

Nikola Tesla's Patents Essence of Patent Protection shown in the example of Nikola Tesla's Patents

Tanja Milović, Ljiljana Kuterovac

State Intellectual Property Office of the Republic of Croatia, Zagreb, Croatia

Nikola Tesla is indisputably one of the greatest minds of technology and science of all times.

He dealt with inventions from his early childhood, having the model and support in the environment in which he lived.

After having finished his schooling in Karlovac, Graz and Prague, and while working in the Telegraph Office in Budapest, Tesla created many inventions in the field of turbines and telegraphy. At that period, he didn't protect his inventions by patents.

Coming to the USA in 1884, Tesla soon realized advances of the protection of inventions by patents, a mechanism which would enable him to present his enormous scientific and technological potential, to transfer such knowledge to the public, and to "put to life" his capital inventions intended for humanity.

Tesla's rich technological and scientific contribution resulted in 112 US patents, and several re-applications in various countries, e.g. in Great Britain and Canada.

The course of Tesla's life shows that his first priority was to work for the welfare of humanity and to allow the use of information contained in his patents for further technological development.

Tesla knew that his achievements had been used for further development of particular technological fields, not showing intention to prohibit it.

The timelessness of his inventions became evident in the course of time. Many new fields of human technology were developed owing to Tesla's ideas.

Development of particular branches of technology based on information contained in Tesla's patents, as well as economic and social usability of the same can be observed.

Many people took advantage of his ideas in various ways. It was proved beyond any doubt that some of his patents were "re-invented".

Deficiencies of patent protection system of that time made possible the infringement of Tesla's patent right in the Marconi case, who "re-invented" a radio.

Tesla's life and his achievements are the best example of the path starting with the idea and vision and leading over an invention to a patent. The chronology of his patents demonstrates all the advantages of the patent protection, and possible infringements of the inventor's right conferred by a patent.

Nikola Tesla's Patents

Essence of Patent Protection Shown in the Example of Nikola Tesla's Patents

Introduction

When dealing with any of the subjects related to Nikola Tesla, one could hardly separate his life from his inventive work. His life was completely dedicated to his constant interest in primarily the field of electricity, and other related fields. To Tesla, disciplined, as he was, ingenious, dedicated and exceptionally educated, the work and inventions represented the essence itself of the life. His mission was to "take" as many laws of the nature as possible from the nature and give them to the humanity.

The relationship between Tesla's inventive work and patenting of inventions was unbreakable most of the time in his life. Not taking into account his inventive contribution before his departure to the USA, and periods in which he didn't have his own laboratory, where he could realize technically his inventions, the majority of his inventions were protected by patents.

Other Tesla's inventions have been partly saved in the notes taken at his lectures, articles published in various scientific and popular journals and famous "birthday parties addressing" to the public, in which he presented plans for his future research and his visions of the development of particular technological fields.

According to a fairly strong but never completely proved indications, it is presumed that a part of Nikola Tesla's inventions has been deposited in the manner that they are not available to the public. However, from his personal correspondence it may be concluded that this inexhaustible genius was working on new inventions covering various fields to the end of his life.

It can be said that information contained in Tesla's patents are the only information that are available in their entirety to the general public, in particular nowadays, when searches of electronic data bases containing patent documents are widely available.

Development of the Patent System

To be able to completely understand the essence of patenting of inventions and the circumstances under which it is carried out, in the example of Tesla's patents, something has to be said about the development of the patent system experiencing its momentum at the time of Tesla's great inventions, and its relation to an extreme spread of industrial revolution in the 19th century.

The first legal regulation on the protection of inventions by privileges or patents is thought to be the Venetian Law of 1474. Pursuant to that Law the Republic of Venice issued a decree by which new and inventive devices, once they had been put into use, had to be communicated to the Republic in order to obtain legal protection.

