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The Historical Aspect of Windmills Architectural Forms Transformation

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Abstract

The modern wind-power engineering is one of the perspective directions of using ecological clean energy in the building. The article deals with the historical aspects in the transformation of the windmill's architectural forms, structures and their elements, which intend to convert wind's energy.

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1. Introduction

The modern wind-power engineering is one of the perspective directions of using ecological clean energy. Renewable energy sources used to ensure energy supply can be considered to be an upcoming trend for civil engineering [1-10]. The article deals with the historical aspects in the transformation of the windmill's architectural forms, structures and their elements, which intend to convert wind's energy. Along using of water power for the rotation of mills' water wheels, from ancient time people used to wind power for sailing. These two ideas had deep combined, forcing the wind to rotate the grindstone in the arid steppes of Asia or in the Middle and Near East (presumably in Persia) around the VII century BC. So, vertical shaft with sails based on the millstones which turned when the wind blew. Wheat or barley was milled with such simple windmills, as well as water was pumped out of

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the ground. The transformation of the windmill's architectural forms has been occur depending on social needs, the development of science and manufacturing processes and natural environment [11-22].

2. Historical Evolution

In general, there are two versions about the time of the windmill appearance (according Ph.D. Ponomarev N. A. [23]. One of them is very often expressed by many authors the windmill was invented in the Middle East, in Asia Minor, and from there entered Europe by the Crusaders. According to another version, the windmill is a European invention, appeared in the XII century or even in the XIII century.

If a post-mill had been brought to Europe by the Crusaders from Asia Minor, and about it only as we shall see, can be a question, it means that it existed in the East, at least in the IX - X c., because the Crusades campaign began in 1096. [23]

Arab geographer al-Masudi wrote about the windmills existence in Persia, who saw them in the Persian province Sistan between 915 and 943: "Sistan is primarily known as a country of wind and sand. It is known for own art using to rotate the wind mills and lifting water from wells for irrigating the gardens." The fact that the appearance in Persia in the VII century the most primitive windmill was possible, almost unquestioned. At this time, the state of the productive forces in the country was at a high level: early feudal relations formed in the VI century in Persia.

Everywhere in the states of Western Europe and Asia Minor a watermill were familiar and enjoyed. Therefore the primitive windmill could well appear in the countryside with poor water resources [23]. Arab travelers and geographers in the middle of tenth century wrote about the existence of windmills in Sistan as well as the indisputable fact. Abu Ishaq Istakri wrote: "The land around the city is deserted and sand. The air is very warm. Figs are growing here; no hills. There is no snow in the winter. Winds blew and therefore they have windmills. [24]. There are several mentions of windmills in Persia. But the most important is the description Sistan's mills and their extremely valuable drawings are in Arabic manuscripts Dimashqi Shams al-Din Abu Abd Allah Muhammad (about 1271) (Fig. 1) [23]. There is description in these manuscripts:

"Sistan has an area where frequent winds dominate and there is a lot of sand. People use the wind to rotate the mills and to move sand from one place to another, so winds subject them... They build a tall building as a minaret, or choose a high place or city tower. Here they build one building over another. There is mill in the upper building in which rotates and grinds grains. Wind wheel is built on the ground floor, rotating by wind. In this case mill on the upper floor also rotates. Whatever the wind is blowing, such mills are rotating, despite the fact that there is one millstone. ... After the construction of the two buildings, as shown in the figure, it is necessary to make four loopholes in the walls on the ground floor... The widest part of it should face outward, and the narrow part is inside; thereby a passage is obtaining for air through which it penetrates into the building with great force.

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