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## **TESLA'S WARDENCLYFFE TOWER HISTORY**

**Summary.** *The paper studies the scientific research by Nikola Tesla in Wardenclyffe in 1900-1917. The author considers the scientist's patented inventions, discloses the principles of the Wardenclyffe Tower, and the role of N. Tesla in the study of electricity.*

**Key words:** *investments, radio, research, technical specifications. wireless communication.*

**Introduction.** The project of N. Tesla in Wardenclyffe was far ahead of time. However, skeptical people were totally opposed to the first full-scale tests of the resonator tower on June 15, 1903. The tower, designed by N. Tesla, was named after James Warden, a Western lawyer and banker who acquired land, where the scientist subsequently implemented his ambitious plan. The entrepreneur supported the Tesla project, believing that this communication transmission system would boost the development of Radio City. For this, he allocated 200 acres of land.

The relevance of this study is that at the moment, the scientific heritage of N. Tesla undergoes revision and many of his inventions are used in modern technologies. The **subject** of the study is the implementation of the project of the Wardenclyffe Tower. The **object** is factors that made this project cost-ineffective. The **objective** of this work is to disclose the reasons that predetermined the economic failure of the Tesla project. The **tasks** of the work are to find out the implementation conditions of the project, to reveal the areas of scientific research by N. Tesla, and to describe the process of investing in the Tesla project.

The **source base of the work** includes letters, patents, and an autobiography of Nikola Tesla. The historiography of the study includes the works by Johnston, B., Cheney, M., Uth, R., Glenn, J.

To solve the tasks posed in the work, we used the **historical-genetic method**, which includes a sequential disclosure of the features, functions, and changes of the studied reality in the process of its historical course, which allows us to reproduce the real history of the object more accurately.

**Discussion.** In 1900, in Long Island, near New York, Tesla began to build a world-wide transmission station, which he had never completed. This experience, better known as the Wardencllyffe Project, was funded by American magnate - J.P. Morgan.

The scientists stated the essence of this project in twelve items, which completely anticipated the basis of the technical and process network adopted today in the world of telecommunications. It was the basis of modern universal information systems. In his letter to Morgan, Tesla wrote: "My planned invention is not a simple, ordinary wireless long-distance information transmitter but rather the transformation of the entire globe into a sentient being, which indeed it is, able to feel in all parts and through which a thought sparkles like through a brain..." [Johnston, 1982: 39]

Tesla tested his transmitter on July 15, 1903, exactly at midnight. New Yorkers attended that night the attraction, demonstrating the technological future of the whole world. A dazzling sparkling flame of electric plasma a hundred miles in diameter connected the spherical dome of the machine with the sky. Tesla described the essence of his invention in the book "My Inventions" and partially in one of the patents. This book helps understand the essence of the experience from his words: The date I shall never forget – when I obtained the first decisive experimental evidence of a truth of overwhelming importance for the advancement of humanity. A dense mass of strongly charged clouds gathered in the west and towards the evening, a violent storm broke loose which, after spending its fury in

the mountains, was driven away with great velocity over the plains. Heavy and long persisting arcs formed almost in regular time intervals. My observations were now greatly facilitated and rendered more accurate by the experiences already gained. I was able to handle my instruments quickly and I was prepared. The recording apparatus being properly adjusted, its indications became fainter and fainter with the increasing distance of the storm until they ceased altogether. I was watching in eager expectation. Surely, enough, in a little while the indications again began, grew stronger and stronger and, after passing thru a maximum, gradually decreased and ceased once more. Many times, in regularly recurring intervals, the same actions were repeated until the storm, which, as evident from simple computations, was moving with nearly constant speed, had retreated to a distance of about three hundred kilometers. Not did these strange actions stop then, but continued to manifest themselves with undiminished force. Subsequently, similar observations were also made by my assistant, Mr. Fritz Lowenstein, and shortly afterwards several admirable opportunities presented themselves which brought out still more forcibly and unmistakably, the true nature of the wonderful phenomenon. No doubt whatever remained: I was observing stationary waves [Tesla, 1904].