Prior to that Law, the English Crown issued letters patent providing any person with a monopoly to produce particular goods or provide particular services. The first monopoly was granted for a period of 20 years, by king Henry VI in 1449, for the manufacture of stained glass. Such a monopoly could have been granted in respect of all sorts of common goods, such as salt, but due to its wide abuse it was revoked. England enacted the **Statute of Monopolies in 1623**, under king James I who declared that monopolies would be granted **only for projects of new invention** for a period of 14 years. The main characteristics of the British patent system of that time were high patent fees, allowing only very wealthy persons to apply for a patent. That system was very complicated, and included 7 – 17 Offices, i.e. institutions, if covering Scotland and Ireland. Briefly, for a citizen not possessing sufficient capital it was almost impossible to obtain a patent. A complicated system of protection made dissemination of information contained in patents also almost impossible.

In 1852, the British patent system was subject to significant changes- fees were lowered, and patent application procedures were carried out only before one office, the so-called "Great Seal Patent Office". Patent specifications were officially printed, published and indexed. Although the British patent system has been in continuous operation for a longer period than any other in the world, it adopted the examination of a patent application as to criterion of novelty only in 1902.

The modern French patent system was established pursuant to the **laws of 1791 and 1844**. The patent applicant had to describe the invention in the way that it could be carried out by the person skilled in the art, but there was no guarantee for patent information to be published and made available to the public. Up to 1902, the publicly available information on the content of a patent was limited to the title of the invention and patent class. Patent fees were extremely high.

Germany passed its first Patent Act in 1877. A centralized administration for the grant of a federal patent was set up. Patent applications were examined by the examiners who were experts in their field. In 1923, the monopoly term for patents was extended from 15 to 18 years. The publication of claims and patent specifications enabled dissemination of patent information before patents were granted. The examination of a patent application included examination of the criterion of novelty, inventiveness and possibility of creating higher effectiveness of the invention applied for a patent. Infringements of patent rights were subject to monetary fines and imprisonment sanctions. At that time, the German patent system was close to the American patent system in many ways.

The Hungarian patent system, which formed part of the Austro-Hungarian system, also including the territories of Croatia, Slavonia and Dalmatia, was established by **the Legal Act of 1895**. A monopoly was granted for a period of 15 years by the so-called Povlasnični ured, constituted by permanent and temporary members, judges and technical staff. Information including the whole content of a patent as granted was published in the official gazette – Povlasnički viestnik. The infringement of the patent right was subject to a monetary fine [5].

In 1790, the American Congress passed the Patent Statute, which regulated the patent system in the USA. In 1836, the United States created the first modern patent institution in

the world, significantly different from the national patent offices of that time. In the USA, the system of examination of patent applications was established in 1790. It included the examination of the novelty of inventions and compliance of patent applications with the legal regulations. The system of registration of patent applications was established in 1793. The Patent Law of 1836 provided for the establishment of the Patent Office, whose trained and technically qualified employees examined patent applications. The patent fees were not high in comparison with the fees applied in the European countries, even being ten times lower (Austria), enabling a wider circle of citizens to file applications for their inventions to the Patent Office, and to be granted patents. In 1861, the term of a monopoly granted by a patent was extended from 14 to 17 years.

The information on inventions contained in patents were readily available, and disseminated rapidly owing to the publication of annual lists of granted patents, which were after 1832 published in newspapers. In addition, patent applications could be sent to the Office by post, free of charges. The American patent system was based on the presumption that social welfare coincided with the individual welfare of inventors, and as such, stimulated the conclusion of contracts and the trade. According to the US Constitution, the defense of rights of the patent owners was important in fostering industrial and economic development of the USA [8].

A breakthrough in the harmonization of the international patent system was **the signing of the Paris Convention for the Protection of Industrial Property, in 1883.**

According to its original version, patents granted by any country, which is a party to the Convention, shall be available to all the countries parties to the Convention.

This Convention also established the right of priority, enabling an applicant from any country party to the Convention to keep the date of his application as the date of priority, provided that he claims it in an application filed within 12 months from the first application in any country party to the Convention. In 1883, 11 countries signed the Convention. Today, 169 countries are parties to the Convention [7].

