

Mechanical Engineering in Ancient Egypt, Part 112: Bags Industry and Applications

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Abstract:

This is the 112 paper in a series of research papers exploring the history of mechanical engineering during the Ancient Egyptian era. The paper investigates the industry of bags in Ancient Egypt over periods from Old Kingdom to New Kingdom. The paper presents samples of bags and tries to analyze each sample showing its characteristics, material and location if known. The design of each bag is outlined. The numerous applications of bags in the ancient Egyptian society are outlined and analyzed indicating the corresponding historical reign of the kings (or pharaohs).

Keywords — Mechanical engineering history, Ancient Egypt, bags industry, bags applications.

I. INTRODUCTION

The ancient Egyptians used bags from early times for multi purposes. The paper aims at investigating the application of bags in the ancient Egyptian society, periods, materials, design, method of handling, present location (if known). The paper investigated artefacts and scenes covering a time period from 2558 BC to 1077 BC.

Bolshakov (2005) presented some reliefs from the tombs of the Old Kingdom as housed in the Hermitage (State Hermitage Museum, St Petersburg, Russia). One of them is a tomb from the reign of King Unis (9th ruler of the 5th Dynasty, 2375-2345 BC) showing a man holding a handbag strengthened by helical cords. He presented also a relief from the same tomb for bearers carrying three different bags in their hands [1]. Barta, Coppens and Krejci (2011) presented some line drawing scenes from Abusir and Saqqara tombs including a market place scene relief from the mastaba of Tep-em-ankh II from the 5th Dynasty during the reign of King Sahur (2487-2475 BC) showing a porter carrying a shoulder bag on his left shoulder and a setting worker carrying a shoulder bag also on his left shoulder [2].

El-Hadidi and Hamdy (2011) studied two bags in display in the Agricultural Museum in Giza of Egypt identifying the materials used. One of the bags was dated to the New Kingdom from Deir el-Medina and made of three-plant materials [3]. Andries (2013) presented some reliefs from some tombs from the Old Kingdom. She presented a carved scene from the tomb of Seneb (a high-ranking court official in the Old Kingdom during the reign of King Menkaure of the 4th Dynasty (2532-2503 BC). The scene showed three scribes before Seneb, two of them holding a strip holding a waist-bag. He presented another scene from the mastaba of Nefertenef from the 5th Dynasty during the reign of King Djedkare Isesi (2414-2375 BC) holding a shoulder-bag and may be an handbag in the right hand [4]. Mahran (2013) presented a scene for a wood-boat construction in the tomb of Niankhkhnum and Khnumhotep from the 5th Dynasty at Saqqara during the reign of Nyuserre Ini (2445-2421 BC) showing a sawing man using a load-bag supporting sawing a wood block [5].

Shagar (2014) in her thesis investigated the technology used in the bags and sacks production in ancient Egypt, the used materials and the ways of their use [6]. Richey (2014) presented a coloured agricultural scene from the tomb of Sennedjem

(Artesian from the 19th dynasty during the reign of Pharaohs Seti I and Ramses II (1292-1213 BC). The scene depicted a woman holding a seeds handbag in her left hand and sowing the seeds by her right hand [7]. Brown (2015) in his master thesis presented a coloured scene from tomb of Ramose (Vizier and Governor of Thebes during Pharaohs Amenhotep III and Akhenaten, 1388-1334 BC of the 18th dynasty) for bearers in a procession with one of them carrying a handbag with his left hand [8].

De Beek (2016) presented drawing for tomb scenes incorporating men carrying shoulder bags from the tomb of Niankhkhnum and Khnumhotch, Tebemankh at Saqqara, Fetekta (shoulder and handbags), Ptahshepses at Abusir [9]. Pemler (2018) investigated the life of the Nubian women in Egypt during the New Kingdom through scenes from tomb and temple scenes. He presented scenes from the tomb of Vizier Rekhmire from the 18th Dynasty (reign of Pharaohs Thutmose

III and Amenhotep II, 1470-1420 BC) depicting ladies and children carrying handbags and a head bag for carrying young children [10]. Hamid (2023) outlined that ancient Egyptians used protective equipment to safeguard their work places using protective clothing or equipment. She presented a colored scene from the tomb of Mereruka (Vizier of King Teti, Founder of the 6th Dynasty, 2345-2323 BC) at Saqqara for a fishman carrying a shoulder bag on his left shoulder [11]. Tawfek, El Magd and Kamal (2025) presented a scene from the tomb of Princess Idut (mother of King Teti from the 6th Dynasty). The scene depicted two fishermen one of them fishing using a cylindrical net-bag. They presented also a scene in the tomb of Senbi from the 12th Dynasty at Meir during the reign of King Amenemhat I (Founder of the 12th Dynasty, 1991-1962 BC) showing a soldier carrying an arrows-bag in his right hand and wearing a shoulder bag of his left shoulder. They presented also a scene in the tomb of governor Amenemhat at Bani-Hassan during the reign of King Senusret I (the 2nd King of the 12th Dynasty, 1971-1926 BC) showing porters carrying offering baskets, trays and net-bags [12].

