

The Gunpowder Factory (Gabhānah) of Mohammed Ali Athar al-Nabi – Istabl ‘Antar

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Abstract

Mohammed Ali and his administration sought to strengthen the army and built a navy and a merchant marine the first attempts at industrialization were geared towards a military industrial complex that allow Egypt to manufacture her own military hard ware and thus end reliance on foreign imports everything that had been imported was promptly copied in the new factories, which were able to turn out rifles, muskets, cannon, gunpowder and small arms in respect able quantities, so Mohamed Ali ordered to construct the Gabkhana of Ather Al Nabi in order to manufacture the gunpowder.

The aim of this study is to shed light to the importance of this monument, after all, one could say that this construction “ Gabkhana of Mohammed Ali overcame the enemies but the negligence vanquished it”. The study also aims to highlight the idea of restoring and reconstructing the structure then to connect it with social activities in accordance with huge monument.

Keywords (Gabkhana – Military constructions – gunpowder – Reusing)

Introduction

Cairo occupies an important status regarding the number of monumental buildings and the varied architectural styles such as being civil and military in addition to its historical and cultural heritage. Muhammad Ali Pasha owes great efforts especially in the military industry and its establishments which enabled him to rule Egypt independently .He ordered to build lots of constructions to satisfy his needs. Among these construction is his famous gunpowder factory “Gabkhana” which is considered the most important military construction to manufacture gunpowder and to store it as well .

This construction is located over a mountain known as the mountain of Istabl Antar. It is a magnificent location overlooking a panoramic view of (The seven domes – The excavations of Al-Fustat – The Museum of Civilization). Despite all these advantages, the area is closed and not available for visitors due to being in a bad condition especially the walls and in addition the trespassing of its neighboring *Izbat khayrallah* and its misusing in the meantime.

Industry during the reign of Muhammad Ali Pasha

His main aim was to care about the education with all its criteria as well as industry which rapidly developed in the 13th century AH/19th AD. According to the chronicles of the French occupation of Egypt, the industry was such primitive crafts especially in the second half of the 18th century AD⁽¹⁾ that was performed by craftsmen to provide people with the essential needs. However, there were no heavy crafts that need technology, only manpower or cattle were needed⁽²⁾.

Moreover, the industrial buildings were mostly small due to the small size of markets; meanwhile, the workman was working alone or with the assistance of one of his assistants. By this way, he could meet the needs of customers and local market; this process could be named as the productive units given up on request⁽³⁾. When Muhammad Ali pasha ruled Egypt, he gave his care to the rise of industry as it is mainly the second pillar of the state after education to convoy the European systems also to avoid importing the armors or military equipment. He aimed also to manage his power to be independent from any European stress or authority especially when the local materials are available and the man power as well⁽⁴⁾.

We have 2 complex for military industry : one in the citadel and the second in Bulaq (Tirsane). Al Hod-Marsud supplied 800 muskets a month, the factories in the citadel produced 3-4 cannon a month, musket factory produced over 625 muskets, various sword lances⁽⁵⁾.

In 1231AH/1816AD, Muhammad Ali started his first attempt to establish a factory of textile in Egypt at al-Khurunfish⁽⁶⁾. Consequently, he started building factories especially, the military ones to promote the Egyptian

(1) In the second half of the 18th century AD, industry was divided into three main parts; the first is connected to nutrition such as the wheat grinding, bread making, butchery, incubation laboratories, in addition to make vinegar, sugar and raisins. The second section is the types of products that connected to the cloth such as weaving, whitening of the cloths, textiles, embroidery, tannage, shoe and saddle making. The third section is the industries that connected to the inhabitation, furniture, and other economical industries.

- على الجريتلى ، تاريخ الصناعة في مصر في النصف الأول من القرن التاسع عشر، الجمعية الملكية للدراسات التاريخية ، دار المعارف ، القاهرة ، ١٩٥٢ ، ص ١٦ .

(٢) جومار ، ترجمة أيمن فؤاد سيد ، وصف مدينة القاهرة وقلعة الجبل ، ص ص ٢٥٣ - ٢٨٧ .

(3) The thing that led to a stagnancy in the status of the Egyptian economic and a decrease in the population. Moreover the decline of the political and the social systems led to a decline in the quality of production. So , it was so hard for Egypt to rival the growth of the European renaissance and technology,

- صلاح أحمد هريدي ، الحرف والصناعات في عهد محمد على ، دار المعارف ، القاهرة ، ١٩٨٥ ، ص ٩٢ .
(٤) على الجريتلى ، تاريخ الصناعة في مصر ، مرجع سبق ذكره ، ص ٢٥ .

(5) Afaf Lutfi Al – Sayed Morsot, A Short History Of Modern Egypt, Royal institute of international affairs, 1944, Vol. 62, No. 1, 1985, 1998, PP. 149-1450.

(٦) نوال قاسم، تطور الصناعة المصرية منذ عهد محمد على حتى عهد عبد الناصر ، الطبعة الاولى ، ١٩٨٧ ، ص ٣٣

industry depending on relying on foreign experts from England, France, and Italy.⁽⁷⁾ Gradually, he replaced the foreign expert craftsmen by Egyptian ones such as managers, workers, craftsmen, after being well-trained in the different fields of industry especially, working in the military factories.⁽⁸⁾ Actually, this reform was criticized by the orientalist when Muhammad Ali turned Egypt to be as industrial country in addition of being agricultural. As a result , many trials were made to undermine the local industries especially, the military ones to be totally relying on importing weapons . In this context, the French general Boyer asked Muhammad Ali to use the French military weapons instead of being manufactured in Egyptian factories, the matter that was rejected by Muhammad Ali as he decided to promote Egyptian industry by increasing number of factories and improving the quality of their products to rival that of Europe.⁽⁹⁾ For that reason, General Boyer realized the rapid development of the Egyptian industries when he visited Egypt in 1924 and he was greatly fascinated by the flourishing of the Egyptian factories saying to France “Be aware, it is a dangerous competitor and all of France and Europe”.⁽¹⁰⁾

There are three types of industries were introduced by Muhammad Ali as follow: 1-Heavy industries

2- Processing industries

3- Military industries

These types established after the Wahhabi war (1811-1819) and the establishment of the first professional organized army in the Tirsana of the Citadel. We have six gunpowder factories set in various parts of Egypt and natron lakes in the western desert yielded chemicals of fine quality easily⁽¹¹⁾.