The international patent system has experienced further development. The characteristics of the modern patent system are:

- promotion of the protection of intellectual property of inventors,
- promotion of financing the creation of inventions, owing to the monopoly conferred by a patent,
- licensing or assigning of the patent rights of inventors to third parties, subject to an appropriate financial compensation,
- availability of information contained in patent documents to the general public, enabling further development of a specific technical field,
- development of the legal system in terms of the protection of intellectual property rights

Nikola Tesla's Patents

Tesla's dedication to inventions began very early in his life. As a boy, interested in the problems of his environment that he wanted to solve, he came to more or less successful practical solutions. Tesla himself has mentioned in his autobiography some of his first inventions, as well as the fact that he is thankful for his inventive spirit first of all to his mother and the members of her family who were all very inventive people [6]. There is no record that any of them applied for or was granted a monopoly, i.e. a patent for the improvements of various agricultural or the like devices. In the Austro-Hungarian Monarchy

early in the 19th century, the procedure of obtaining the rights to a monopoly was complicated and very costly.

At the age of 13, Tesla's attention turned to water turbines, and he himself constructed some of them. A breakthrough in Tesla's life occurred when he was 17, and attended the Real Gymnasium in Gospić, where he, under the stimulating influence of his professor of physics, became interested in electricity. Attending the second year of the Polytechnic School at Graz, he conceived an alternating current motor without brushes or commutator.

He dealt with this area up to 1882, when working at the Central Telegraph Office of the Hungarian Government in Budapest he devised a solution to the principle of rotational magnetic field, created by two or more alternating currents of different phases. According to Tesla's words, after that, ideas came in an uninterrupted stream, and in less than two months he evolved all the types of motors and modifications of the whole system [6]. In 1883, he undertook construction of the first prototype of alternate current induction motor in a mechanical shop in Strasbourg. Another Tesla's invention from that period, a telephone amplifier, was not patented, so information about it could not be found in the patent literature. This invention was soon put into use by the general public and thus became a public good. Tesla has never applied for a patent for this invention. The reason for such a long period between the idea and the solution to a technical problem and its practical realization was Tesla's heavy schedule, lack of understanding of his environment for his solutions to problems, and lack of capital for the realization of such practical solutions.

One may ask why Tesla hasn't patented his inventions.

It is supposed that the reason was the European patent system of that time, which was complicated and included high fees. At that time Tesla lived in Budapest, which was one of the capitals of the Austro-Hungarian dual Monarchy. The first modern patent law for that territory was established in the Legal Act of 1895. We may presume that in Europe, in mid 19th century, the idea of patenting inventions was relatively unavailable even to Tesla, and its effects and advantages were insufficiently clear. Meanwhile, Tesla moved to Paris and took a job in the Continental Edison Company, but there, he couldn't find interest in or financial support for his inventions.

In 1884, Tesla came to America and took a job in Edison's laboratory, where his work was not evaluated in the satisfactory manner.

After foundation of the Tesla Electric Company in 1884, in 1885 Tesla began to apply for patents for inventions that he created when working on the improvement of electric lighting.

In 1887, after foundation of the Tesla Electric Company, Tesla eventually had a possibility to develop a system of alternating current, conceived in 1882. This resulted in the number of patent applications filed to the US Patent Office in the period from 1887 onwards. Soon, he applied for his first patents related to alternating current. Up to 1891, he applied for 40 patents, and all of them were granted.

He obtained 60 thousand dollars for those 40 patents from the Westinghouse Company. According to the Company's records, under the contract, Tesla should receive 2,50 dollars per each horsepower of electricity as sold. Later, Tesla waived that contract, having a promise from G. Westinghouse that his poly phase system would be made available to the whole world [5].

In 1897, Tesla sold his patent rights and received 216.600 dollars.

The so-called war of the currents began, in which all the means were used – from propaganda to trials for the infringements of the priority rights. Hundreds of electric power producers used Tesla's patents (4), trying to claim that their inventors invented them. In 1900, the judgment delivered in Tesla's favor confirmed its right of priority in the field of alternating currents.

Certain stagnation in the number of patent applications filed during 1892 is likely to be due to Tesla's tour of Europe, where he gave numerous successful lectures.

