 12th dynasty. All of them are manufactured from gold and shown in Fig.20 [35]. The bezel in the three designs have a rectangular shape. In (a) the Pharaoh cartouche is inscribed deeply in it. In (b) a crocodile is inscribed in it and in (c), a scorpion is inscribed in it. All the units are from pure gold and the hoop has gradual increase in diameter from its end at the joint to its middle. A small diameter gold wire is rapped around the hoop covering about 70 % of its area.



(a) Cartouche bezel



(b) Crocodile bezel



(c) Scorpion bezel

Fig.20 Rings of Pharaoh Horemheb [35].

V. CONCLUSIONS

- The manufacturing of finger-rings in ancient Egypt was investigated from the predynastic period to the 18th dynasty of the new kingdom.
- The ancient Egyptians new finger-rings since more than 5000 years ago.
- An ivory finger-ring from Naqada I to Naqada III period still surviving in the Museum of Fine Arts at Boston. It was a solid one piece..
- In the 12th dynasty of the middle kingdom, they produced swivel finger-rings with revolute joints between the bezel and hoop..
- The bezel took the shape of a scarab manufactured from single semi-precious stone or multi semi-precious stones with different colors.
- The bezel also took a rectangular shape.
- They used lapis lazuli, carnelian and other semi-precious stones in the manufacturing of the ring-bezel.
- The hoop in the finger-rings of the 12th dynasty was manufactured from a golden small diameter wire.
- In the second intermediate period, the designers of the finger-rings continue to design and produce the swivel finger-rings emerged in the 12th dynasty with almost the same mechanical features.
- In this period, a finger-ring model appeared with inscription on its bezel for a child holding an scorpion in his hand.
- In the 18th dynasty, new designs of finger-rings appeared. The solid one piece appeared with bezels depicting useful information about the user.
- One bezel carried the cartouche of Pharaoh Amenhotep I, another one carried two cartouches: one for Queen Hatshipsut and the second for the Pharaoh Thutmose III, another carried the cartouche of Thutmose III alone.
- The bezel during this dynasty took the shape of a rectangular or elliptic shapes.
- The bezel in some finger-ring designs carried objects like scarab or mouse.
- They manufactured finger rings during this dynasty from gold, silver, semi-precious stones and glazed composition.



- Inscriptions on the bezel were deep and took the form of heliographic writings, cartouches, humans, animals (crocodile) and insects (scorpion).
- New designs of finger rings appeared during the reign of Pharaoh Tutankhamun including hoop design and decoration.
- The swivel type of finger-rings appeared again at the end of the 18th dynasty during the reign of its last Pharaoh Horemheb.

