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# How were Patent Rights from Nikola Tesla Stolen

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**Abstract** –On the occasion of marking the commencement of works at Niagara Falls on 12<sup>th</sup> January 1897, talking about the monuments left by the inventors to the civilization, Tesla said “We have numerous monuments of past times, we have castles, palaces, Greek temples and cathedrals. They reflect the strength of people, the greatness of a nation, the love towards art and dedication to religion. This monument at Niagara denotes the beginning of harnessing the forces of nature to human needs and the salvage for millions of people. Regardless of all our endeavours we still depend on the inventors. Our economists may propose more efficient management methods, our lawyers may create wiser laws, but without the inventors we can not live better lives. To reduce poverty we need more inventions. With sufficient inventions at disposal we can fulfil lots of wishes and provide guarantees for a safe and comfortable life to all, save for, perhaps, those who are the greatest of all villains – the ignorant and idlers. Development and wealth of peoples and progress of the entire human race depend on the number of inventions”.

**Keywords** –Nikola Tesla, Niagara Falls, Patent.

## I. INTRODUCTION

Number of inventions – the basic impulse which prompts material development of mankind is created by inventive people. They are spiritual people – inventors, as Mihajlo Pupin put it – who is not guided by greed for money, but by care that material progress is everywhere accompanied by spiritual growth, thus expelling greed and hatred from the human heart by applying the most powerful spiritual force – the power of love, in the way the Christian philosophy also pleads for. Therefore, inventions are not merely economic, but also a human and spiritual category.

The inventions originate from the earliest period of human existence and the idea of protection and fair reward of their authors date back to the period of Ancient Greece, the age of Pythagoras. In Europe greater attention to inventions was devoted in the Middle Ages (XIV and XV century), when inventors were given various privileges. Frequently the kings granted such privileges for new products and innovations that stimulated economic development. In addition to the exclusive right of the inventor to manufacture his invention, the privileges implied protection of the privilege holder from

powerful guild organizations. At that time, the entire economy was organized by guilds and there were no free economic activities out of control of such organizations. The guilds were particularly unfriendly towards inventors among their members because they feared from disruption in the strict system of internal relations. Contrary to them, the wise kings invited craftsmen (not only from their countries) to apply their knowledge in the advancement of production of material value, whereby they protected them by privileges. It is found in literature that the first privileges were known about 500 B.C. in the Greek colony Sibaris, in the south of Italy. There was a privilege given to a cook who invented a new recipe for preparation of a dish that meant his exclusive right to prepare such dish for the period of one year. Let us mention here the Venetian Decree from the year 1474, which is also known as the Venetian Law, although it is not what it is (because the authorities decide whom the privilege is to be granted to). This assertion is supported by the application of Galileo Galilei from the year 1594, who requested the privilege for his invention “device for water transport” from the Venetian authorities. We will also mention the privilege that was granted to Pascal in the year 1649 for the invention of the calculating machine and the privilege to Higgs for the clock mechanism. Still, the famous English Statute on Monopolies from 1623 passed by the King Jacob Stuart I can be considered to be the first patent law. This Statute proclaims all monopolies illegal, excluding the ones resulting from the inventions. England, France, USA and Germany were the leading countries in the field of patent law from the fifteenth to nineteenth century and establishment of the International Patent System in 1883 or Paris Convention. At the time of the King Milan’s rule Serbia was one of the 11 founding countries of this Convention. The first modern patent law based on the ideas of the French Revolution was first adopted in USA in 1790, and then in France in 1791; Brazil, 1809; Austria, 1810; Russia, 1812; Prussia, 1817; Belgium, 1820; Spain, 1825; Mexico, 1836; Chile, 1840, Portugal, 1852; England, 1852; Italy, 1859, India, 1859, and other countries. In Yugoslavia such law was passed only in 1922.

## II. PARIS CONVENTION

Paris Convention represents international basis for the national patent systems and covers the markets in the

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countries where the patents could be potentially applied, retaining monopoly in production.

It was signed in 1883 by 11 countries, and negotiated between Belgium, France, Great Britain, Italy, the Netherlands, Portugal, Serbia, Spain and Switzerland from Europe; Brazil, Ecuador, Guatemala and El Salvador from Latin America and Tunisia from the Northern Africa. USA joined in 1887.

From the very beginning the Paris Convention has been a privilege of the rich. It was revised 6 times: Brussels, 1900; Washington, 1911; the Hague, 1925; London, 1934; Lisbon, 1958; and Stockholm, 1967. In addition to these six successful diplomatic conferences the other two were in Roma in 1886 and in Madrid in 1890. Each of these revisions affirmed monopolistic right of the foreign patentees, making their market function stronger. The main conflict of interests of the foreign patentees from the technologically developed countries and the public interest of the developing countries has been interweaving in this Convention.