In 1893, after his return to the United States Tesla gave a lecture in which he described in detail the principle of radio-technique. The lecture was published and translated into many languages, being in such a way made available to the public, which was sufficient for Tesla to ensure priority for the discovery of the principle of radio-technique. Although Tesla was the first to demonstrate the communication by radio, and to file the basic applications of such invention to the Patent Office, as well as being granted two patents US 645 576 and US 649 621, that invention was officially attributed to Guglielmo Marconi in 1895.

In 1943, several months after Tesla's death, the US Supreme Court delivered a judgment stating that Nikola Tesla is to be considered the father of the wireless radio transmission. Giving reasons for its decision, the Court stated that Marconi's patent US 763 772 of 1904, did not contain new technical characteristics that would not had been published and registered by Tesla.

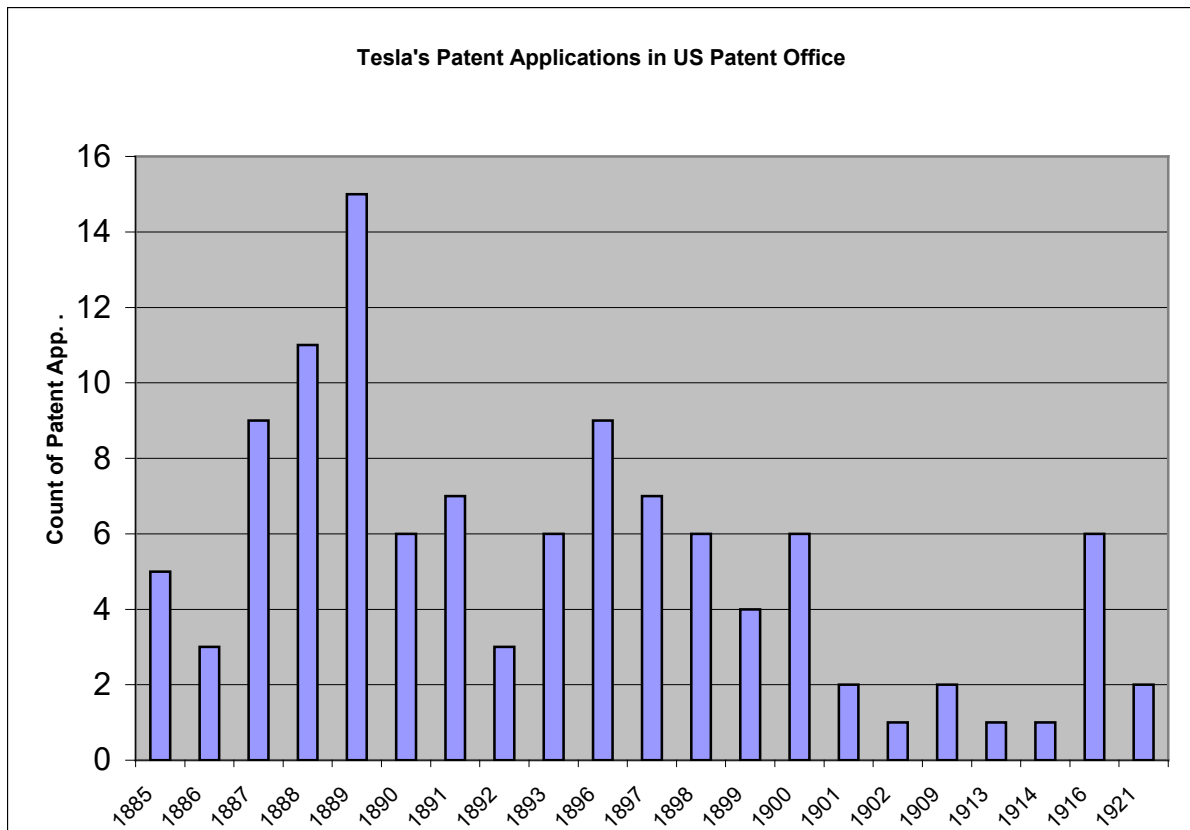
Up to early 1960', 11 cases related to patents were brought before the US Supreme Court, out of which two were related to Tesla's patents [5]. The Supreme Court judged in Tesla's favor in the cases related to patents for poly phase system of alternating currents and radio.

