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Receptivity of Nikola Tesla's works in Romania

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Abstract – We have examined the receptivity of Nikola Tesla's personality and works in the Romanian scientific literature, by considering only the works of general significance (scientific and technical dictionaries, encyclopaedias, lexicons and books of main publishing houses). In most cases we can conclude that Tesla's work was correctly presented, by underlining its scientific and technical priorities.

Key words – Tesla, Romania, inductive motor, Tesla's coil.

I. INTRODUCTION

Being one of the most brilliant world scientists and inventors, Nikola Tesla has left a visible trace in world's scientific patrimony. The receptivity of Tesla's works in Romania, directly or indirectly, i.e. by pointing out his achievements, with or without explicitly indicating their name, occupies an important place. Obviously that in Romania, as well as in other countries, the perception of the value of Nikola Tesla's results is changing in time, due of the fact that some of his scientific ideas and results (which were a long time misunderstood or contested) receive new and unexpected dimensions. In this paper we will try to present a partial (and limited, because of the extent of Tesla's scientific opus) section of the receptivity of the works of this real genius of modern science, whose many ideas were "so far in front of their time". Some of those ideas have even today this characteristic. Because of the limited space we are forced to refer only on the books of general interest written by *Romanian authors*, which are scientific and technical dictionaries, encyclopaedias and lexicons, containing the "kernel" of the science. The reason is simple: Tesla's works are so widely distributed that any serious scientific student course paper or book of physics, electrotechnics, radiotechnics and telecommunications, even a generic technical book (especially those which have been translated from foreign languages), contain some of Tesla's achievements (Tesla's coil, Tesla's currents, the rotating magnetic field, elements of teleautomatics).

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Even if in many cases, the source of these ideas (because of the space limitation) is not explicitly specified. In many specialized books the names of different scientists or inventors generally are not presented. So, the simple enumeration of these books is practically impossible, in the frame of the present paper.

II. TESLA IN ROMANIAN ENCICLOPAEDIAS

By their works and patents, Tesla has definitively entered in the world history of scientific discoveries. Alexander Hellemans and Bryan Bunch have included three Tesla's inventions (the electrical alternator – 1884, the induction motor – 1888, Tesla's coil – 1891) in their book "*The Timetables of Science*" (which was translated also in Romanian [1]).

In one of the oldest encyclopaedic books edited in Romania, „*Minerva – Romanian Encyclopaedia*“ [2], at page 916, we can find 14 lines dedicated to Nikola Tesla (the book is printed on three columns, which is a characteristic template for these kind of books), stating that he is an electro technician of Serbian ethnical origin and that he lives in America. The editor of this text was most probably prof. dr. eng. Augustin Maior, the head of the Institute of Theoretical and Applied Physics in Cluj, who has also performed researches on the simultaneous transmission of telegraphic signals by help of alternative currents of high frequency.

More allocated space (36 lines at a page of three columns, as well as a photography - portrait) about Nikola Tesla we can find in the „*Romanian encyclopaedical dictionary*“, edited in 4 volumes [3]. The editors for this part were academicians Remus Radulet and Serban Titeica. At page 650, besides the years of birth and death, it is specified that Tesla was an electro technician and inventor of Yugoslav origin. His main inventions are also enumerated there. On the next page, for the word *tesla* (as the magnetic induction measure unit), besides the explanation, it is specified that the name was given in honour of Nikola Tesla. In the „*Little encyclopedical dictionary*“ [4], in its revised and completed edition, at page 1763, beside a photography, in 8 lines we can find that Nikola Tesla was an "American inventor of Yugoslav origin. He has works in the fields of electro techniques, techniques of high voltages and radio techniques (the asynchronous motor bearing his name, the high frequency generator, and the systems for radio communications). He has projected the hydro-electric power plant on the Niagara".

A very important appreciation of Nikola Tesla's achievements can be found in the "*Chronological Dictionary of World Science and Technics*" [5], where Tesla's name appears 12 times, on many pages. In the name index, at page 741, we can find the name TESLA, Nikola (1856-1943), as well as the page numbers: 75, 76, 78, 422 – 424, 435, and 436. In the section "Science and technics in the second half of XIX century", where the most important realizations in the science and techniques are time-ordered, and in the brackets the sections in which these realizations are detailed are indicated, the following Tesla's inventions are given: "1885 – N. Tesla elaborates the two-phase electric motor (III 3 a); 1890 – N. Tesla discovers the telegraph with harmonic signals (III 3 b); 1897 – N. Tesla receives the patent for the excitation of the emission antenna (III 3 b). In Chapter "III 3 a Electrotechnics", the authors C. Neuman and C. Voith, give the following assertions connected to Tesla: "1882 – The American engineer of Yugoslav origin Nikola Tesla (1856-1943), in USA and, independently of Tesla, the Italian engineer and physicist Galileo Ferraris (1847-1897), discover the rotating magnetic field"; "1885 – N. Tesla elaborates the two-phase electric motor and predicts the possibility of elaborating a poly-phase machine"; "1891 – N. Tesla invents the transformer for obtaining the electric current with high frequencies and high tension, which is called by the name of Tesla („Tesla's coil“)"; "1893 – N. Tesla installs, at the First World Exhibition in Chicago, the first electric power station, whose work was assured by the alternating-current machines".