The developing countries have been fighting against this, especially after the World War II in order to redefine the whole system of the industrial property, with fairer relations, both on the national and international level. Unfortunately, it all came to nothing because at the end of the twentieth century someone had an idea to transfer the patent system from UNCTAD (specialized UN organization for trade and development) to GATT – “the club of the rich” (General Agreement on Tariffs and Trade), and thus weaken manufacturing role of the patent at the expense of the poor countries.

Some of the essential articles of the Convention are briefly given in the further text. The first Article deals with definition of scope and contents of the industrial property. The second Article guarantees equal treatment of patents from all countries, rich or poor, weak or strong, developed or undeveloped. This apparent equality between the very strong and the very weak is a continuous advantage of the powerful companies from the developed countries on the underdeveloped markets.

The Convention states in details the manner in which the signatory countries should adopt new and abolish the current laws in order to respond to the main purpose of the Convention – to protect only the rights of the patentees, but totally neglecting their obligations.

Article five represents a historical compromise between the conflicting interests of the patentees and the public interests. It treats a key issue of approval for the use of the granted patent – whether it is really used in the country granting the patent right or not. In this way it becomes legitimate that importation of articles manufactured in any of the countries of the Union by the patentee into the country where the patent has been granted shall not entail forfeiture of the patent. The Article 5A strictly limits a compulsory license by setting very severe preconditions. As a consequence of that and the insufficient knowledge about the importance of this license it took more than 100 years of struggle to get only 20 favourable legal decisions which protect the public interest. In Canada, where this problem draws much greater attention, such compulsory license often protects public interests.

However, there is an aspect deserving special attention. The Convention could become acceptable provided major compromise is made between the private interests of the patentees and the public interests. To that end, it would have to acknowledge the main freedom and flexibility of the member countries to make their own regulations in accordance with the way they understand their own national interest and the degree of their economic development.

The Convention has a unique system as indicated by the provision concerning its revision requesting unanimous consent. Veto system, limited to only five UN Security Council members, is only pale reflection of the practice introduced in the Paris Convention much earlier. Even the procedure of withdrawal from Convention is rather complicated and time consuming. It can last five to six years.

Had the Paris Convention (international patent system) been intended to protect the inventors from its very beginning, which is one of its main tasks, Nikola Tesla could have not been robbed. To date, it has unfortunately been protecting only the powerful transnational companies in their greed, or the powerful states to the disadvantage of the weaker inventors in protecting their rights and the spiritual values.

### III. PATENTS DECISIVE FOR STAGES IN INDUSTRIAL DEVELOPMENT

A patent is not only an economic, but also a human institute. Partly it protects inventors, but it is more a driving force of the industrial revolution. The three patents determined the First, Second and Third Industrial Revolutions.

Some people think that industrial revolution did not begin with the invention of the steam engine, but with the invention of the water-mill. All main characteristics of the industry powered by the force of water that existed in the Roman Age are the heritage of the Hellenic World. The medieval Christianity was the first civilization to know how to use the machines for different needs. The water-mill was also used for some other purposes: driving of the rollers, crushers, coal milling, olive squeezing, fruit pressing, etc. However, a big disadvantage of the water-mill is fixed location of the water power, as well as of the power of wind. At that time, there was no known way to transmit this energy to the other location for use. That was achievable by means of the electric power only at the end of the nineteenth century, with the appearance of a large number of inventions created by Faraday, Gramme, Swan, Jablokov, Edison, Tesla and others.

Still the world counts the First Industrial Revolution from 1769, when James Watt patented the first steam engine. He solved the technical problem of translation of straight line piston movement into the rotary motion of the flywheel. He invented the automatic distributor and capacitor and used steam expansion on both sides of the piston. In this way he created the practical machine which was the only driving unit in the factories, mines, mills, textile and other factories for more than one century, until the end of the nineteenth century.

In the field of electricity, the nineteenth century gives birth to a large number of the significant inventions that enabled the Second Industrial Revolution which begins with Tesla's patents. Great English scientist and inventors Faraday

and Maxwell can be mentioned here. The first invented electromagnetic induction in 1831 and enabled production of electric energy in dynamo-engine. The second invented magnetic flux and the way it transmits its energy through space. Faraday invented electric motor and thus helped Morse to invent electric telegraph in 1837, Reis and Bell to invent the telephone, the former in 1861, and the latter in 1876, Mihajlo Pupin to invent long distance voice transmission and Gramme to invent a practical dynamo-engine and electric motor in 1868. The Belgian Gramme made a great achievement and the true electrical engineering begins with this invention. The Gramme's machine made it possible for the great Russian inventor Jablokov in 1876 to invent electrical lighting by using his invention of arc lamp, and for Edison and Swan in 1879 to invent electric bulb, which was greatly facilitated by the scientific research work of the Russian scientist Ladigin. Jablokov is the inventor of the transformer which converts alternating current of certain voltage into some other voltage. This transformer was patented in England in 1877, and Jablokov was considered to be an inventor of electric lighting.