II. BAG TYPES AND DESIGNS IN ANCIENT EGYPT

The ancient Egyptians used various designs and materials for their bags for a large number of applications as will be investigated in this section:

1. Handbags:

According to available documentation, handbags appeared in ancient Egyptian society from 2331 BC (during the Old Kingdom). Here are some examples of the applications of handbags during the period 2331-1077 BC (Old to New Kingdoms):

- The first example is a relief in the tomb of King Nyuserre (2445-2421 BC) of the 5th Dynasty depicting a porter carrying a long circular handbag strengthened by a rapped cord around its top part in his left hand shown in Fig.1 [13].



Fig.1 Porter from the 5th Dynasty carrying a round strengthened handbag [13].

- The second example is a scene in the tomb of King Nyuserre (2445-2421 BC) of the 5th Dynasty depicting four porters in a procession carrying three different handbags shown in Fig.2 [13] with bag-design summarized as follows:

- ✚ The first porter carries a semi-circular handbag with medium dual handles.
- ✚ The second porter carries a rhombus handbag with short single handle.
- ✚ The fourth porter carries a bowl-shaped handbag with short dual handles.

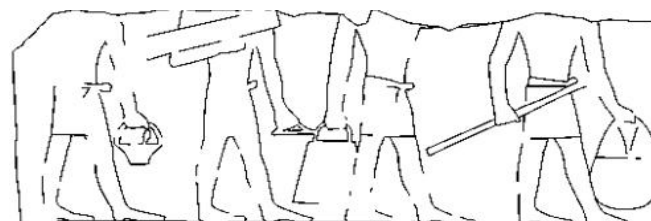


Fig.2 Four porters from the 5th Dynasty carrying three handbags [13].

- The third example is a handbag with right-rectangular-prism design carried by a statue for the high official ranking Ni Bibi Ankh from the 6th dynasty during the reign of King Pepi II, 2381-2287 BC of the 6th Dynasty shown in Fig.3 as displayed in the Egyptian Museum at Tahrir, Cairo [14]. The bag has a short single handle.



Fig.3 Ni Bibi Ankh from the 6th Dynasty carrying a colored handbag on his right hand [14].

- The fourth example is a true rhombus handbag in display in the Agricultural Museum at Cairo shown in Fig.4 [15]. It was produced during the New Kingdom from doom palm leaflets, had about 50 cm diameter at its opening and used as a heavy-duty container.



Fig.4 Rhombus heavy duty handbag from the New Kingdom [15].

- The fifth example is a scene in the tomb of Vizier Rekhmire who served during the reign

of Pharaohs Thutmose III and Amenhotep II of the 18th Dynasty, 1479-1398 BC shown in Fig.5 [16]. The scene depicts 3 lady-porters and a child carrying handbags having single short and medium length handles. All the bags have a semi-circular body.



Fig.5 Porters scene from the tomb of Rekhmire from the 18th Dynasty [16].

- The sixth example is a colored scene in the tomb of Overseer of the Fields Menna who served during the reign of Pharaohs Thutmose IV and Amenhotep III of the 18th Dynasty, 1398-1350 BC shown in Fig.6 and in display in the Metropolitan Museum at New York [17]. The scene depicts a taxes team and a porter offering to them. The porter carries a triangular handbag having a short handle in his right hand.



Fig.6 Taxes team scene from the tomb of Menna from the 18th Dynasty [17].

- The seventh example is a shabti handbags carried by two shabtis in both hands produced during the reign of Pharaoh Thutmose IV, 1398-1388 BC of the 18th shown in Fig.7 and in display in the Brooklyn Museum at New York [18]. The bags in the hands of the shabtis are of the rhombus type with short handles.



Fig.7 Shabtis carrying handbags from the 18th Dynasty [18].