In Chapter „III 3 b. Telecommunications (Telephone, Telegraph, Radio, Television)", whose authors are Edmond Nikolau, N. St. Mihaileanu and C. Voith, Tesla's contributions are pointed out four times: „1890 – The American electrotechnic engineer and physicists of Yugoslav origin Nikola Tesla (1856-1943) has invented the telegraphy with harmonic signals, which are produced by rotating electric generators"; „1897 – N. Tesla receives the patent for indirect excitation of the emissional antenna"; „1898 – N. Tesla invents and receives the patent for the first model of boat directed by radio, thus registering the beginning of teleautomatics. Since 1893 Tesla has been communicating his idea about the transmission of information by the help of electromagnetic waves, without the conductor of electricity"; „1900 – Ducretet experimentally researches the possibility of „telluric telegraphy", which is characterized by the fact that electrical currents are transmitted through the earth, whose electrical conductibility has been established by the German physicist Karl A. Steinheil (1801-1870) in 1837. This possibility was also examined by Tesla."

As we can see, by his presence on 8 pages in the above mentioned "*Chronological Dictionary of World Science and Technics*", Tesla is placed in the "golden center". Let us note, from the point of view of this dictionary, a comparison with some well-known world scientists and inventors, contemporary with Tesla, or his correspondence friends. In alphabetical order they are: Edwin Howard Armstrong (1890–1954) – on 8 pages, William Henry Bragg (1862-1942) – on 6 pages, Arthur Holly Compton (1892-1962) – on 4 pages, Gottlieb Daimler (1834-1900) – on 10 pages, Thomas Alva Edison (1847-1931) – on 20 pages, Albert Einstein (1879-

1955) – on 18 pages, Heinrich Rudolf Hertz (1857-1894) – on 9 pages, Guglielmo Marconi (1874-1937) – on 14 pages, Robert Andrews Milliken (1868-1953) – on 6 pages, Michael Idvorski Pupin (1858-1935) – on 2 pages, Wilhelm Conrad Röntgen (1845-1923) – on 6 pages. Excepting Daimler and Edison, all above mentioned are physicists laureates of the Nobel prize, which have great contributions in the scientific fields in which also Tesla has been working (especially in the fields connected with the electricity). As we can see, in their position of candidate for the Nobel prize (it is well-known that Tesla was nominated for the Nobel prize for physics in 1915, together with Edison, but he declined this nomination) Tesla was placed in front of many laureates of Nobel prize, due to the importance of his diverse researches. This also consists a specific acknowledgement of the results of our great scientist.

In a book which presents the most important personalities of world science, "*Personalities of Science – A Small Dictionary*" (Editor in Chief Carmen Zgavardici) [6], as we can find, Tesla is considered as having a prominent role in the world science development. At page 284, in 16 lines (the book has a medium format, with the text printed on two columns), the following text is printed about Tesla: "TESLA, Nikola (1856-1943), American inventor of Yugoslav origin. Works in the fields of electrotechnics and radiotechnics. He discovered simultaneously and independently of G. Ferraris the rotating magnetic field, elaborated the two-phase alternating electrical system and researched the high frequency currents. He constructed the first two-phase alternating engines, alternating-current dynamos and high-frequencies electrical transformer. Researches in the field of nuclear fission by high-voltage electrostatic generators." Differently from the earlier book [5], in [6] Tesla is considered, even if only partially, as the first scientist who has discovered the rotating magnetic field. In the world science history this fact has been established for a long time, in almost all student's books and manuals (see, e.g. [7]). This position is a consequence of important and serious references, which the authors of this book have used: Encyclopaedia Britannica, Grand Larousse enciclopedique, Encyclopaedia Americana, World Who's who in Science, Bolshaya Sovetskaya Encyclopaedia, McGraw-Hill Modern Man of Science. Undoubtedly that in these books this position is sustained. We mention "en passant" that another Serbian-American physicist, Michael Idvorski Pupin, is also presented in these books [5] and [6]. In the "*Polytechnics Dictionary*" which has two editions (1957 and 1967), in the first edition, as well as in the second, revised and completed [8], Tesla is presented on 4 lines in the chapter "Technicians, inventors, scientists which have contributed to the development of technics" (page 1045): "Tesla, Nikola (1856-1943) – Croatian physicist. He dealt the problems of alternating-current generators, the study of electromagnetic waves and so on".