REFERENCES

- [1] G. Kunz, *Rings*, J. Lippencott Company, 1917.
- [2] G. Brunton, *The Badarian civilization and predynastic remains near Badari*, British School of Archaeology in Egypt, 1928.
- [3] J. Payne, *Catalogue of the predynastic Egyptian collection in the Ashmolean Museum*, Oxford University Press, 1993.
- [4] W. Ward, "Beetles in stone: The Egyptian scarab", *The Biblical Archaeologist*, vol.57, issue 4, pp.186-202, 1994.
- [5] A. Maravelia, "The Egyptian golden ring with lapis lazuli inscribed scarab at the Benaki Museum", *BENAKI*, vol.4, pp.9-13, 2004.
- [6] L. Troalen and M. Guerra, "Technological study of gold jewelry pieces dating from the middle kingdom to the new kingdom in Egypt", *Archeo Sciences*, vol.2, issue 33, pp.111-129, 2009.
- [7] Y. Petrina, "Jewellery from late antique Egypt", *British Museum Studies in Ancient Egypt and Sudan*, vol.21, pp.31-43, 2014.
- [8] G. A. Hassaan, "Mechanical engineering in ancient Egypt, Part II: Jewellery industry (pectorals)", *International Journal of Recent Engineering Science*, vol.19, pp.25-32, January 2016.
- [9] G. A. Hassaan, "Mechanical engineering in ancient Egypt, Part III: Jewellery industry (necklaces)", *International Journal of Engineering and Techniques*, vol.2, issue 1, pp.59-67, 2016.
- [10] G. A. Hassaan, "Mechanical engineering in ancient Egypt, Part IV: Jewellery industry (bracelets)", *International Journal of Science and Engineering*, vol.2, issue 2, pp.16-30, 2016.
- [11] G. A. Hassaan, "Mechanical engineering in ancient Egypt, Part V: Jewellery (crowns and headdresses up to the 18th dynasty)", *World Journal of Engineering Research and Techniques*, vol.2, issue 2, pp.1-25, 2016.
- [12] J. Mark, "Predynastic period in Egypt", www.ancient.eu/Predynastic-Period-in-Egypt/
- [13] Museum of Fine Arts, "Ivory finger-ring", www.mfa.org/collections/ivory-finger-ring-139039
- [14] Wikipedia, "Twelfth dynasty of Egypt", http://en.wikipedia.org/wiki/Twelfth_Dynasty_of_Egypt, 2016.
- [15] U. Valar, "Egyptian jeweler", www.pinterest.com/ulisesvalrezo/egyptian-jewellery-V/
- [16] Metropolitan Museum, "Scarab finger-ring of Senwosret III", www.metmuseum.org/collection/the-collection-online/search/546139, 2016.
- [17] Pinterest, "Scarab finger-ring", <http://uk.pinterest.com/pin/516788125965238810/>
- [18] Pinterest, "Rings of ancient Egypt", www.pinterest.com/thehegab/rings-of-ancient-egypt/
- [19] Pinterest, "Egyptians", www.pinterest.com/sejinjeong7/egyptian/
- [20] Metropolitan Museum, "Scarab finger-ring", www.metmuseum.org/collection/the-collection-online/search/546849
- [21] UCL, "Finger ring Amenhotep I", www.ucl.ac.uk/museums-static/ave/detail/details/index_no_1_ogin.php?objectid=UC_11881_&accesscheck=%2Fmuseum-static%2Fave%2Fdetail%2Fdetails%2Findex.php
- [22] Metropolitan Museum, "Scarab finger-ring inscribed with the cartouche of Hatshepsut and Thutmose III", www.metmuseum.org/art/collection/search/545428
- [23] British Museum, "The Ashburnham ring", http://www.britishmuseum.org/research/collection_online/collection_object_details.aspx?objectId=116521&partId=1&searchText=Swivel+bezel&people=&place=&from=ad&fromDate=&toDate=&object=&subject=&matcult=&technique=&school=&material=ðname=&ware=&escape=&bibliography=&citation=&museumno=&catalogueOnly=&view=&page=1
- [24] Metropolitan Museum, "Ring with a mouse design amulet", www.metmuseum.org/collection/search/547674, 2016.
- [25] Pinterest, "Scarab finger-ring", www.pinterest.com/pin/11251969966057509/
- [26] Pinterest, "Ancient Egypt", www.pinterest.com/paperwhistle/ancient-egypt/
- [27] Global Egyptian Museum, "Gold finger-ring of Amenhotep II", www.globalegyptianmuseum.org/detail.aspx?id=4287
- [28] Pinterest, "Signet ring of Amenhotep II", www.pinterest.com/pin/171559067027685800/
- [29] British Museum, "Finger-ring", http://www.britishmuseum.org/research/collection_online/collection_object_details.aspx?objectId=134158&partId=1&searchText=%22Pharaoh%3A+King+of+Egypt%22&page=1
- [30] Metropolitan Museum, "Finger-ring of King Akhenaten and Queen Nefertiti", www.metmuseum.org/toah/work-of-art/26.7.767/
- [31] British Museum, "Finger-ring", http://www.britishmuseum.org/research/collection_online/collection_object_details.aspx?objectId=464751&partId=1&people=114343&peopleA=114343-1-8&page=1
- [32] M. Maitland, "Tutankhamun in the National Museum of Scotland", <http://blog.nms.ac.uk/2012/11/26/tutankhamun-in-the-national-museum-of-scotland/>

- [33] Pinterest, "Ancient Egypt",
www.pinterest.com/paperwhistle/ancient-egypt/
- [34] Archive, "Signet ring with Tutankhamun's throne",
https://archive.org/details/mma_signet_ring_with_tutankhamuns_throne_name_549200
- [35] Pinterest, "Signet ring of Horemheb",
<http://uk.pinterest.com/pin/306104105897539886/>



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