In 1893, Tesla applied for a patent for one of his most important inventions, a coil for electro magnets (although the first patent for a coil named after Tesla's name, US 454622, was applied for in 1891), widely used in various technological fields many years later.

In 1895, his laboratory was caught by fire, in which his whole valuable equipment was destroyed, as well as many results related to his research of wireless transmission of energy, X-rays, and invention related to the production of liquid oxygen.

In that year Tesla didn't apply for any patent, in US Patent Office.

In 1927, Tesla applied for his last patent in US Patent Office.

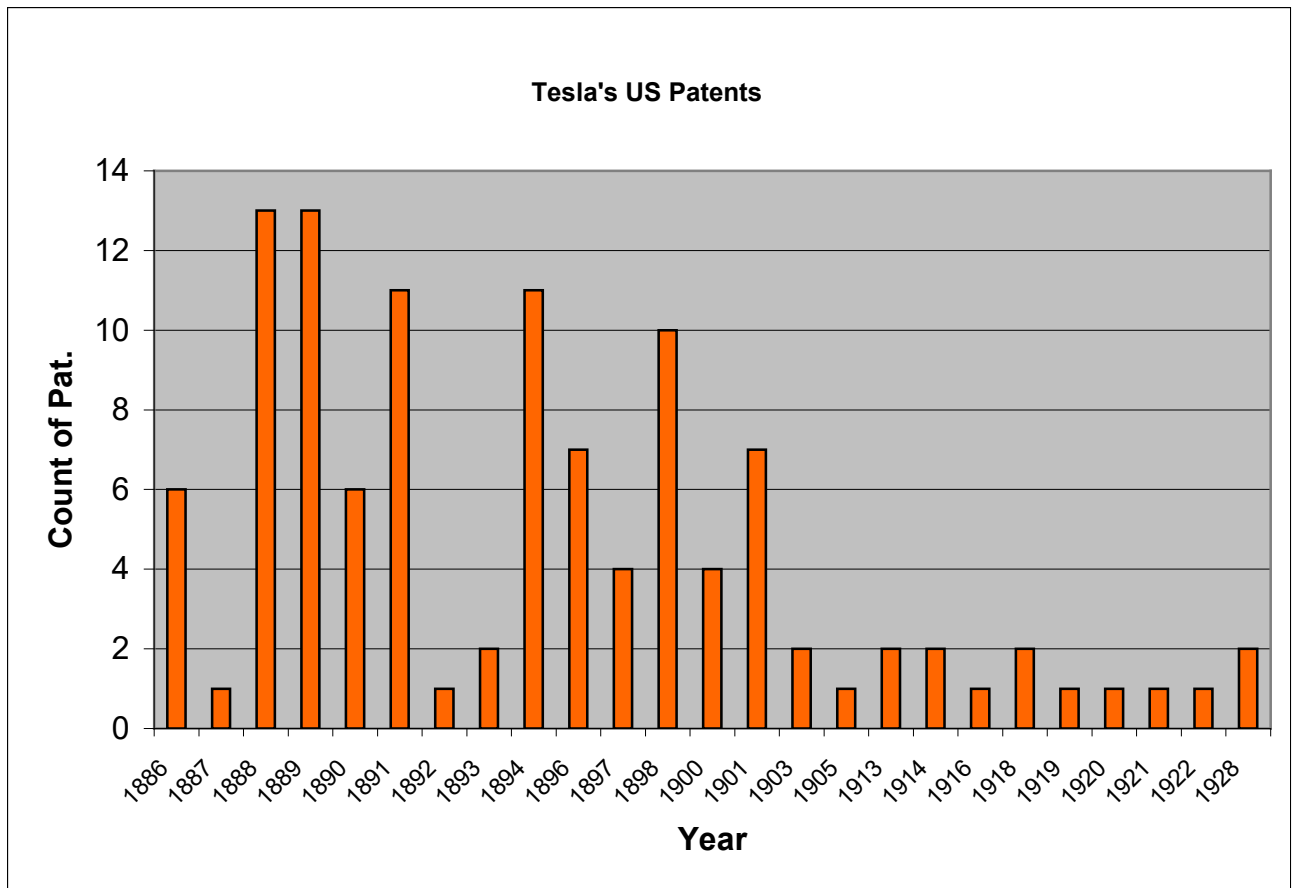


The time span between the filing of an application to a Patent Office and the patent granting varies from country to country. The American patent system of that time included the system of examination of novelty that have significantly impeded the procedure of examination of patent applications, extending a period up to the patent grant, under the circumstances in which many countries didn't publish information on the content of patents.

In Tesla's case, average time span between the application and the patent granting was a year, or less than a year, except for particular patent applications in relation to which such period was significantly longer. For example, a