They almost spread out all over Egypt and Alexandria; however lots of Tirsanas were established aside to the military factories. Regarding Cairo, the military factories were as follows:

- The Guest house of the citadel

(7) Dodwell, H., The Founder of Modern Egypt, A Study of Mohammed Ali, Cambridge, 1931, p. 238 .

(^٨) شارلس مري، تعريب سليم حسن وطه السباعي، تاريخ محمد على مؤسس مصر الحديثة ، مطبعة المعارف ، القاهرة ، ١٩١٨ ، ص ٥٥ .

(9)Weygend , General, Histoire Militaire de Mohamed Ali et ses fils, London, 1936, p. 195.

(10)Andrew Mc Gregor, A military history of modern Egypt: from the Ottoman conquest to the Ramadan war, praeger security international west port Connecticut, London, 2006; Pp.53-60.

(^{١١}) Ibid., p.196

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- Gabkhana ⁽¹²⁾ of the citadel ⁽¹³⁾
- Gabkhana Athar al-Nabi – Istabl ‘Antar (the topic of study)
- Gunpowder laboratory at al-Rawdah “al-Baroud Khana” ⁽¹⁴⁾
- Al-Hawd al-Marsoud or the gunpowder factory-Tafkakhana ⁽¹⁵⁾ of al-Hawd al-Marsoud.

When Muhammad Ali started the development of the Egyptian Army, missions were sent to Europe to train them the art of war. These missions were trained and educated in different foreign language. Consequently, the military books were translated from French and Italian into Arabic that were necessary for the soldiers to keep the internal security and also to build the fortresses. ⁽¹⁶⁾

The plan of the military constructions

It was a traditional plan that spread during the reign of Muhammad Ali, it was applied in schools, factories, barracks *qushlaqat* and hospitals. Their plan was almost square or rectangle with one or two floors. The buildings had paralleled roofs opened with air shafts or wind catchers for ventilation and light. They had also stone or wood minarets and shallow domes. Lord Campbell mentioned this plan before in the military factories that resembled also schools, hospitals and military buildings. Muhammad Ali constructed the Egyptian factories on the European style which had paralleled roofs

(12) Gabkhana is a Turkish word divided into two sections; the first is “Geb” which means the multisided shield, and “Khana” which means the place or house, the Gabkhana is the place where the arms and munitions were stored means the depository. Sometimes the word Gabkhana refers to the munitions itself not the depository . The word also means “the place of the gunpowder manufacturing”. For more details see:

- أنظر : صالح مجدي، رسالة ميادين الحصون والقلاع ورمي القنابر باليد والمقلاع، كتاب عسكري، ١٨٥٨/٥١٢٧٥م، ص٤٤؛ محمد لاط، منكرة لطيفة في الاستحكامات الخفيفة، كتاب عسكري، ١٨٧٢/٥١٢٨٩م، ص١٥٤؛ أحمد السعيد سليمان، تأصيل ما ورد في الجبرتي من الدخيل، ص٦

(13)The Gabkhana of the citadel is located in the south eastern part from the courtyard. It was not only built for preserving the gunpowder, but also was used for manufacturing of a certain kind of gunpowder “the black gunpowder” which is called Tangah.

(14) A gunpowder laboratory was established nearby the Nilometer on the Rawdah island. This location is an area between Gizah and the old Cairo clearly shown on the map of Egypt dated to 1868AD. It is located beside al- Qasr al-Ainy school of medicine which was established by Muhammad Ali and turned to be the Hospital of al-Qasr al-Ainy. In this street, the gunpowder laboratory was existed and became known as the street of the gunpowder laboratory till 1921AD. Later on, the Rawdah laboratory became known as the BaroudKhana means the gunpowder factory or Kharagala Khana which means the factory or the white powder laboratory. Generally, its director was a French man named Maretal.

(15) It means the guns factory, it is a Turkish word “Tafnak” or “Tofnek” means the rifle, from which the word “Tafkangi” means the rifle maker, was derived.

- أحمد السعيد سليمان، تأصيل ما ورد في الجبرتي من الدخيل، ص٥٥

(16)Menjin Felix, Histoire de L’Egypte sous le gouvernement de Muhammed Ali, Paris, 1823.

comprising one or two floors provided with a row of windows, while the roofs were also flat and polished⁽¹⁷⁾. A manuscript dated to the 19th AD century, stating rules that should be available in the military buildings, that could be the elegance, durability, and abundance. This is the art of constructing solid and beautiful buildings in the same time and the art of decorating the interior and exterior facades.⁽¹⁸⁾

The manuscript also stated three criteria of the military constructions in the reign of Muhammad Ali that could be, the regularity⁽¹⁹⁾, the unity and the simplicity⁽²⁰⁾. This manuscript also the rules of planning the military buildings that must be built in a form of workshops, separated from each other around a main construction set in order that suits the type of works going inside⁽²¹⁾.

The Planning of the military factories: We have two types of plans:-
The first: The citadel Tirsana which is a construction consists of several factories or adjoining workshops as mentioned in the manuscript.

The second: Is a rectangle or square construction with a courtyard in the center. This plan could be seen in the Gabkhana of the citadel and the Gabkhana of Athar al-Nabi- Istabl Antar. The two constructions are different in plan; the first one has almost arches that overlooking the courtyard, a style that occurred before the time of Muhammad Ali most probably was used as a laboratory of gunpowder in the Ottoman period and was reused by Muhammad Ali after making some restorations and renovations mostly seen in the arcades and the arches as well as some basins for the black gunpowder.