In the nineteenth century Europe started to integrate science and technology aiming at application of the scientific results in industry through the epochal inventions. The process started in Germany in 1887 when Siemens founded the Technical Institute for Experimental Research where Hemholz, Herz, Kirchhoff, Plank and many others, including our scientist Mihajlo Pupin, worked.

In the second half of the twentieth century Intel microprocessor (USA, 1971) invented by Ted Hof, an engineer, started the **Third Industrial Revolution**, which opposite to the first two industrial revolutions that found substitute for the physical labour, provides machines that can even replace the human brain.

#### IV. INNOVATION MOVEMENTS

Prevalence of the philosophical learning of Democritus – Archimedes – Bacon – Newton created the preconditions for the development of the Innovation Movement in some countries. It originally started in the European countries in the seventeenth century and later on, first in England, Germany, France and other countries in the eighteenth century the real inventor movement was active. In the nineteenth century it extended to USA, where a powerful Innovation Movement was established which was active through the whole twentieth century. After the World War II, owing to the Innovation Movement, Japan developed so fast that it was justifiably called “the world economic wander”. In Yugoslavia, organized Innovation Movement was active after 1975, upon decision taken on the highest level of authority in the country. In order to accelerate its economic development China also turned towards the Innovation Movement in the 1980s, and today it is the world economic power.

The innovation activity in USA deserves special attention. This activity was promoted by: Franklin, Washington, Hamilton, Adams, Jefferson, Madison, Lincoln and others. It was initiated in the eighteenth century and it intensively developed in the nineteenth century creating a

country of powerful economy. It could be said that these leading figures, some of them the US presidents, initiated material progress not only of America, but of the contemporary civilization on the basis of the Newton learning. The genius of Washington reflects in the fact that, as the first elected US president and the creator of the Constitution of USA, he realized that he had to create additional centripetal force in order to preserve the Union, which was initiated with thirteen countries. This additional force was the strengthening of economical links between these thirteen countries after USA started to expand across the vast territory between the Atlantic and Pacific Oceans.

In the nineteenth century America experienced a powerful economic growth. In this period the inventors were much appreciated, some of them even became national heroes. They were the men of progress associated in the union of inventors – the famous Cooper Union. Some of these inventors from the very foundation of the Union were: Peter Cooper, Mc Cormick, Witney, Fulton, Westinghouse, Morris, Goodyear, Erickson, Gatling, Edison, Bell, Tesla, Pupin and many others. These names were very popular among American people and every man heard about them. America rejoiced at every new invention because it was well aware that it would speed up social and economic progress of the country.

It would be interesting at this point to give the example of “cotton gin” invented by Eli Whitney in 1793, and what it meant for the American people. This relatively simple machine very soon provided an enormous economic power to the Southern countries which produced cotton. Before this invention the cotton fibres had to be manually separated from the seedpods, so that only a half of kilo could be produced in one day. Now a slave could easily gin 25 kg of cotton, which quickly became a lucrative business of national interest for the American South.

Since the times of Washington the Presidents of USA, as a tradition, have been regularly receiving the most successful inventors once a year to present the awards. On the occasion of celebration of the fiftieth anniversary of the Edison's invention of bulb in 1929 the American President Herbert Hoover expressed his personal acknowledgment to the great inventor and the entire nation celebrated this as a national holiday. This fiftieth anniversary of the invention of bulb was celebrated worldwide and at that time Edison was 83 years of age. On that occasion on the very day when the bulb was invented, on 21<sup>st</sup> October, the lighting in the entire America was turned off for the duration of two minutes. At that moment Edison remembered the time of fifty years ago when his first bulb had been turned on – he had not left that bulb staying there for 45 hours until it had extinguished. He was young then, 33 years of age and full of faith that his bulb would conquer the whole world and that he made something big for the mankind. When Edison died in 1931, the US President gave the eulogy personally at the funeral.

That is the America in which worked one of the columns of the technological revolution – our Nikola Tesla. Tesla solved the technical problem of universal significance - electrical transmission of power along very long distances.

Thus, with his basic US patents 381968, 382280, 382279, 390413, 391414 he caused the Second Industrial Revolution.

Lead by Newton and Galileo the scientists discovered the laws of substance in motion, and lead by Faraday and Maxwell – the laws of electricity in motion. These are laws of nature, as eternal truths. The inventors James Watt and Nikola Tesla initiated the First and the Second Industrial Revolution with their inventions of steam engine and induction asynchronous motor.