- The eighth example is a colored scene from the tomb of Scribe Onsu who served during the reign of Pharaohs Thutmose IV and Amenemhat III, 1398-1850 BC of the 18th Dynasty depicting a ploughing and sowing process shown in Fig.8 [19]. The sowing worker is holding a rhombus type seed handbag with medium length handle by his right hand.



Fig.8 Ploughing and sowing colored scene from the tomb of Onsu [19].

- The ninth example is a colored scene from the tomb of Vizier Ramose who served during the reign of Pharaohs Amenemhat III and Akhenaten, 1388-1334 BC of the 18th Dynasty depicting bearers in an offering procession of the Vizier shown in Fig.9 [20]. One of the bearers a small decorated circular with flat-base handbag with medium length handle by his left hand.



Fig.9 Procession colored scene from the tomb of Vizier Ramose [20].

- The tenth example is a colored scene from the tomb of Artisan and Tomb Builder Sennedjem who served during the reign of Pharaohs Seti I and Ramses II, 1290-1213 BC of the 19th Dynasty shown in Fig.10 [21]. The scene depicts the wife of Sennedjem sawing the seeds using a rhombus type seed handbag with medium length handle by her left hand.

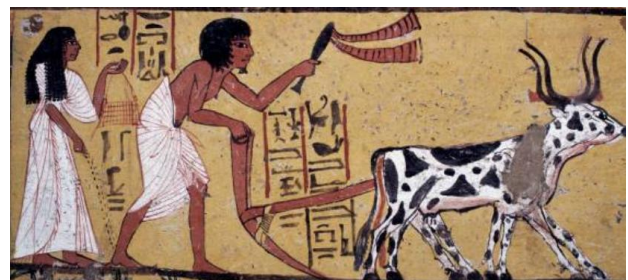


Fig.10 Ploughing and sawing colored scene from the tomb of Artisan Sennedjem [21].

2. Back bags:

A back bag was depicted from a statue for the high-ranking official Ni Bibi Ankh from the 6th Dynasty (2278-2184 BC) in display in the Egyptian Museum at Cairo and shown in Fig.11 [14]. The bag has an elliptical body and the statue designer did not show how it was secured to the statue back.



Fig.11 Ni Bibi Ankh from the 6th Dynasty carrying a back bag [14].

3. Shoulder bags:

Evidences from ancient Egypt from 2494 BC showed that this type was known from the time of the 5th Dynasty. Here are some examples from the 5th, 6th and 11th Dynasties:

- The first example is a scene in the mastaba of the high ranking official Tep-em-Ankh who served during the reign of Kings Userkaf, 2494-2487 BC and Sahure, 2487-2475 BC of the 5th dynasty depicting a worker carrying a shoulder bag on his left shoulder as shown in Fig.12 [22].



Fig.12 Worker scene from the mastaba of Tep-em-ankh from the 5th Dynasty [22].

- The second example is a market scene in the mastaba of the Overseer of the Department of Palace Attendants Tep-em-ankh II at Saqqara who served during the reign of King Sahure, 2487-2475 BC of the 5th Dynasty shown in

Fig.13 [9]. The seller and two male buyers carry shoulder bags on their left shoulders.

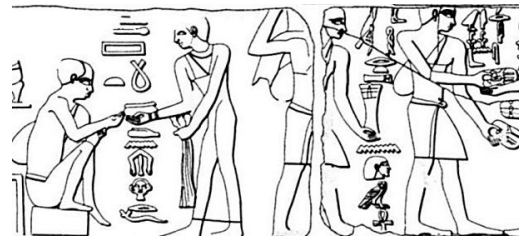


Fig.13 Market scene from the mastaba of Tep-em-ankh II from the 5th Dynasty [9].

- The third example is a scene in the mastaba of the High Ranking Official Neferirtenef who served during the reign of King Djedkare Isesi, 2414-2375 BC of the 5th Dynasty shown in Fig.14 [3]. The bearer is carrying a shoulder bag on her left shoulder.



Fig.14 Scene from the mastaba of Neferirtenef from the 5th Dynasty [3].

- The fourth example is a colored scene in the mastaba of Vizier Mereruka who served during the reign of King Teti, 2345-2323 BC of the 6th Dynasty shown in Fig.15 [11]. The scene depicted two fishmen wearing shoulder bags on their left shoulder.