time span between a patent application and the grant of a patent in relation to the following patents was: US 1 119 732 (7 years), US 555 190 (8 years), US 511 915, US 524 426 (6 years), US 511 559, US 511 560 (5 years), US 487 796, US 1 061 142, US 1 061 206, US 1 329 559 (4 years), US 645 576 and US 649 621 (3 years).

In the period in which Tesla's inventions provoked astonishment and suspiciousness of both the public and professional public, the patent examiners had to perform a difficult assignment. Patent US 613 809 for an invention entitled "Method of operation and device for remote control of a mechanism from a distance" was granted in 1898, only after the examiner-in-chief had visited him in his laboratory to examine the device and the possibility of its functioning [6].

Nikola Tesla was granted a total amount of 112 US patents for inventions covering various fields of technology. The first US patent was granted to him in 1886 and the last in 1928.

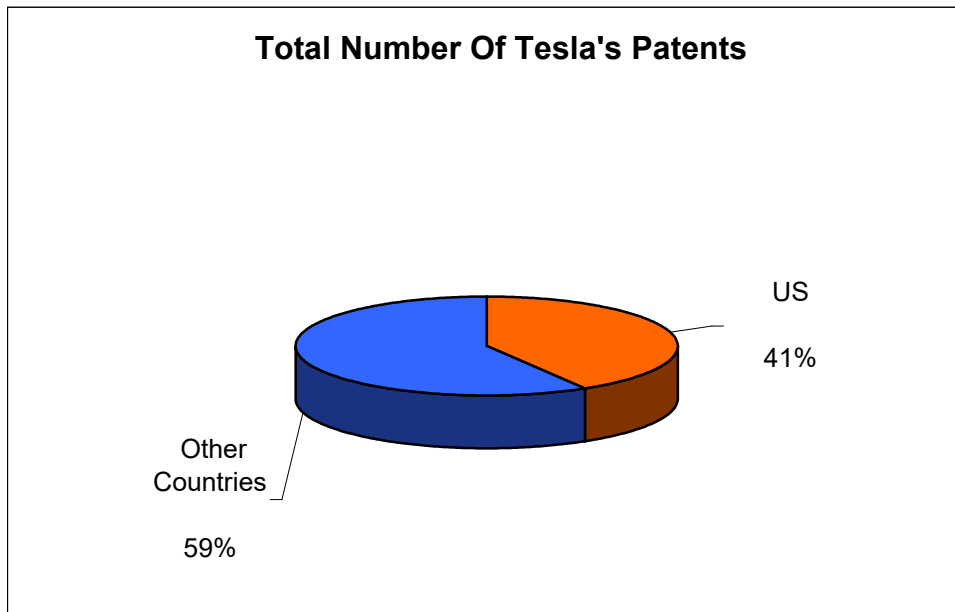


Different sources indicate different (total) amount of Tesla's patents.

Territorial principle of the patent protection, according to which a patent shall be granted in each country in which the inventor desire to protect his invention entails the possibility that several patents for the same invention are available in different countries.