Before the Watt's invention, the man had to perform all the heaviest work by applying the force of his muscles. Maximum use of electric energy and transmission of its power along very long distances started after Tesla's invention of polyphase system, contrary to steam engine. Until that time the engineers applied only direct current, convinced that it was impossible to make suitable motor for alternating current. Even after publishing Tesla's patents in USA and Europe, the experts retained such opinion until 1890. Alternating current has a number of advantages, it is easily generated, and its transformer enables transmission along very long distances in a very economy efficient manner. The first official success of the polyphase system was achieved during the Frankfurt Exposition in 1891. Electrical power was transmitted along distance of 100 miles whereas 30,000 V line generated the power to the three-phase motor designed by Dolivo Dobrowolsky. The entire project was managed by one of the most world famous engineers at that time, C.E.L. Brown, who admitted later: "It is Tesla we have to thank for the three-phase current applied near Frankfurt". Dobrowolsky claimed that he was the inventor of the key motor of polyphase system and that Tesla was an imitator, belittling Tesla's 20 H.P. motor with short circuit rotor, which Tesla sent to the Frankfurt Exposition. It took a while until Dobrowolsky realized that only Tesla's motor was the first practically usable induction motor, because its efficiency ratio was over 90% and its weight much lighter.

The great manufacturers lead a struggle against introduction of alternating current, although their system, in fact, slowed down industrial development due to numerous limitations. First, all mechanically generated currents are alternating currents; with one complicated device – commutator, which is the cause of many accidents, this current is translated into direct current through a motor making progressive shift of poles to achieve motor rotations. Both these actions are unnecessary in the new system (alternating current rectification in the generator and change the direction of current in the motor), because Tesla invented a motor in which alternating current directly shifts the poles, US patents no. 381968, 382280, and others.

The "War of Currents" began between the American companies owned by Thomas Edison, who developed his alternate current business also in Europe, and the Company founded in 1886 by George Westinghouse, who advocated alternate current and Tesla's patents. This war was fierce until 1893, and it was lead between two interest groups of big investors with growing needs for electrification of the American society. Tesla won the war in 1893, when the Westinghouse Company was awarded the contract for installing all lighting at the Chicago Worlds Fair held to

celebrate the four-hundredth anniversary of discovery of America.

On that occasion a great power station was presented for the first time, and it was the biggest in the whole world. It included 12 Tesla's two-phase generators of 750 KW, which were driven by steam engines and produced two-phase current of 9000 KW in total. The frequency of these machines was 60 Hz, and the generators had 200 rotations per minute. In fact, they were generators made of two generators under Tesla's patent no. 487796 from 15<sup>th</sup> May 1888, as multi-polar generators with two armatures on the same axis with the windings shifted by 90°, so that the machines generated adequate two-phase current. Electromagnets consisted of 36 poles made of laminated mild iron which were attached to the joint casing. The armatures were constructed with grooves in which the windings were installed. Three dynamo machines, of 200 KW each, were planned for generation of direct current intended for excitation of poles.

These generators supplied dozens of thousands of bulbs and arc lamps, which provided electrical lighting, and also a large number of two-phase motors from 1 H.P. to 300 H.P., and commutators which generated direct current for special purposes. Several bigger two-phase motors activated three-phase generators which generated current for various three-phase motors which were exhibited in many electro technical exhibition departments.

On that occasion the Westinghouse Company exhibited various Tesla's motors and other devices which Tesla made in his workshops in 1887 and the devices which were made by Tesla at the railway workshop in Strasburg in 1883.

The International Commission chaired by the famous British scientists-physicist Lord Kelvin, who was against alternating current until the Frankfurt Exposition in 1891, after the success of Tesla's polyphase system in Chicago, departs from the Edison direct current system. The biggest investor of the Niagara Falls Power Company commenced construction of the powerful hydroelectric station with Tesla's patents. The contract with the Westinghouse Company was concluded in October 1893 after 7 years spent in worldwide search for the most appropriate solution.

The suffering of the winners Tesla and Westinghouse started only now since mass production commenced especially in America, Germany, Britain, France, according to Tesla's patents. It was disputed that Tesla was the author of the motor with rotating magnetic field, polyphase system of generation, transmission and use of alternating current. It was claimed, completely ungrounded, that the inventor of the rotating magnetic field was Prof. Galileo Ferraris, the Italian, and that the inventor of the induction motor and three-phase system was Dolivo Dobrowolsky, the German. Tesla was even named an imitator, that he took the Aragon's rotation from 1825, which was presented in Paris; the motor of Walter Baily announced in London in 1879; research of Marsel Depre in Paris in 1880; the US patent by Charles Bradley from 9<sup>th</sup> May 1887; and the Pottie theory from 1888.

Aware of the threats, Tesla protected his inventions of polyphase system also in Europe in due time. In Germany at the end of April 1888, he filed two applications for his patents with right of priority of the American application from 12<sup>th</sup>

October 1887, which included various combinations of induction motor, generator, polyphase system transformer with transmission lines. He was granted two German patents, no. 47012 and no. 47885, as early as 1<sup>st</sup> May 1888. All the US patents are described here (381968, 382280, 382279, 381969, 382281 – included in the German patents no. 47885 and 381970, 382282 – included in the patent no. 47012).