Let us consider in more detail the technical specifications of the potential process. The starting point of our discussion is Tesla's patent for a wireless long-distance electric power transmitter. The patent describes clear process parameters of the device. There are several of these parameters: 1) the length of the wire in the machine from the ground point to the point of the top capacitance is an odd multiple of a quarter of the wavelength of the master oscillator; 2) the circuit pumping frequency is not higher than 20 kHz, preferably lower, which contrasts sharply with the parameters of early experiments where Tesla used frequencies of about 200 kHz - the reasons for this return to low frequencies will become clear below; note that the vast majority of enthusiasts exploring the Tesla tower ignore the fact that the required frequency of the circuit, according to Tesla himself, is below 20 kHz, which does not allow such researchers to come to the correct conclusions or

practical results. Tesla expressed this idea in the journal «Electrical World and Engineer»: «I noticed several times that my instruments were affected stronger by discharges taking place at great distances than by those nearby. This puzzled me very much. What was the cause? A number of observations proved that it could not be due to the differences in the intensity of the individual discharges, and I readily ascertained that the phenomenon was not the result of a varying relation between the periods of my receiving circuits and those of the terrestrial disturbances. One night, as I was walking home with an assistant, meditating over these experiences, I was suddenly staggered by thought. Years ago, when I wrote a chapter of my lecture before the Franklin Institute and the National Electric Light Association, it had presented itself to me, but I dismissed it as absurd and impossible. I banished it again. Nevertheless, my instinct was aroused and somehow I felt that I was nearing a great revelation.» 3) the duration of pumping is such that the light during one series of pulses of the generator must have time to run to the opposite end of the globe, and return, however, it is not known whether this statement is speculative based on the idea of resonance of currents throughout the planet, or Tesla obtained this condition from his experiments[Tesla, 1904; Martin 1997: 44].

In the column headed “Tesla's sparkling scares” and “But he does not want to share us the essence of his experiments with the machine”, the ‘New York Sun’ newspaper the next day announced that “... neighbors living near Tesla’s laboratory in Long-Island are highly intrigued by his experiment with wireless transmission. Witnesses said that last night they saw an unusual phenomenon, including flashes of lightning of different colors, produced by Tesla, then ignited parts of the atmosphere at different heights at a rather large surface, so that night turned into day... it happened that all the air for several minutes was filled with sparkling electricity concentrated on the surface of human bodies, so that everyone present shone with an eerie light blue glow... and we all looked like ghosts...” [Cheney, Uth, Glenn 1999: 95].

In his interview on July 17, 1903, to the already mentioned New York Sun, Tesla exacerbates the secret: "People who were so amazed at my experiments two days ago and who were more awake than slept in the past two years could see truly incredible things. Someday, but not now, I will announce something that any fairy tale has never described." [Cheney, Uth, Glenn 1999: 101].

After an unusual night, when his discoveries lit not only the sky over New York but also over the vast territory of the Atlantic Ocean, in 1905, Tesla suddenly, for no apparent reason, left his laboratory, leaving everything untouched inside. Many believe that research ended together with funding, accusing Morgan of stopping financial assistance precisely when Tesla reached the peak of his scientific strength when it was necessary to complete and launch the invention. [Johnston, 1982: 54].

Tesla himself in his autobiography "My Inventions" explains this in a completely different way. "Despite the gossip of the world, Morgan had fully met his obligations to me. My project was postponed due to natural laws. The world is not prepared for it yet. It was too ahead of its time. But the same natural laws "will eventually prevail, and the project will be repeated. It will be a triumphal success." [Johnston, 1982: 55].

**Results.** Nikola Tesla created a truly outstanding invention, which would be explored for many years more. However, based on the words of Tesla, one can understand that many of his brilliant ideas cannot yet be discovered to the world because humanity is not yet ready for such progress. Tesla himself expressed the value of his experiment with its intrinsic philosophical meaning.

**Conclusions.** The Wardenclyffe Tower can be called the first device in the world that could provide humanity with wireless communications at the beginning of the XX century, however, due to the violent reaction of people, Tesla had to hide his secret from everyone. Nevertheless, in the course of our study, we found some unhidden facts, and many details of its device are known. It can be fully characterized as a state-of-the-art device.

### **References**

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