As for the Gabkhana of Muhammad Ali- Istabl Antar, the white gunpowder or the sunny gunpowder was produced, therefore the architect had provided the building with a vast courtyard prepared for the barrels of gunpowder after being filtered and dehydrated. The construction was also provided with a warehouse in the center of the courtyard to preserve the

(17) عبد الرحمن زكي، التاريخ الحربي لعصر محمد علي، دار المعارف، ١٩٥٠، ص ٥٠، مجلة الجيش، العدد الرابع والأربعون، المجلد الحادي عشر، ١٣٦٨/٥١٩٤٩م، ص ١٧٦، ١٩٢.

(18) محمود فهمي، المطلاع القمرية في الابنية العسكرية، مخطوط حربي، ١٢٨٥/١٨٦٨م، ص ٤.

(19) The simplicity is to give oneself away from any unwanted details in the decoration. Also it is the harmony in the dimensions of the facades to find more proportion and harmonization.

(20) The regularity is the analogy of the items in size, length, width and axis

(21) محمود فهمي، مخطوط حربي، مرجع سبق ذكره، ص ١٦.

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gunpowder in the barracks building that located in the center of the courtyard of the citadel of Muhammad Ali on Muqattam ⁽²²⁾.

Some Definitions for the Military parts of the Gabkhana:

1- Qushlaqat or Barracks⁽²³⁾ : It is a separated section derived from the idea of the *Tibaq* of the citadel in the Mamluke period. It is mainly some chambers prepared for the residence of the soldiers. There are two types of barracks according to its plan during the reign of Muhammad Ali:

The first type: is some barracks in one or some buildings adjoining each other. It is a rectangular plan comprising two floors and provided with various wide chambers with high roofs, and it has also some air shafts for ventilation and light. Each chamber could house numerous soldiers. It is provided with baths, kitchens and other compartments. This style could be seen in the barracks of Salah al-Din at the citadel.

The second type: is the Qushlaq or the barracks attached to the Gabkhana of Athar al-Nabi – Istabl ‘Antar. The Qushlaq was set outside the Gabkhana for the safety of the soldiers from the gunpowder that could be exploded. The Qushlaq or the barracks comprising one storey could be reached by a corridor and housing various chambers on the left and the right. It is much smaller in shape than the first type ⁽²⁴⁾.

The ceiling: divided into two main types:

- A- Paralleled roofed ceilings
- B- Gable ceiling which is built of stone like those in the Gabkhana of Athar al-Nabi. The ceilings were covered of shallow domes like that of the Gabkhana of Muhammad Ali. The shallow domed were used to decrease the density of the moisture and the temperature inside the building in order to preserve the gunpowder and the stores inside the Gabkhana. The ceiling is doubled and provided with shallow domes resting on stone piers, however, a flat ceiling was made above the shallow domes.

2- The cistern⁽²⁵⁾: The cistern was used in the military constructions for different purposes as follows:-

(22) أمل محفوظ أحمد جمعة، العمائر الحربية في عصر محمد علي بمدينة القاهرة، ١٨٠٥-١٨٤٨م، رسالة ماجستير، كلية الآثار، جامعة القاهرة، قسم الآثار الإسلامية، ١٩٩٩، ص ١٧٨.

(23) Qushlaq: Plural Qishla: means the barracks of soldiers instead of the tents that were rapidly spoiled. It is derived from a Turkish term Qash that means the winter place .

(24) صالح مجدي، رسالة ميادين الحصون والقلاع ورمي القنابر باليد والمقلاع، مرجع سبق ذكره، ص ٤٤ .

(25)The Cistern: A rectangular space separated by columns or piers, of various numbers in accordance with the size of the cistern. It has a ceiling in a shape of stone or brick shallow

- a) To provide the soldiers and the building with water that comes from the citadel of Muhammad Ali at Muqqattam.
- b) In the cistern of the Gabkhana of Athar al-Nabi, the cisterns have two functions; first is to provide the settlers with water, and the second is to get suitable needed amount of water for manufacturing the gunpowder salts or the white gunpowder for its filtering and purification⁽²⁶⁾.

3- The entrances

In the reign of Muhammad Ali, the entrances took the flat axis form that mainly leads directly to a corridor. This kind of entrance was used instead of the bent entrances to give more protection to the entire construction, therefore, the architect created three types of entrance according to the purpose of the building. In the Gabkhana of Muhammad Ali, the entrances were filled with various chambers prepared for the guards and to organize the access and going out process in the building. The chambers could be seen flanking entrance of the Gabkhana of Athar al-Nabi.

1- The courtyards

They were known before the reign of Muhammad Ali in a numerous of Islamic constructions, but in the military buildings the courtyard mainly located in the center of the building like that occurred in the Gabkhana of Athar al-Nabi. Stores, cisterns, and barracks were built in the courtyards especially in the forts and the military factories⁽²⁷⁾.

domes resting on stone piers. Its walls are covered with stucco, however, its floor is paving with stone tiles. The piers could afford more heaviness rather than the columns especially in the military constructions. The piers are used in the Gabkhana of Istabl Antar especially in the gunpowder store. It has shallow domes resting over stone piers. It could also be seen in the cistern of Athar al-Nabi while the builder divided the cistern into four arcades covered its roof by shallow domes and resting over four piers in the middle with cornered stony piers.

(26) صالح مجدي، المطالب المنيفة في الاستحكامات الحقيقية، كتاب حربي، ١٢٨٢/٥١٨٦٢م، ص ٢٠.
(27) عمر طوسون، الصنائع والمدارس الحربية في عهد محمد علي باشا، الطبعة الثالثة، مطبعة العدل، القاهرة، ١٩٣٥م، ص ٣٨.

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The gunpowder (*Al-Barud*)⁽²⁸⁾

Historians and travellers discussed the first occurrence of the gunpowder, and the cannons. In history, the gunpowder was firstly used in China especially in the fireworks during their festivals and ceremonies⁽²⁹⁾. The Egyptians used the gunpowder in the Ayyubid period by Salah al-Din during his wars against the crusades, and later it was used in the battle of Ain Galout, that gunpowder was put in small Naphtha pots. And also The gunpowder was used in the Mamluke period and was put in pots to act like a hand grenade and also inside the cannons.