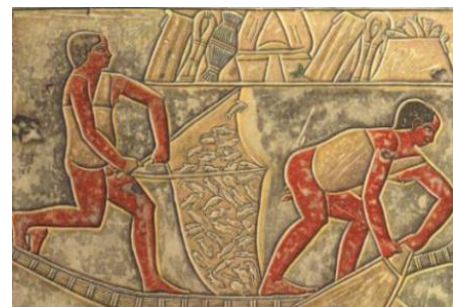


Fig.15 Scene from the mastaba of Vizier Mereruka from the 6th Dynasty [11].

- The fifth example is a Bearer lady statue in a procession of Governor Djehutynakht who served during the reign of King Mentuhotep IV, 1998-1991 BC of the 11th Dynasty and King Amenemhat I, 1991-1962 BC of the 12th Dynasty shown in Fig.16 [23]. The scene depicts the lady bearer carrying a colored-decorated semi-circular shoulder bag with long handle on her right shoulder.



Fig.16 Bearer lady statue in a procession of Governor Djehutynakht from the Middle Kingdom [23].

4. Net bags:

Net bags were a specific application for nets industry as will be clarified in the following three examples from the 5th, 8th and 12th Dynasties.

- The first example is a round net bag used by a fishman to hunt a hippopotamus depicted in a colored scene in the mastaba of Princess Idut, daughter of King Inas, 2375-2345 BC of the 5th Dynasty shown in Fig.17 [12]. The fishman is holding the net bag by both hands through a handle. Its body is almost circular with flat base.



Fig.17 Fishman hunting a hippopotamus using a round net bag in the mastaba of Princess Idut [12].

- The second example is an agricultural net bag depicted from a colored scene from the tomb of Scribe and Astronomer of Amun Nakht who served the Pharaohs Thutmose IV and Amenhotep III, 1398-1350 BC of the 18th Dynasty shown in Fig.18 [24]. The net bag has a spherical base and circular body strengthened by a wooden frame and carried by a (wooden) pole from one end and a flexible long rope from the other facing end through two workers.



Fig.18 Agricultural net bag from the tomb of Nakht from the 18th Dynasty [24].

- The third example is a bearer scene from the tomb of Governor Amenemhat at Beni-Hassan who served during the reign of King Senusret I, 1971-1926 BC of the 12th Dynasty. The scene depicts a bearer carrying two duck-net bags with a single handle, one bag at the end of a wooden pole as shown in Fig.19 [25].



Fig.19 Duck-net bag from the tomb of Governor Amenemhat from the 12th Dynasty [25].

5. Cattle-seeds-feeding bag:

The ancient Egyptians established great agricultural activities for planting and livestock farming. Among those activities is using special backs to feed the animals. Of course, net bags are not suitable for this purpose not to leak the seeds. The designer has to use non-leaking surfaces from different materials available in the ancient and present Egyptian society.

The available example is a colored scene from the tomb of the Scribe and Grain Accountant Nebamun who served during the reign of Pharaoh Akhenaten, 1351-1334 BC of the 18th Dynasty in display in the British Museum, UK shown in Fig.20 [26]. The scene depicts a livestock farming herdsman carrying an animal-seeds-feeding bag in his left hand and feeding the cattle with his right hand. The bag has a very special bag-design where it has a loop body with seeds inside. May be there is another interpretation for this scene.



Fig.20 Cattle-seeds-feeding bag from the tomb of Nebamun from the 18th Dynasty [26].

6. Arrows bags:

Arrows were used by the ancient Egyptians for hunting and fighting purposes. To keep the arrows in a functionally suitable place, they designed a round non-porous bag hold by a hunter's or fighter's assistant handling arrows to the hunter or fighter. We have two examples from the 12th and 18th Dynasties of the ancient Egyptians as follows:

- The first example is a hunting scene from the tomb of Governor Khnumhotep II during the reigns of Amenemhat II and Senusret II, 1929-1878 BC of the 12th Dynasty shown in Fig.21 [27].



Fig.21 Scene of arrows bag from the tomb of Khnumhotep II from the 12th Dynasty [27].

- The second example is a colored scene from the tomb of the ancient Egyptian Official Userhat who served during the reign of Pharaoh Amenhotep II, 1425-1398 BC of the 18th Dynasty shown in Fig.22 [28]. The design of the arrows bag is different than that of the 12th Dynasty. The arrows bag of the 18th Dynasty has a long- rhombus -shaped body.



Fig.22 Scene of a fighting soldier showing an arrows bag from the tomb of Userhat from the 18th Dynasty [28].