III. TESLA'S PRESENCE IN FUNDAMENTAL SCIENCES

Tesla's name also appears in some books of fundamental sciences, written by Romanian authors. First of all in physics, where are treated subjects like: rotating magnetic field,

electrical motors, currents of high frequencies and, naturally, the unity of magnetic induction *tesla*, the name of Nikola Tesla appears explicitly. We will give only a few examples. In the book “*General Physics IP*”, (its author is a prominent Romanian physicist Alexandru Cisman [9]), at page 437, when referring to the magnetica induction unity, in the footnote is written: “It was proposed that this measuring unity to be named *tesla* (Te !?), in honour of the scientist Nikola Tesla (born in 1857 (!?)), of Yugoslav origin, which emigrated in America”. We will point out that this book has been printed in 1960, i.e. in the same year when at XI General Conference of Measures and Weights have been accepted 27 of 33 measurement units of the International System of Measurement Unities (SI) [10]. So, we can consider adequate the above formulation in this book. As a fact, in Romania the use of the International System of Measurement Units (SI) became compulsory as of 1st January 1971 in all technical documents, books, and also in school books [10]. So, beginning from this date Tesla’s name, even if only through the unit of magnetic induction, entered compulsory in all technical and scholar books. More comprehensive about Tesla we can find on page 457, in the chapter „Oscillatory discharge“. The author explains in detail the experiment connected with the Tesla’s currents in which the oscillatory discharge generates alternating-currents with high frequency and high voltage (a few hundred thousand volts). Their frequency depends on the capacity and inductivity of the oscillant circuit. A photo representing the experimental device is also inserted: Fig. 278. *Tesla’s experiment*. The explanation of this experiment is also inserted: „These high currents, which have been examined by *Tesla* (and, in the footnote: *Nicolae Tesla* (1856-1943), Serbian physicist, who has emigrated in America), are not dangerous and have applications in the medical therapeutics, because the high frequencies do not have any physiological effect besides the heating of the tissue through which these currents pass“. In the book “*General Physics IP*” [9] Tesla’s name appears again on page 495, in the chapter “Alternating-current motors”. It is pointed out that “the rotating magnetic field principle has been formulated by *Ferraris* in 1888 and applied by *Tesla* in the same year”.

As we can see, in the Romanian specialized literature there are many oscillations regarding the priority of the discovery of the rotating magnetic field between Tesla and Ferraris. It is possible that this fact is a consequence of using different reference sources. Besides this, in this book (although very correct from scientific point of view) we observe series of inconsistencies regarding Tesla’s given name and also regarding his birth year or his ethnical origin.

Another book from the category of Romanian authors in which Tesla’s name is mentioned as important is “*The History of Physics*” [11] (its author is Professor Valeriu Novacu). This book contains the authors’ lectures at the Physics Faculty of the Bucharest University between 1962 and 1964. In the chapter “Revolution in physical sciences (1895-1917)” he says that, among other things, the basis of this revolution has been set by the discovery of telegraph, telephone, electric lighting, as well as the production of dynamos (Gramme, Siemens (1879), Wheatstone, Edison (1880), Desires (1881))

and electrical motors (Tesla (1887), Dolivo-Dobrovolski), transformers (Usagin and Hollard). Implicitly by this assertion Tesla’s role in the releasing the beginning of the great development of physics at the end of XIX and beginning of XX century has been recognized.

Certainly that Tesla’s name and realizations are also evinced in other books of Romanian authors, not only in the field of physics, but also in the electro-techniques. We give only an example, a fundamental book from this field, “*Electrical devices*” [12]. In this book the names of scientists and inventors are given only in an appendix: “Historical development of the electrical machines and transformers” (pages 509-512). Tesla’s name is given here twice, in connection with synchronous, respectively induction motors: “1887 – Yugoslav N. Tesla licenses the two-phase induction motor”. Unfortunately, in the “*Dictionary of Physics*” [13], even if the notion *tesla* is explained, as the measurement unit, the origin of this word is not indicated and also Tesla’s name does not appear. A possible explanation may be in the fact that this book is small (501 pages, in small format), and so, only the names of Romanian great physicists or the foreign physicists - laureates of the Nobel prize are inserted. Also, this dictionary does not contain the concepts of rotating magnetic field, high frequency and high voltage currents and so on.