The gunpowder chemically comprises three essential minerals; the gunpowder carbon, saltpeter, and sulfur commensurably distributed. The liter of the gunpowder is almost 840 to 845gm and produced in several shapes like gunpowder, threads, squares, tubes and slides⁽³⁰⁾.

The gunpowder had numerous sorts and types, and it is developed with the growing of the bombs, armors and guns.

The places in which the gunpowder was made in the 19th century was called the “*Baroud Khana*” also called “*Gabkhana*” means (the depository) or (the store place) or the place in which the gunpowder was preserved, especially the type that was called *the black gunpowder*. also another place that was called “*kahragalat*”⁽³¹⁾, a word to identify the place in which another gunpowder was made called the white gunpowder or the saltpeter (the salt of gunpowder).

The manufacturing Techniques in the Gabkhana and the BaroudKhana

The gunpowder was prepared through several processes that were mentioned in the manuscript of *Mulakhas Fi Fann Al-Tubgiyah*: It states the method of manufacturing through the 19th AD century. It is being produced through several processes:-

It is started by crushing, mixing, pressing, imposing, and dehydration. The powder was crushed by using wooden mortars. The mortars were set vertically between some wooden beams to slide over it. If the beams set in

(28) Sometimes it is written as Baroud which is a Turkish term, it is called Abraq in Arabic.

- أحمد تيمور، معجم تيمور الكبير في الألفاظ العامية، ج٢، تحقيق حسين نصار، الهيئة المصرية العامة للكتاب، ١٩٧٨، ص٩٣.

(٢٩) ملخص في فن الطوبجية، مخطوط حربي، ١٨٤٩/١٢٦٦م، بدون مؤلف، ص٢.
(٣٠) عبد الرازق بركات، الرسالة الفنية في تاريخ الآلات الحربية، مطبعة السعادة، القاهرة، ١٩٣٢/١٣٢٢م، ص ١٨-١٩.

(31) Singular “Kahrgalah” means the saltpeter (salt of the gunpowder), it is also named Potassium Nitrate and it is found naturally on the surface of the ground.

higher position, the mortars might be circular in shape lied in some pieces of Oak⁽³²⁾. Each mortar is 40 Kg. and slide from 40 cm high.

The process starts when some of carbon (it's carbon of gunpowder not carbon of wood) are put in each mortar with a small amount of water then to be hammered for about 15 minutes, then to add salts and sulfur. This step is applied outside the powder factory mainly inside a Moulin (the Moulins spread in the time of Muhammad Ali to grind the seeds or the dung that was used in making the gunpowder. Each Moulin was used to crush the powder and comprises 20 to 24 mortars approximately. The Moulins are known in Ancient Egypt and in the Gabkhana of Athar al-Nabi).

The powder is delicately crushed and being bolting. The three substances were mixed then moving inside the mortars for about 11 to 12 hours transferring from mortar to the other. A small amount of water was added to consolidate the mixture forming paste or disks.

The mortars were taken to other places to dry the disks, then powder was taken from the mortar and then it was broke in a riddle from leather or metal wires, then it is passing through some riddles to be a powder and then it was dried. The dehydration has two processes:

First: the natural process through the powder which exposed to air and sun on panels covered with pieces of cotton. The powder is put on cotton layers; each layer is between 5:7 ml then to be exposed to the open air from 10 to 12 minutes.

Second: It is dried by using hot air on each layer of powder (10cm thick). It is the accurate process with no side effects, whereas the amount would be 1200 kg. of powder daily. For the powder, before it is put in barrels, it is bolted once again by using riddles from hair and silk to purify the powder from the dust. This process is named "the purification".⁽³³⁾

The gunpowder which is produced from the private factories has three types; the first is the so-called hunting powder, the commercial powder, and the booby-trap powder. Each one of these types had private ratio in its manufacture then all these kinds were preserved in private barrels; each barrel could afford 50 to 100 kg. of powder .Then each barrel is put inside another barrel that is called the preserver taking in consideration the type of gunpowder, the name of the laboratory and the date of its manufacture.⁽³⁴⁾

The Charcoal of the gunpowder:

(32) A sort of wood "Qarow" or Oak .

(33) مخطوط ملخص في فن الطوبجية، مرجع سبق ذكره، ص ١٩٠.

(34) مخطوط ملخص في فن الطوبجية، مرجع سبق ذكره، ص ١٩٢، ١٩١.

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Natural materials that were produced from firing plants and trees. The charcoal is used for making the gunpowder that is coming from a special type of wood. The nut wood is used as well as the garlic wood, willow, and Roseberry. They are all light and white types of wood and have firing character if compared with the other types.

The process of making the carbon starts by cutting the wood especially in the spring times into stems about 18m thick and then they are scratched and fired as follows: The wood stems must be put in holes with walls and preserved in cast iron panels then it is put in stores like furnaces. The furnace is closed for 48 hours then the charcoal is coming out and it is put in a dry area. The carbon then is crushed to be like a powder with no smell and taste.⁽³⁵⁾

The Kahragalat or the Salt of the gunpowder

The second element after the charcoal of the gunpowder and it is used for making the black gunpowder which used for manufacturing the cannonballs. The word means the factories in which the salt of the gunpowder is made inside it.

The saltpeter is found in the organic atmosphere as the vapors to interact with a dry air. In the artificial saltpeter, debris is put as well as chemical substances to give more chemical interaction.