7. Food bags:

This is a civilized application of bags in the ancient Egyptian society to store foods during the daily life of the ancient Egyptian people during a time period from 2487 BC to 1111 BC as depicted by the following four examples:

- The first example is a scene in the mastaba of Overseer Tep-em-ankh II at Saqqara who served during the reign of King Sahure, 2487-2475 BC of the 5th Dynasty shown in Fig.23 [22]. The scene depicts a lady buying food from the market and holding a long flexible food bag with her left hand. The bag has a thick handle for supporting heavy loading of the bag.



Fig.23 Market scene in the tomb of Tep-em-ankh II from the 5th Dynasty [22].

- The second example is a market scene in the mastaba Official and Priest Fetekta at Abusir who served during the reign of King Unas, 2375-2345 BC, last king of the 5th Dynasty shown in Fig.24 [29]. The buyer is a man holding the food bag by his left hand in a way to seal it not to leak the food sold by the setting man who is also holding the food bag by his right hand and preparing himself to pour the food (may be liquid or cooked food). The thick boundary of the bag has an engineering indication of the objectives of the bag not to leak the food through its boundaries.



Fig.24 Market scene in the tomb of Fetekta from the 5th Dynasty [29].

- The third example is a colored scene from the tomb of the ancient Egyptian Official Userhat who served during the reign of Pharaoh Amenhotep II, 1425-1398 BC of the 18th Dynasty shown in Fig.25 [30]. The scene depicts soldiers standing in front of the Officer in charge of food-keeping and holding their food bags in their left hands.



Fig.25 Colored scene in the tomb of Userhat from the 18th Dynasty [30].

- The fourth example is an ostracon in display in the Egyptian Museum at Cairo depicting a cat herding a flock of geese and carrying a food net bag having a short handle produced during the reign of Pharaoh Ramses IX, 1129-1111 BC of the 20th Dynasty.



Fig.26 Colored scene an ostracon from the 20th Dynasty [31].

8. Tool bags:

Mechanical tools are the backbone of various mechanical industries requiring cutting, trimming, hammering, smoothing, etc. The ancient Egyptians appreciated the role of their tool in their production

procedures. Therefore, they were keen to produce heavy duty bags to use as tool bags. Here are some examples:

- The first example is a model tool bag fragments in display in the Liverpool Museums, UK, from the First Intermediate Period-Middle Kingdom of ancient Egypt, 2160-1773 BC made of linen shown in Fig.27 [32].



Fig.27 Model linen tool bag from the 1st Intermediate-Middle Kingdom Periods [32].

- The second example is a tool bag in display in Manchester Museum, UK, produced from woven date palm leaf fiber. It was found in Kahun (workers settlement at Fayum of Egypt) and shown in Fig.28 [33]. It was produced during the reign of Kings Amenemhat III - Sobekneferu, 1950-1802 BC of the 12th Dynasty. It has an elliptical body and single handle from the same body material secured to the top-peripheral on the major axis of the top ellipse.



Fig.28 Model linen tool bag from the 12th Dynasty [33].

- The third example is a complete tool bag from the tomb of the Architect and Supervisor Kha who served during the reign of Pharaohs Amenhotep II, Thutmose IV and Amenhotep III, 1425-1350 BC of the 18th Dynasty shown

in Fig.29 [34]. It was produced from palm leaf/fiber and strengthened by a wooden base. It is now in display in the Egyptian Museum at Turin, Italy.



Fig.29 Tool bag of Architect Kha from the 18th Dynasty [34].

9. Waist bags:

Because they were keen to increase their productivity during work, they thought to provide extra ways to store various stocks and leave their both hands free and allocated for work carrying other stocks. Waist bags come through this category as will be illustrated in the following example: Fig.30 shows a relief from the mastaba of the high-ranking Court Official Seneb who served during the reign of Kings Khufu and Djedefre, 2589-2558 BC of the 4th Dynasty. The relief depicts a scribe-team reporting to the Court Official Seneb with two of them wearing waist bags hooked to a belt around their waists [4]. The bag here may be used to keep writing tools or personal utilities and has an elliptical shape.



Fig.30 Relief in the mastaba of Seneb from the 4th Dynasty [4].