Table 1: The number of Tesla's patents in the specified countries

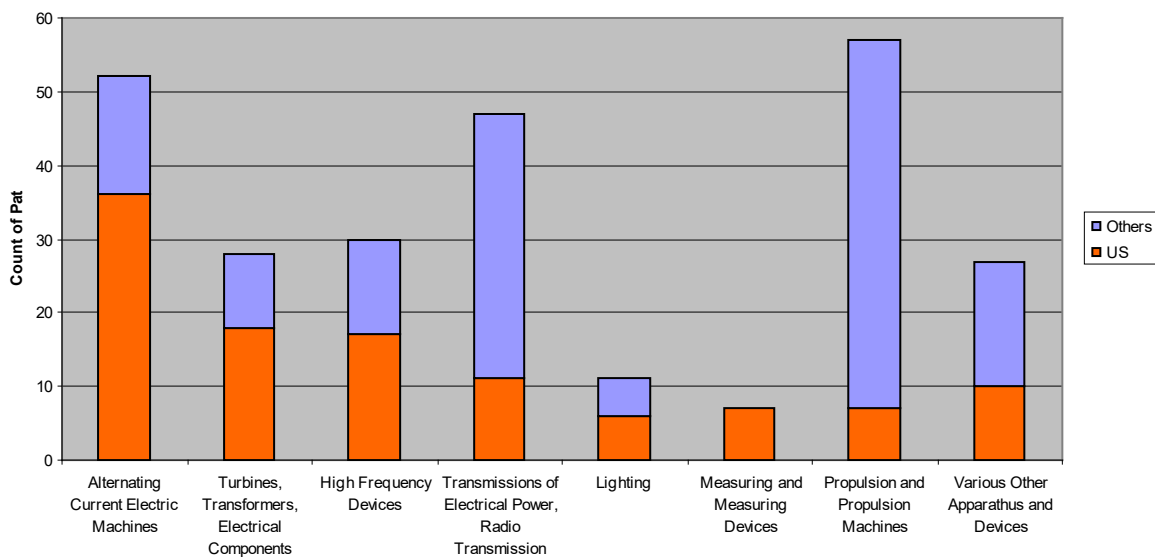
Argentina	1	New South Wales	2
Australia	3	New Zealand	1
Austria	4	Norway	3
Belgium	21	Rhodesia	1
Brazil	2	Russia	4
Canada	6	Spain	4
Cuba	1	Switzerland	4
Denmark	3	Sweden	4
France	20	JAR	1
Germany	18	USA	112
Great Britain	29	Total	272
Hungary	7		
India	1		
Italy	11		
Japan	1		
Mexico	1		



Therefore, when establishing the count of Tesla's patents account shall be taken of whether the inventions patented by Tesla (the so-called first patents) or the total amount of patents granted in different countries is to be concerned.

Ancient patent documents as such from Tesla's time are not available in their entirety, so one cannot establish the total count of his patents, nor can reach facsimiles of each of them. According to the indications available so far, as shown in Table 1, the total amount of available patents granted in 26 different countries/States, including USA is 272 [7].

Presentation of Tesla's Patents According to Technical Fields



Tesla's patents can be grouped in several basic groups. The patents related to alternating current electric machines, chronologically falling within the earliest Tesla's patents (US patents applied for between 1886 and 1893) belong to the largest group. The most important patents of this group relate to Tesla's poly phase alternating current motors and poly phase systems of supply of such motors, constituting the most famous Tesla's contributions to the electrical engineering. Interesting and less famous patents belonging to this group are those related to a thermo-magnetic or pyro-magnetic motor in which alternating magnetic field has been achieved by alternative heating and cooling of a magnetic body. Almost the largest total count of Tesla's patents – 52* patents, or the largest count of US patents – 36 patents belong that group. A group related to (low-voltage) transformers, converters and electrical components (18 US patents, or 28 patents in total) belong to the second, thematically and chronologically related group (US patents from 1885 to 1897). The so-called Tesla's coil belongs to this group. The patents related to lighting (mainly arc lamps) belong to the chronologically subsequent smaller group of patents (6 US patents applied for from 1885 to 1891, or 11 patents in total).

After that, from 1890 to 1898, Tesla applied for a series of patents (17 US patents, 30 in total), related to high-frequency devices. From 1897 to 1902, Tesla applied for patents related to transmission of electric power, and radio transmission.