The saltpeter is extracted by washing these materials then the saltpeter sediment remained in the bottom of the furnace. The process is repeated daily to purify the saltpeter from any unwanted deposits. To give more purification, small amount of water is put then it is vaporized and dried. Later on, the saltpeter is put in basins then it is deliberated. This process is called “the gunpowder refining”. The next step is to use a bolter from thin metal wires to give more purified white powder then it is preserved in special barrels away from the moisture and other chemical factors⁽³⁶⁾

The Gabkhana of Athar al-Nabi – Istabl Antar

This Gabkhana is located east to Athar al-Nabi district in Old Cairo (al-Zahraa outskirt) over a mound of Istabl Antar. (Plate no 1). So, it took its name “The Gabkhana of Istabl Antar”.

The mound of Istabl Antar was known as “the observatory mound” or Gabal al-Rasd⁽³⁷⁾ which is overlooking Athar al-Nabi village from the west.⁽³⁸⁾

(٣٥) المخطوط السابق، ص ١٩٥.

(٣٦) مخطوط ملخص في فن الطوبجية، مرجع سبق ذكره، ص ١٨٦.

(37) The Arabs called the Muqattam hills by numerous names. As for its northern part, it is called “the red mountain” or al-Gabal al-Ahmar due to its red color. Regarding The cliff which located to the western side, it is called the citadel of the mountain. This is the area occupied by the citadel of Salah al- Din. The cliff that is overlooking this part was used as an observatory marsad as the Fatimid vizier al-Afdal, son of Badr al-Gamali had

It is considered the third Gabkhana established by Muhammad Ali in Cairo⁽³⁹⁾ for preserving the gunpowder after the Gabkhana of the Citadel and the Gabkhana of Al-Giushy Mountain south of the citadel⁽⁴⁰⁾.

It is founded in Safar 1244AH/1829AD.⁽⁴¹⁾ The plan suggested was 230 cubits long and 200 cubits wide⁽⁴²⁾ or 147m long and 128m wide. The suggested total area was 18816 square meters to house more than 120.000 quintal of gunpowder⁽⁴³⁾. Although being spacious, it was not sufficient enough to carry more quantities of gunpowder. The thing that caused enlarging the plan of the Gabkhana as seen nowadays a rectangular plan 181m long and 117m wide; however, the entire space is 21177 square meter (Plate no 2) . Four fortresses were built on its four sides⁽⁴⁴⁾ ; they are four square towers 11m long in each side.

The construction of Gabkhana has two storeys, the lower one is a wide courtyard centered by a small building acting as a store for preserving the gunpowder.

A huge cistern is attached to the store under the ground level for preserving the water. The upper storey comprises chambers which were once surmounted the main entrance; most of them are vanished in the meantime. The upper floor has a defensive enclosure known as “*Qadamat biyada*”. A

established an observatory there. However, his father Badr al-Gamali erected a mausoleum or mashhad there. It is known to the public as the mosque of Amir al-Giyush 478AH/1085AD(Monument No.354). This part of the mountain now is called Gabal al-Giyushi.

(٣٨) بول كانانوف، ترجمة أحمد دارج، تاريخ ووصف قلعة القاهرة، الهيئة المصرية العام للكتاب، القاهرة، ١٩٧٤، ص ٦١.

- (39) The Gabkhana of the citadel is considered to be the oldest one, it was founded by Muhammed Ali. The Gabkhana was used as a store for the gunpowder and a center of its manufacturing as well. Moreover, it even preceded the specialized laboratories for gunpowder which were widely spread all over Egypt. This building was burnt two times; the first took place in 1235AH/1819AD , it was a great fire that damaged some parts of al- Gawhara palace and The diwan or registry of Katkhuda as it lasted for a couple of days. The second fire was in 1239AH/1823AD, it caused a serious damage to some buildings in the citadel. As a result, Muhammad Ali called for the sovereign of Saloniki and brought a group of workers to restore the building. Consequently, The Gabkhana was transferred from the citadel to another place according to documents the place was nearby the mountain of al-Giyushi east to the citadel.

- أمل محفوظ أحمد جمعة، العماير الحربية في عصر محمد علي بمدينة القاهرة، مرجع سبق ذكره، ص ٢٠٠.

(٤٠) جريدة الوقائع المصرية - العدد ٤٧ - الخميس ٢٧ صفر - سنة ١٢٤٥ / ٢٩ - ١٨٣٠م.

(٤١) جريدة الوقائع المصرية - العدد السابق.

(٤٢) جريدة الوقائع المصرية - العدد ٤٧ - الخميس ٢٧ صفر - سنة ١٢٤٥ / ٢٩ - ١٨٣٠م.

(٤٣) جريدة الوقائع المصرية - العدد السابق.

(٤٤) جريدة الوقائع المصرية - العدد السابق.

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Qushlaq or barracks was once added from the outside in the southwestern side, but now in ruin.

a) The Exterior

It has mainly four façades. The main one is the north western, it measures 117m long and 7 to 10.20m high (Plate no 3). Two square towers are outstanding from the two corners of this facade; each one is 11m long. The entrance portal is located in the center of the façade while it is protruding and leads to the interior of the Gabkhana.

The main entrance is a rectangular 3.5m wide, and 4m high surmounted by a semi-circular arch. The entrance has a huge wooden door (plate no 4). The controlling room is located on the top of the entrance, and resting on four stone corbels, and it is decorated with two rectangular window openings surmounted by a relieving arch. Most of the controlling room is destroyed now and it has on roof even (plates nos 5,6).

A rectangular recess is located on the right hand side of the controlling room, whereas the left side has two rectangular recesses, both were once acting as entrances of chambers in the first storey of Gabkhana. (Plate No 7).

The controlling room is surrounded by two stone cornices known as Frinsh Carve .(plate no 8)

Numerous slits are located in the façade used for gun fire. They are getting narrower outwards and wider inwards. They are counted 33 machicoulis openings. Each tower has a rectangular slits surmounted by semi-circular arch prepared for the cannon, on the right and left of each recess has 2 rectangular machicoulis for gun fire.

The southeastern façade in its upper level has 40 machicoulis overture used for firing, while each tower has a big cannon overture resembles that in the main façade. Two slits are found to the right and left .