10. Load bags:

A load bag was used by the ancient Egyptians to support and secure a block of stone or a stock of sand to be used as a load. An example of its application was in a scene from the mastaba of the Secretary of the Toilet House Kaemrehu who served during the reign of King Nyuserre, 2445-2421 BC of the 5th Dynasty shown in Fig.31 [5]. The scene depicts a carpenter cutting a block of wood using a saw using a load bag at the end of a lever to ease the cutting process. The bag has a long handle designed to support the load without failure. The corners of the bag-body are rounded not to harm the user (concept used by the ancient Egyptians 4000 years before the modern machine design technology).

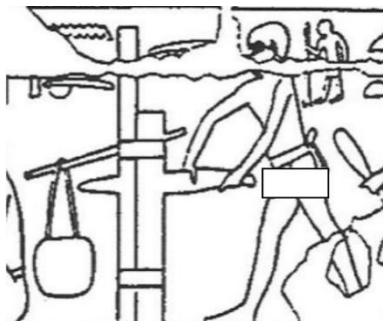


Fig.31 Scene in the mastaba of Kaemrehu from the 5th Dynasty [5].

11. Animal and Bird's bags:

All the artifacts available in the whole world support the scientific bases of the ancient Egyptian civilization. For example, if they want to transport an animal such as a hedgehog, they design a suitable bag according to the shape of its body. While to transport two birds such as ducks, they design another bag different than that of animal transportation. This was very clear from a relief in the mastaba of Vizier Mereruka who served during the reign of King Teti, Founder of the 6th Dynasty, 2345-2333 BC shown in Fig.32 [35]. The animal bag body had an almost-rectangular body, while the bird's bag has a trapezium shape depending on the shape of the transmitted body (they were so ingenious). The bags were carried by porters on their left arm-elbows and the bags had medium-length handles.



Fig.32 Relief in the mastaba of Mereruka from the 6th Dynasty [35].

III. CONCLUSIONS

- The paper presented the part 112 of this series handling the bags industry and application in Ancient Egypt during the period from Old Kingdom to Late Period.
- The ancient Egyptians authorized the use of bags through actual models put in some of their tombs, reliefs and scenes in their mastabas and tombs.
- The paper presented 11 types of bags (11 applications according to use).
- Handbags appeared during the period: 2445-1213 BC (Old Kingdom-New Kingdom).
- Back bags appeared during the period: 2278-2184 BC (Old Kingdom).
- Shoulder bags appeared during the period: 2479-1962 BC (Old Kingdom-Middle Kingdom).
- Net bags appeared during the period: 2375-1926 BC (Old Kingdom-Middle Kingdom).
- Cattle-seeds-feeding bags: appeared during the period: 1351-1334 BC (New Kingdom).
- Arrows bags: appeared during the period: 1929-1398 BC (Middle Kingdom-New Kingdom).
- Food bags: appeared during the period: 2487-1111 BC (Old Kingdom-New Kingdom).
- Tool bags: appeared during the period: 2160-1350 BC (1st Intermediate Period-New Kingdom).
- Load bags: appeared during the period: 2445-2421 BC (Old Kingdom).
- Animal and birds' bags: appeared during the period: 2345-2333 BC (Old Kingdom).
- The ancient Egyptians produced bags during the period Old Kingdom-New Kingdom using local materials such as: halfah grass,

papyrus, palm leaves, palm leaf and doum palm [36], [37].

- They designed bags with various configurations for their handles: short, medium, long, single and double.
- They designed the bags bodies with various configurations: semi-circular, circular, bowl-shaped, rhombus, right-rectangular-prism, triangular, elliptical, circular with spherical-base, elliptical with wooden-base, long-flexible, trapezium.

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DEDICATION



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- ✚ Professor of Architecture and Founding President of the Civilization Rights Institute in Virginia, USA.
- ✚ He earned his Ph.D. from the University of York and is a Fellow of the UK's Royal Academy of Engineering.
- ✚ Four decades of experience in heritage conservation, urban planning, and sustainability.
- ✚ He has led more than 35 high-impact projects across Egypt, the Gulf, and beyond, collaborating with institutions including USAID, the European Union, and UNDP.
- ✚ A prolific author of over 60 scholarly articles.
- ✚ He has held department chairs at the British University in Egypt and Mansoura University.
- ✚ Professor Rashed is the founder of the new sciences: Civilization rights and civilizology.
- ✚ This is why I dedicate this work to the Egyptian Professor Ahmed Yahia Rashed.
- ✚ Research on Automatic Control, Mechanical Vibrations, Mechanism Synthesis and History of Mechanical Engineering.
- ✚ Published more than 370 research papers in international journals and conferences.
- ✚ Chief Justice of the International Journal of Computer Techniques.
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