In the most significant German patent no. 47885, Tesla described the effect of the rotating magnetic field in the same manner as it was done in the US patent no. 381968; asynchronous motor from the US patent no. 382279 and the synchronous motor from the US patent no. 381969 were presented.

Although these patents describe the inventions identical to the discoveries described in the US basic patents, the patent claims are not identical, so that Tesla was not granted the same patent rights in Germany as in other countries. The main reason for this fact, in addition to the control of Tesla's patents, is found also in the German Patent Law applicable at that time, according to which the application filed in other countries did not grant the inventor the right of priority, because at that time Germany was not the signatory of Paris Convention. Germany protected the right of priority of the inventor in all countries which joined the Convention, subject to elapsing less than three months between the publications of the patent in one country and filing the application for the identical patent in another country.

Only in 1891, in its new patent law Germany recognized the right of priority to the inventors. Therefore, at filing applications for all patents, in Germany Tesla did not have right of priority as of date of filing the application for the US patents from 12<sup>th</sup> October 1887, but only from 1<sup>st</sup> May 1888, when the applications were officially received in the German Patent Bureau. On the other hand, in the meantime Professor Ferraris in Turin published his lectures held on 18<sup>th</sup> March 1888, in the form of a short article. The subject of these lectures was the production of rotating magnetic field with one-phase current and one artificially produced phase. The article about this lecture was published in April 1888, before Tesla had filed applications for his patents in Germany. But, despite all these facts, Germany did not opt to invalidate Tesla's patents on the ground of "new solution" principle, because "state of the art" in the world at the time when Ferraris held his lecture, included the solution of the rotating magnetic field from 12<sup>th</sup> October 1887 and the US patent no. 381968. Tesla's German patent no. 47885 relates to: the protection of induction multi-phase motor in which rotating magnetic field produces rotation of motor and the entire system of generation, transmission and use of polyphase currents.

The Court applies another principle of "abuse of patent monopoly", for the cases when patent has only market function, and supposedly protecting national interests, a principle intended to secure that the international patent system remains economical, development and human institute, is converted into its contradiction.

Despite this, the State Court in Berlin invalidated both above mentioned patents on 26<sup>th</sup> November 1898, based on the claim filed by German companies on the ground that Tesla

did not apply his patents in Germany, and that these patents only served to obstruct development of German industry, what was completely untrue as we will see in the further text. The German State Court assumes an incomprehensible attitude that the German three-phase system, better known as "*Drehstrom*", did not fall under Tesla's patents. The Court claims that these are two different systems in spite of hundreds of expertises indicating that these two systems are the same thing.

This court judgement clearly indicates how the German industry used Tesla's inventions in the field of polyphase system; what various experts tried to prove that "*Drehstrom*" did not fall under Tesla's German patents and, moreover, how the invention of polyphase current and rotating magnetic field did not belong to Tesla, but to Ferraris and Dobrowolsky.

The proposal for forfeiture of Tesla's patents was filed by the well-known AEG Company, when the licence holder of these patents in Germany – HELIOS brought the action against companies AEG, SIEMENS and HALCKE on the ground of unauthorised use of patents. The expert of AEG Company – Dobrowolsky, a great German inventor, like many others, did everything to illustrate how Tesla had invented just an impractical two-phase motor. The basic discovery of polyphase current and rotary magnetic field, on the basis of which "*Drehstrom*" was developed, belonged to Ferraris. According to the opinions of the afore mentioned, the inventor of the three-phase system was not Tesla, but Gramme, Ferraris, Dobrowolsky, Bradley, Depre, Haselwander, Venstrem and others, who were the pioneers in the field of development of electrical engineering.

It is clear now why this was done. The German industry needed to be exempted from legal payment for the use of Tesla's patents. To this end, it was necessary to reduce Tesla's epochal achievements to certain impractical construction solutions and to point out that Tesla had reached such solutions on the basis of the great discoveries made by others.

Had the results of struggle against Tesla been limited only on the enormous material losses suffered by Tesla in Germany, we would not have dealt here in details with the wording of the decision of the German State Court. This has to be done because this decision contributed to the fact that the inventions of the three-phase system and the basic discoveries, such as polyphase current and the rotary magnetic field, are attributed to others in the professional literature, especially in many textbooks in different countries. At this point it should be emphasized that the legal assessor E. Arnold, whose worldwide known textbooks on electrical engineering speeded untruths about Tesla, participated in taking this decision of the German State Court.

In analyzing this court decision we come to many conclusions, the most significant of which will be stated here.

First of all, Tesla himself in his written statements to the court explicitly claimed that the contested German patents comprised his three-phase system, as it was the case with these US patents and the patents of other countries. This is clear from his sentence – "*when polyphase alternating current paved its way under the new mark "Drehstrom", this system was used by the German industry without*

*authorization*". Tesla submitted to the court various expertises by German and other experts, which claimed the same.