The southwestern and the northeastern façade are 181m long each. They are mostly similar in upper level and each one have 65 rectangular machicoulis. Each tower has a wide cannon overture prepared for the big sized cannons. Each recess has two small openings for the gun fire.

The southwestern façade in the western area has a prolonged wall leads to the barracks attached to the Gabkhana, however it is in hewn under the sweepings. The southeastern, the southwestern and the northeastern are mostly similar except for some few differences in the height between 7 to 8.10m because of the towers in the corners. The four façades are surrounded by stone cornice that is partly damaged.

b)The Interior

The entrance of the main façade leads to a rectangular hall paved in stone. The ceiling has a shallow dome resting on four spherical triangular

pendentives (plates nos 9,10). There are two rectangular recesses flanking the hall; each one leads to a small rectangular chamber 4.70m long and 9.5m wide, and the entire space is 44.65 square meters. Each chamber is paved with stone paving while the ceiling has semi-circular vault.(plate no 11)

A rectangular door recess is opened right to the vestibule of the entrance in the south portion of the first chamber. It leads to another rectangular chamber which has a rectangular recess in its southern part, it is originally leading to the courtyard of the Gabkhana. In the meantime it reaches to modern buildings built in front of it, most of them were now vanished (plates nos12, 13). The second chamber lies on the left of the entrance, it has a rectangular hole in the eastern area. It leads to another small room in the northeastern side. Those chambers were once used as a dwelling for the guards of the building .

The corridor leads to the courtyard through a semi-circular recess with a two door leafs; the right leaf has small wooden trap door *khawkha*⁽⁴⁵⁾ surmounted by small semi-circular arch (Plate no 14).

c)The Courtyard of the Gabkhana

The courtyard is rectangular in shape, it is 107m long, 158m wide while the entire space is 16906 square meters. It has a huge building in the middle of the courtyard acting as the depository for the gunpowder .

The enclosure walls of Gabkhana have recesses different in number and width according to its location, except the southern wall, which has no recesses. The northwestern has 12 recesses; six in each side on the right and left. They are rectangular semi-circular arched recesses 4.50m wide each and 5m deep. Most of them were blocked with stone walls to be in a form of small chambers. Each wall is opened by a rectangular door overture for entering aside to a small window for light and ventilation .

An external enclosure lies in front of the building and was comprised several rooms and leads to the courtyard. Some of this enclosure is ruined except for few parts. It is clearly that this wall was once roofed and was having rooms. It was extended to the northern part of the façade. The purpose of this was probably to provide more privacy to the main building and to give more protection. So the person who entered from the main door to the courtyard , should be passed from this building .

⁽⁴⁵⁾The Khawkha or the trap door is a small door, suitable for one person only .It lies within the original door of the building. It was used to facilitate the access with no need to open the original door.

- أحمد أمين، ليلي إبراهيم ، المصطلحات المعمارية في الوثائق المملوكية، ص ٤٣ .

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The western part of the northwestern façade overlooking the courtyard has a stone building added in recent times ⁽⁴⁶⁾ used for the dwelling of the guards.

The southwestern and the northeastern facades overlooking the courtyard have 30 recesses in each. Each recess has semi-circular arch and they are 4m wide each, and 1m deep.

The western part of the southwestern façade is provided with rectangular door overture once led to the outermost barracks (now blocked). The southeastern façade is free of recesses; only an external enclosure remained. (Plates nos 15,16,17,18,19,20,21,22)

d)The Gunpowder Depository

It lies in the center of the courtyard of Gabkhana. It is a rectangular plan 30m long, 95m wide, and its entire space is 2850m². It is 10m high and its southwestern and northeastern façade has 9 rectangular piers; 2.5 wide and 1.20m deep. But for the northwestern, and the southeastern facades of the depot, they are provided with only three piers. They are surmounted by a small protruding cornice (Plate no 23)

The store could be reached through a door overture lies in the northern part of the northeastern façade. It is a rectangular door overture with semi-circular arch. (Plate no 24).

The interior of the depot has mainly two sections; the first has a huge chamber for storing the gunpowder, the second is attached to a courtyard and a cistern is located underneath to be a water reservoir.

The First Section: The Gunpowder Storehouse:-

It could be reached through the previous door opening, and leads to a long corridor which is a rectangular area 33m long and 6m wide. Three window openings are found in its southwestern part and overlooking the courtyards that is attached to the depository used for cooling and lighting.

The corridor leads to a rectangular door overture covered by semi-circular arch with wooden door in the southwestern side and leads to another rectangular corridor (18m long) and has a vaulted roof. Three window recesses enhanced its northwestern wall overlooking the courtyard of the store and used for cooling and lighting .

Rectangular door opening is found in the southeastern wall covered with semi-circular arch and provided with wooden door and preceded by a rectangular basin (3m long) , (1,5m wide) and 50cm deep) ⁽⁴⁷⁾

(46) In the past, the Gabkhana was used as a guarding center for the soldiers riding camels who were mostly Sudanese. The building then became attributed to the ministry of Interior. The building was used for the cavalry up till nowadays according to a slab recording this information.

(plates nos 25,26).

This corridor leads to the gunpowder store which is a rectangular area (26m long), and (54m wide), and the entire space is 1404m. The area comprises four arcades by 27 square piers connected by semi-circular arches and covered by shallow dome (plates no 27,28) .

Four rectangular window openings are found in the southwestern and the northeastern walls and overlooking the courtyard of the Gabkhana and used for lighting and cooling. These openings are covered with iron bars.

The Methods of Storing The Gunpowder ⁽⁴⁸⁾

Several techniques were used in storing the gunpowder to preserve it from spoiling or exploding. The manuscript “The art of Artillery ” *Fann al-Tawbgiyah* described these methods as follows: The process starts by cleaning the gunpowder from the unwanted dust and then it is put in barrels; each barrel could afford more than 50 or 100 kg. Most probably the barrels were put in other bigger barrels after bolting the powder. The second step is weighing the barrels then they must be closed ⁽⁴⁹⁾. The gunpowder has hygrometric criteria and can powerfully absorb the moisture and within 8 to 10 days, it can absorb 18 amount of water in each hundreds of its weight. It must be put in dry stores which are made out of stone and built isolated from the other compartments. They have also a protection from the thunders. The ground floor is covered with wood panels free from nails. The barrels should be put far from the walls; each barrel is 100kg arranged in three rows; two rows in the middle. Other barrels are 50kg arranged in 4 or 5 rows only.