IV. BOOKS ABOUT TESLA

As we had the possibility to establish, the Romanian libraries do not have many books about Tesla or translations of his works. As an example, in the Central Library of the West University of Timisoara (Romania) we found only 5 books about Tesla’s creativity (in Serbian language, maybe these books are donations from the Nikola Tesla’s Museum of Belgrade), as well as 2 books (in French and Russian). The Russian book is also translated in Romanian [14] and can also be found in other libraries. Some years ago, a book called “*The Romanian Extra-terrestrial – Nicolae Tesla*” [15]. As we can see just from the title, the purpose of this book is primarily to demonstrate the Romanian (Istro-Romanian) ethnical origin of Nikola Tesla and, consequently, his given name is written in Romanian, as *Nicolae*. But the author does not presents any serious arguments to endorse this hypothesis. So, we will not pay much attention to it. Let us only notice that in the last years, in some newspapers in Romania (it is true that their number printed and circulation area are limited) have appeared some articles in which the same hypothesis about the ethnical origin of Tesla has been attacked (also without any serious arguments!). Referring to the above book [15], excepting the assertion about Tesla’s origin, we can see that from the scientific point of view it is very well-informed, containing many information and facts, obtained also from the Internet. We don’t know which were the real reasons of the intentions to buy up the Tesla’s ethnical origin (and, as a consequence, the different method of writing their Christian and family name) and so we will not to polemize on this subject. In the elaboration of this paper, in accordance with our earlier certitude, we have started from the fact that the Serbian ethnical origin of Nikola Tesla *is indubitable and demonstrated with strong arguments*, and so, any new interpretation and “discovery” is useless.

V. TESLA IN SERBIAN JOURNALS IN ROMANIA

It will be useful to point out that the journals in Serbian language in Romania have published some articles on the occasion of different Tesla jubilees. We will present only a few examples of our contribution to this subject. On the occasion of 25 years from Tesla's death, in our Serbian journal from Timisoara („Justice“), has appeared an article entitled „Nikola Tesla – pioneer of electrotechnics“ [16], while with on the occasion of 50 years from Tesla's death, in our Serbian journal from Timisoara („Our Word“), a series of articles about the Tesla's life and activity have appeared [17]. As a consequence of a mini symposium which some personalities from Belgrade together with their hosts from University “Politehnica” of Timisoara have held on 11th of March 1994, in the Serbian journal from Timisoara “Literary Life” the article “Tesla's Scientific Patrimony” has been published [18]. In the same year, in the “Literary Life” has appeared the article “Similitude and Differences (in the life and works of Michael Pupin and Nikola Tesla)” and the author's interests for these two our great scientists was pointed out also by a conference paper in Novi Sad [19]. With little differences, the paper [17] was reprinted in “Literary Life” with the occasion of present year Tesla's jubilee [20], while the some new example is a series of articles by writer Ivo Munčan, in „Our Word“ [21].

CONCLUSIONS

The aim of this paper was to present, even if partially, the manner in which the works of the great Serbian-American scientists and inventor Nikola Tesla have been received in the Romanian scientific and technical literature. Because of the limited space, we have examined only the books of main importance like scientific and technical dictionaries, encyclopaedias, lexicons and books of important publishing houses. A possible conclusion is that, generally, in the majority of cases, Tesla's works were correctly received and presented, by pointing out their scientific and technical priorities. However, some inconsistencies exist in the presentation of Tesla's ethnical origin, being written that he is an American scientists of Serbian, Croatian or Yugoslav ethnical origin (extremely, of Romanian or Istro-Romanian). Some inconsistencies appear even in the determination of Tesla's profession: it is written that he was only an electro-technician (electro technical engineer), only an engineer and inventor, only an electro-technician and physicists and now and then only physicist. Among Tesla's inventions, the most indicated are: the two-phase induction motor, asynchronous motor, high-frequencies generator (transformer or Tesla's coil), the excitation system for the emission antenna, the rotating magnetic field, telegraph with harmonic signals, the system for wireless communications and, of course, the unit for magnetic induction. Some of the consulted books give a different priority over the discovery of rotating magnetic field between Tesla and Ferraris. We have considered as useful to insert also the articles which have been appeared in the journals in Serbian language in Romania. Even if these journals have a limited area of readers in Romania (because of

the Serbian language); we consider that these articles can contribute to better perception of the life and work of Nikola Tesla.

Finally, we will to point out that for such type and size of paper it was impossible to entirely cover the perception of Tesla's scientific work in the specialized scientific and technical literature in Romania. It is was impossible to insert all editions (encyclopaedias, dictionaries, books and newspapers) in which Tesla's name, works and results are mentioned. We have referred only on the editions which we have considered as being representative and, of course, which we have found in libraries or particular sources. This approach opens an interesting research task: the necessity of elaborating the bibliography of Tesla's works and works about Tesla in Romanian libraries.

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