However, AEG Company and Dobrowolsky claimed that in the "world of experts" it was considered that the inventor of polyphase current was not Tesla, but Ferraris, and that the patent claim related to "Drehstrom" had been deleted from Haselwander's patent no. 55978 filed in June 1889 by the decision of the Patent Bureau issued on 13th November 1891, because this invention, allegedly, had been published earlier in the Bradley's US patent no. 390439, which, as the State Court states, had been granted to Bradley in October 1888.

The truth about Tesla's inventions, although much distorted by this decision, can not be denied any longer if we take into consideration the facts found not only in Tesla's US patents, but also in the German patents that had been forfeited from Tesla by court decision. On the basis of these facts Tesla first discovered not only polyphase currents and the rotating magnetic field, but also the basic inventions on the basis of which polyphase system had been created, and especially the three-phase system or "*Drehstrom*" system. The forfeiture of above mentioned patents illustrates only the extent of significance of Tesla's inventions for the development of industry in Germany and how the truth about the true values was in the service of profit.

This court decision included another significant conclusion related to the issue of dependence of the "*Drehstrom*" system on the wording of Tesla's patents. Even if Tesla's patent claims had been formulated in the way that envisages two conductors for each electric circuit, the "*Drehstrom*" system would have been dependent on these patents because it represents only one modification of the polyphase system comprised in these patents.

Reference to Haselwander's patent no. 55987 from June 1889 and to Bradley's patent no. 390439 is completely unfounded. First of all, not a single word in Bradley's patent relates to the three-phase system. It is neither clear how the AEG Company could have referred to that specific Bradley's patent, nor how the Patent Bureau could, by its decision dated 13th November 1891, partly invalidate Haselwander's patent on the basis of Bradley's patent. Bradley described a special application of the three-phase system in his patent no. 409450, filed on 20<sup>th</sup> October, 1888, and published on 20<sup>th</sup> August 1889. This patent relates to the three-phase generator with closed winding which is obtained when three-phase current is conducted from the direct current dynamo machine with three points, at 120 degrees distance between them, on the basis of the principle of delta connection. The identical invention represents also the basis for Haselwander's patent no. 55978 from June 1889. But, since this Bradley's patent was published on 20<sup>th</sup> August that same year, after filing the application of Haselwander's patent, within the meaning of the Patent Law effective in Germany at that time, it could not be used for partial invalidation. It is completely incomprehensible how the State Court could base its decision on such mistakes.

The fact that such invalidation still occurred could only be explained by taking into consideration Tesla's US patents 390413 and 390414, but not Bradley's patent, which were published on 2<sup>nd</sup> October 1888, and which comprise both star

connection and delta connection with the three-phase system of 120 degree phase difference. The mistake made by the State Court in its decision is even more incomprehensible because these two Tesla's patents were explicitly stated in the decision itself in order to prove that Tesla would have protected the inventions comprised in these patents in Germany also if it only had crossed his mind to include the "*Drehstrom*" system into his German patents. This mistake becomes understandable only if one supposes that the intent was to avoid reference to these patents in connection with Haselwander's patents, due to absence of will to give credit to Tesla for inventing the "*Drehstrom*" system. Tesla did not file applications for these additional inventions in Germany because he considered that these additional inventions could not be used in Germany as separate inventions without the basic inventions which were described in the German patents and which included such special modifications. This particular fact is an evident argument against the decision itself, which is unreasonable and misleading in its statement that Tesla's German patents did not include the "*Drehstrom*" system.

Not only the patent claims, but the entire wording of the patent application should be taken into consideration in the interpretation of the far-reaching effects of the inventions since Tesla's patents in Germany dated from 1<sup>st</sup> May 1888. In order to understand the decision of the State Court in Germany and the unusual procedure behind it, it is necessary to take into consideration the entire patent application of Tesla's German patents, although the extracts stated here and other explanations will be sufficient to illustrate the lack of grounds found in the wording of the German court decision published in the court announcements in the beginning of 1899. This text in its entirety reads as follows:

#### V. COURT DECISION OF THE STATE COURT AND CIVIL SENATE FROM 26<sup>TH</sup> NOVEMBER 1898

Revocation of the patents No. 47012 and 47885, the property of Nikola Tesla, the electrician, due to their failure to work in the territory of the German Reich. – The patentee should be recognized for the carrying out not by him or the holder of his licences, but by the others against his will and with infringement of his patent rights. – Three-phase system (*Drehstrom*) is not covered by the disputed patents. – Granting the licence to a community capable of conforming to the obligations from the patent does not relieve the owner from his duty to carry out which is compulsory for him. – Under some circumstance, the carrying out realized after submission of claim for forfeiture of the patent may be considered in favour of the patentee. – Mistakes of the patentee regarding far-reaching effects of his patent shall not make his excuse for failure to carry out.