The types of gunpowder are put separately according to level of the production, the nature of the factory, place and the year of its manufacture. Each type is labeled and put in the bottom of each barrel. The store houses of the gunpowder must be opened in regular times to renew the air especially when the weather is clear and dry ⁽⁵⁰⁾.

(47) The sources are lack in mentioning any details on this basin in front of the store entrance; most probably this basin was used to carry the water or other substances to absorb the moisture and not to effect the salt of the gunpowder. The basin was paved with stucco. It probably could be reached through putting wooden panels to act like a bridge to access the gunpowder store.

(48) Actually, the sources are lack in mentioning any details on the methods of preserving the gunpowder inside the Gabkhana. A manuscript entitled “the art of artillery” or *mulakhas fann al-tawbgiyah* had stated few words on this method. However, these methods are not used yet now and they are not even mentioned in the historical sources.

(٤٩) مخطوط ملخص في فن الطوبجية، مرجع سبق ذكره، ص ١٩٢.
(٥٠) مخطوط ملخص في فن الطوبجية، مرجع سبق ذكره، ص ١٩٢ : ١٩٣

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The Second Section: The cistern attached to the depository:-

The cistern is located in the southwestern part from the depot, and could be reached through a gate in the center of the depot. It is a rectangular door overture with semi-circular arch and preceded by two flight of stony steps. The previous door leads to the cistern which is a rectangular open court 17m long, and 23.30m wide, and the entire space is 370m². The ground of the court was built of burnt brick and it represented the ceiling of the cistern from the inside. An iron measure still remained in one of its recesses to measure the level of water inside the cistern (plate no 29).

The northeastern part of the courtyard has two stone buildings:-

The first one is the spout of the cistern (well spout) which took a square shape of solid stone. A solid well appeared from inside with ten recesses on its walls, and were purified regularly. besides the spout is attached to another rectangular building of solid stone in which the water was poured which out of the cistern where there is a square small hole is found to supply the other edifice with water (plate no 30).

The second building is a rectangular building known as *doulab* and is built of hard bricks. (Plate no 31). The ground is set higher to 50cm and has semi-circular vaulted roof. A solid stone drain or a water spout is found inside, and connected to the second section of the well spout to supply the previous building *doulab* ⁽⁵¹⁾ (plate no 32).

The Interior Plan of the Cistern

The cistern could be reached through a well from some recesses inside the body of the well. (Plate no 33). These recesses lead to the interior of the cistern which is a square space 7,70m long and the entire space is 59,29m². Four piers are standing in the middle of the cistern supported by four semi-circular arches.

The ceiling is supported by four shallow domes from burnt brick. The cistern is 6.30m deep until the bottom and it is 5.30m high. The walls are built with stucco and covered with red ashes. Those are insulator substances can resist the moisture. In the meantime the cistern preserved its red color (plate no 34).

(51)This Doulab was used in manufacturing the gun powder or the salt of the gunpowder. It was known also as the white gunpowder or the solar gunpowder, whereas the potassium nitrate was put to purify the gunpowder and then it was bolting, and later it is exposed to the sun to be dried

- أمل محفوظ أحمد جمعة، العماير الحربية في عصر محمد علي بمدينة القاهرة، مرجع سبق ذكره، ص ٢٠٤.

The First Floor of the Gabkhana

It could be reached through some flight of stony steps in the northern corner of the northeastern façade. The staircase leads to the first floor of Gabkhana. (Plate no 35) which is considered as the roof of the Gabkhana in which the soldiers stand carrying their guns to protect the Gabkhana. It is known as *Qadamat biyadah*. This enclosure is 6.50m wide and directly connected to the Gabkhana from all sides except for the southeastern part (plate no 36).

The enclosure is surrounded by another protective enclosure 2.50m high provided with multiple recesses with semi-circular arches for the guns also some cannon slits. This enclosure is connected to the four cornered towers protruding from the façade. It is noticed that the ground was once paved with stone paving; few remains existed. The southeastern façade is free from any wall; it has only 40 machicouli overtures giving false impression as if it is a protective line.

The controlling room in the Main Façade

They could be reached through the previous stony staircase that leads to the first floor of the Gabkhana. It was once leading to a bent corridor with some watching rooms on its back. These rooms are now vanished; nothing exists except for some openings overlooking the main façade, in addition to some walls. The chambers were rectangular in shape 35m long and 14m wide and the entire space is 490 square Meter. It is consisting of three sections; the first is two small chambers from the southeastern part. The second is a bent corridor lies in the northwestern side and has three chambers emerging; the first and second one have two rectangular window openings whereas the third one has only one window overture. Those are the openings seen in the main façade. The previous corridor leads to a rectangular overture ended by a staircase (now vanished). This staircase was once led to the second part from the northwestern façade from which reached the enclosure of the southwestern façade.

The Barracks (*Qushlaq*) of the Gabkhana

It was once reached through two entrances; one inside the Gabkhana while the other is outside.

The first lies outside the Gabkhana from the northwestern side. An entrance was existed leading to the interior of the barracks. Although it turned into

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ruins, parts of it are now existed, and its entrance was leading to an extension of 33m long.

The second entrance that lies in the Gabkhana is in the western part of the southwestern enclosure. It has a rectangular door overture leads to a rectangular corridor 20m long and 5m wide. It is built of stone and burnt brick as for now, it has no ceiling, but most probably it was a vaulted ceiling.