The inventions belonging to the indicated groups of patents form the most important and the most famous part of Tesla's invention heritage. In addition to that, Tesla applied for less famous and less significant patents covering the fields such as measuring and measuring devices, turbines and propulsion, and various other apparatus and devices (e.g. artificial fountain). It is interesting to note that according to available information the patents covering the field of turbines and propulsion (57 in total) belong to the largest group of Tesla's patents, taking into account their total number, although such count comprises almost exclusively re-applications in the large number of countries (only 7 US patents covering that field). On the other side, according to available information, it seems that Tesla applied for patents in the field of measuring and measuring devices exclusively in the USA, since the re-applications in other countries are not available.

Such consideration of thematically and chronologically related groups of Tesla's patents indicates the dynamics of his research and inventive work, the subject matters that he addressed in particular periods of time, and the particular strategy that Tesla developed.

Tesla's patents, in addition to their practical application, have inspired generations of scientists and inventors, who inspired by his patents, lectures and thinking, have continued developing particular fields, not rarely re-inventing or re-patenting many of his patents. The reason is, to a certain extent, deficiency of the patent system available early in the 20th century, and ingeniousness of Tesla's ideas that have become understandable, "conceivable" and accepted by the professional public.

Searching of the current electronic databases containing patent documents [2,3] may very simply confirm this allegation. Namely, Tesla's patents prevent inventors from obtaining patents even a hundred years after having been granted. Tesla's patents, by the extent of the technical fields covered, and their content being far ahead of their time, form part of the so-

* The numbers indicate the total number of patents not including unavailable Hungarian and Russian patents

called state-of-the-art searched when modern applications are examined as to the criterion of novelty.

This concerns, among others, the following Tesla's US patents cited by patent examiners in the examination of particular modern patent applications: US 613 809 (1 document published in 2005), US 723 188 (3 documents published in 1996 and 2004), US 725 605 (1 document published in 1996), US 1 061 142 (32 documents published from 1972 to 2006), US 1 061 206 (28 documents published from 1972 to 2006), US 454 622 (3 documents published from 1996 to 2002), US 645 576 (4 documents published from 1999 to 2006), US 568 177 (1 document published in 2002).

Among the applicants for the mentioned modern patents are also: Sony Corporation, National Research Development Corp., The United States of America as represented by the Secretary of the Navy, University of Utah, Protein Foods (U.K.) Limited, Hewlett-Packard Development Company, The Boeing Company, Tokyo Electric Power Co. Ltd., Canon Kabushiki Kaisha, Samsung Electronics Co. Ltd.

Tesla didn't want to apply for many possible practical applications of his inventions, and didn't engage to that effect a team of engineers, like his contemporary T.A. Edison.

He would simply continue working, and after explaining one principle, his attention would be drawn to another field.

He didn't have time to apply for a series of inventions related to research tools or methods, e.g. insulating of high-voltage devices by submerging them in oil, a wire constructed of individual film insulated wires bunched or braided together in a uniform pattern of twists and length of lay, the so-called Litz wire, chronometer [1], so they became the public goods. He has also very generously given the inventions protected by patents to the public use, not minding the competition.

In 1956, Gardner H. Dales when addressing the American Institute of Electrical Engineers said that if there ever was a man who created so much and whose praises were sung so little – it was Nikola Tesla. A poly phase system was his invention and his first use of the power of Niagara Falls had set foundations of the power system used today by the USA and all the countries all over the world [1].

Tesla himself said in his autobiography: "Many technical men, very able in their special departments, but dominated by a pedantic spirit and nearsighted, have asserted that excepting the induction motor, I have given the world little of practical use. This is a grievous mistake. A new idea must not be judged by its immediate results. My alternating system of power transmission came at a psychological moment, as a long sought answer to pressing industrial questions, and although considerable resistance had to be overcome and opposing interests reconciled...

These and other inventions of mine, however, were nothing more than steps forward in a certain directions. In evolving them, I simply followed the inborn instinct to improve the present devices without any special thought of our far more imperative necessities"[6].

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