In the patent dispute of Nikola Tesla, an electrician from New York, represented as the defendant and claimant by the Helios Electrical Joint Stock Company in Cologne, – Erenfeld, against AEG Company (General electric company) in Berlin, as the claimant and defendant regarding the forfeiture of the patents 47012 and 47885, the State Court, the first civil senate at its session of 26<sup>th</sup> November 1898, made the following Decision:

The Decision of the King's Patent Bureau of 10<sup>th</sup> December 1896 is hereby confirmed. The claimant is obliged to pay the costs of the appeal procedure.

## VI. REASONES

The claimant demands in his action of May, 1895 that the defendant be forfeited of his patents nos. 47012 and 47885 granted to him on 1<sup>st</sup> May 1888, because the patented inventions have neither yet been carried out in the country nor any action has been taken to insure such carrying out.

\* \* \*

This statement of the claimant was not correct, because it was Tesla who had the greatest interest to have his inventions applied, and such Decision of the Court is not understandable. Tesla did everything to have his patents applied, not only in USA, but also in Europe, especially in Germany by granting his licence to Helios.

Tesla, being an alien in Germany, appointed his agent – The Joint stock company Helios from Cologne. He granted an exclusive licence to this Company in 1892 for use of two patents. He made a licence agreement with this well-known and reputable company to insure application of the patent in Germany. Helios was not in position to build big electric plants in accordance with the Tesla's patents because the other companies, including AEG, had huge privileges. Namely, they used the patents of the defendant without paying any fee, when the multi-phase alternating current cleared the road under the name "*Drehstrom*". Helios had to initiate a whole series of patent infringement claims against Siemens and Halske in Berlin and Kemnic, Oscar von Miler in Munich, Virtenberg Cement factory in Laufen and Vilhelm Raizer Company in Stuttgart. On the other hand, F. Lachmayer & Co. initiated the action against Helios with a motion to determine absence of patent infringement in application of "*Drehstrom*". Helios also took all possible actions to use the patents in practice. On many occasions an engineer was sent to the States to obtain instructions for practical execution of the patent; then, transformers and engines were built for the purpose of the patent, that were stored at Helios ready for sale. The Company offered the licence to some other counterparts. Helios made further efforts in that regard, and after initiated claim the Company concluded a Licence Agreement with Union Company in December, 1895. It started construction of the electric power station in Cel, and its own factories for manufacture of the electric plants, in accordance with the Tesla's German patents, without any modifications. Helios had negotiations with the city of Dortmund and Count Henkel – Donersmark about construction of an electrical power plant.

In the end, regarding the shameful court decision, we can just note that in his German patent No. 47885 Tesla was not only the inventor of the multi-phase current and rotating magnetic field, but also the patentee of the asynchronous and synchronous motors which are the precondition for application of both the general polyphase system and "*Drehstrom*". Failure to mention these grand inventions in the Decision of the State Court, despite their explicit protected status through the patent no. 47885, pursuant to German law

of that time, is an unrecorded precedent in the international patent law.

\* \* \*

*The situation in USA was not much better, because Tesla's patents were also used without authorisation by many companies during the fast US electrification.*

Tesla's patents in polyphase systems were the cause of many judicial proceedings, due to a large number of their unauthorised use in US, Germany, France and even England. It is understandable, because for many years these patents covered a wide range of generation, transmission, distribution and use of the electrical power by means of the polyphase system. Many companies and individuals tried to use the main Tesla's ideas to create their own systems, which they, which according to them did not fall under Tesla's patents.

The Decision of the Connecticut Circuit Court, USA, is of special importance for the truth, because it states that Tesla's basic patents 381968, 382280 and 382279 from 1887 comprise all systems used by different inventors, a three-phase system in particular, that has been applied in a number of modified alternatives. That Decision was elaborated in details by the patent judge TOWNSEND, who took into consideration all pleas related to Tesla's patents.

The lawsuit was initiated by *Westinghouse*, the owner of Tesla's patents, against *New England Granite Company*, which was producing multi-phase generators and engines without authorisation. This Decision of the Circuit Court in Connecticut, is a judicial acknowledgement that the whole polyphase system in terms of its basic principles, inventions and discoveries is Tesla's work and that the entire development of electro-techniques, based on the main Tesla's patents, resulted from the simple implementation of the epochal Tesla's ideas, and Judge Townsend says: "*It remained to the genius of Tesla to capture the unruly, unrestrained and hitherto opposing elements in the field of nature and art and to harness them to draw the machines of man.... What others looked upon as only invincible barriers, impassable currents and contradictory forces he seized, and by harmonizing their directions utilized in practical motors in distant cities the power of Niagara.*"

Townsend's judgement was made public on September 19, 1900. We will quote only some of the parts from the judgement, to illustrate how thorough and professional it is:

*"The patents being the subject of the case relate to the process of electric transmission of the power by use of the mechanically generated alternating electrical currents.*

.....  
*Every mechanically generated current is alternating current in its nature. It was thought earlier that it was impractical to use mechanically generated currents before their alternations were rectified by means of commutators that changed the current direction so that the current flows through conductors continuously in one direction. The currents periodically rectified by means of the commutator, which breaks current between two direction changes and conducts it in sections are known as rectified or changed current. We should be more careful about this difference between the alternating and changed current. The alternating current keeps flowing in the opposite directions, in the same*

way as originally generated. Changed current is rectified to flow in one direction and as such it is known as direct current. When rectified by the commutator to become direct current, it loses some characteristics essential for its greatest effects.