Regarding the barracks, they are a rectangular space 15m long and 41.5m wide while the entire space is 622.5meter square. The whole barracks are built of gravels, and burnt brick. It is divided into two main sections; the first lies in the southwestern side, while the second lies in the northeastern side. Each section has six rectangular chambers; each one is 5m long and 3.50m wide, and the entire space is 17.50 square meters. A long corridor is separating the two sections, it is 39m long and 2,5m wide.(Plates nos 37,38)

In spite of the importance of these barracks as the third barracks or *qushlaq* after those in the citadel of Salah el-Din El-Ayyoubi at Muqattam, but unfortunately, great part of them are damaged as only the outermost walls still survived. Moreover the barracks turned to an awful space of garbage in the outskirts of Istabl Antar which is dangerous not only for the barracks but also for the district and it would catch fire and threaten the people living there.

Conclusion

There is no doubt that Gabkhana of Mohammed Ali at Stabl Antar is one of the most important military buildings, not only in Egypt, but all over the world. It is known for many of its integrated parts, which, tell the most important military industries that Muhammad Ali started to manufacture, namely the gunpowder to make weapons for his army to protect his country and expand it, besides preventing other big powers from controlling it.

Muhammad Ali began to be independent and strong. He showed this when he stopped importing a lot of industries, including the heavy ones. He issued decrees for the establishment of a lot of sites to manufacture these materials to provide supplies to meet the needs of the army in its expansions and wars, and to achieve his goals, ambitions and independence.

The Gabkhana is characterized by its wide area. It produced tremendous quantities of gunpowder, especially the white gunpowder, known as solar powder. The Gabkhana at Ezbet Khairalla has a unique site, as it is far away from populated areas, as the Pasha of Egypt issued decrees for moving it to a remote area. He also ordered that it should be reconstructed to avoid the harms that badly affected other Gabkhanas.

The building of Gabkhana is one of the most important historic places. The Egyptian cinema used it to embody important historic scenes collected from different historical eras. It was built in the modern era and had scenes from

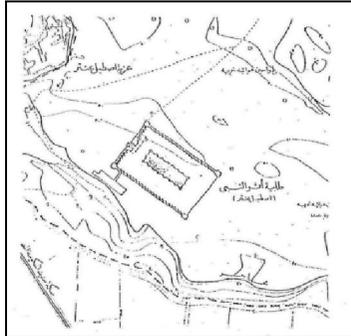
the pre-Islamic era as in the film "Antara Ben Shaddad" and the Islamic Ayoubi era as in Al-Nasser Salah al-Din. This building and these walls have had witnessed the most important industries that defeated the great colonial powers. It had also witnessed panoramas of the most important cinematic scenes of different important periods in the history of Egypt, namely, the resistance of Salah al Din against the Crusaders. The Gabkhana of Mohammad Ali represents a great historic building characterized by its wide courtyard. Besides it lies on the highest plateau known as the Zahra Plateau. It overlooks an amazing archeological panorama of civilization. Despite all these unique features, it is completely closed. We can say that it defeated the enemy, yet it was defeated by negligence.

It is a must and an ought that all governmental and non-governmental organizations should cooperate to save this building from neglect and sabotage and use it for purposes that suit the nature of the site and to satisfy the needs of the surrounding urban environment and include it in the tourism programs. Therefore, the General Administration of the Egyptian Armed Forces should give a hand to the concerned authorities for the reconstruction and enhancement of that great building. Since it is under the supervision of the classification of military architecture. It is suggested that an open museum should be established to display the fighting tools and the war machinery that dates back to the period of Muhammad Ali and his family, to complement the panorama of the Egyptian military history in the modern times and the evolution of the military industries from guns and weapons that were identical to those in Europe. This necessitates documenting this period and highlighting it to become a commemoration and glorification of the great ancient civilization of Egypt.

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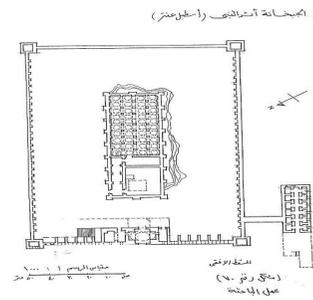
The plates

1)



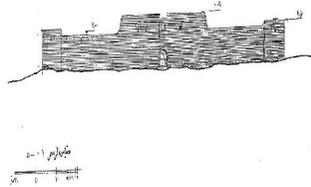
Map showing the location of the Gabkhana. Scale: 1-50000

2)



The measures and the entire space of the Gabkhana

3)



The main Façade of the Gabkhana

4)



The main entrance of Gabkhana

5)



The Controlling room on the top of the main entrance resting on 4 stone corbels

6)



7)
T



The recesses on the each side of the main façade of the Gabkhana

8)



The cornices known as the frinsh carve

Abdel Tawab. Sh

9)



10)



The ceiling of the main entrance with a shallow dome resting on four spherical triangular pendentives 11)



12)



13)



The ceiling of the small rectangular chamber which flanked the hall of the main entrance

The remains of the modern buildings on the Southern part of the Gabkhana but now vanished

14)



The small trap door which known as khawkha with semi circular arch

15)



16)



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17)



18)



19)



20)



21)



22)



15-22: the internal recesses on the enclosure walls of the Gabkhana

23)



24)



The Gunpowder depository in the middle of the courtyard of Gabkhana

The depository of the gun power from the exterior with the staircase which leading to the long corridor

25)



26)



The long corridor with three windows opening with the rectangular basin

Abdel Tawab. Sh

27)



28)



The gunpowder store with 4 arcades by square piers with semi circular arches by shallow dome

29)



The courtyard of the cistern with 2 stone buildings; the spout of the cistern and the doulab

30)



The spout of the cistern with square shape of solid stone

31)



The Doulab building

32)



The Doulab building and its clear which attached to the spout of the cistern

33)



The recesses inside of the body of the well which leads to the cistern

34)



The cistern from down

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35)



The staircases which leading to the 1st floor of the Gabkhana but now destroyed

36)



The first floor of the Gabkhana

37)



The barracks of the soldiers (Qushlaq)

38)



(The photos taken by the researcher)

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