Before Tesla's inventions, power was transmitted only by direct electric current. Application of that power transmission system was restricted for many reasons, one of which is unsafe use of strong currents for long distance supply of high voltages. On the other hand, the real alternating current had practically immense potentials in strength and voltage, and the voltage could be changed economically by a transformer. However, in spite of all this, such fast change of direction of the alternating current before Tesla's inventions, disturbed motor operation from its start and during its rotation, except when synchronisation with the generator was achieved. For this reason, alternating current was not applicable in situation of load change.

The problem faced and successfully solved by Nikola Tesla was: How to overcome the difficulties occurring in use of the alternating currents and use their energy for unlimited transmission of power.

.....  
"His large-scope invention, briefly explained, eliminates the problem with motors, and consists of production of progressive movement of the magnetic field (or motor poles) by means of two or more independent alternating currents in different phases, and electric circuits that provide independent character and phase relation of such currents"

.....  
The lawyer of the defendant says: "For this reason, it comes out that the claimants request a wide-scope patent protection. On the other hand, the Defence thinks that this invention had been known long time ago, that its application has been in use for years, and that since the time of Arago there has never been room for such invention, and that the state of the art is the result of past developments, including Arago's rotation, achieved by simple implementation of the engineering skills of the capable electricians who implemented their knowledge in accordance with the progressive needs of the day, plus special inventions related to the motors or generators or different connecting current circuits. It does not give any right to Tesla or any other patent owner to prevent sale of generators and motors by possessing the patented system which includes everything."

.....  
In support of their evidence, the defence refer to four published documents: Baily's article from 1879, Siemens patents from 1878, Depre's article from 1880-1884 and Bradley's application of May 9, 1887 and his patents."

Townsend mentions the German judgment and quotes, lengthily in parts, Argon's rotation and Siemens English patent from 1878, which relates to the advancement of the device for electricity generation in a dynamo machine and regulation of the electrical power for lighting purposes. The judgement states that on May 9, 1887, about 6 months before Tesla's patent applications were filed, Charles S. Bradley filed his application for a dynamo-electric machine (one generator for conversion of the mechanical energy into electric energy). Judge Townsend continues:

"Comparison of Bradley's application, which has been filed before Tesla's patents application, with Bradley's patent No. 409450, which was published on August 20, 1889 after Tesla's patents, reveals that the application describes the method and explains the apparatus specified to avoid accidents with two-phase alternating currents by combining both currents in one by use of one transformer. In the patent, Bradley omitted the description and method, and introduced the pictures, which despite their striking resemblance to the apparatuses demonstrated by Tesla, cannot prove that Bradley made the Concept of the Tesla's idea, or that he thought to protect the subject of the Tesla's invention. Because Bradley's application is indefinite and of limited objective, and because it does not show that Bradley had any concept of the Tesla's idea of "utilisation of motor on the basis of progressive movement of the magnetic poles of the alternating currents by use of electric circuits, which provide independence and different time relation of their phases", and because, even if Bradley was the first creator of that concept, the concept was insufficiently described to explain the principle or method of work, and finally, because Tesla was the first to practically implement such principle, Bradley has neither anticipated nor limited it.

The Defence placed main hopes on the article of Mersel Depre from 1880-1884, and they were right, because Depre not only presented the principle used by Tesla, but also gave a mathematical explanation of the rotating magnetic field. The claimant's experts also say:

"The article explains a mathematical fact, which has also been determined in the Tesla's patents, that the polar line in a circular magnet can move along its full perimeter under the action of the two magnetization forces in adequate relation." Judge Townsend quotes Depre's article and says:

"All that Depre said was, that when a field is created where an electromagnet changes its position in relation to the brushes, or vice versa, the angle of such change can be reflected in another machine by means of a compass needle, which will rotate faster or slower depending on how the magnet and brushes move towards each other, and will indicate a new angle between the brushes and the magnet. One useful and practical application of that device was to connect it to the power generators and use land or vessel to demonstrate change of position by means of the compass needle on the top of the mast. These devices could not induce anybody to think that the alternating currents can be used as the engine power source. It was an indicator only. It did not include utilization of two different phases as a power source in generation of the permanent magnetic field. It did not rely on any permanent, regular, progressive currents, and as demonstrated by evidence, it was, according to recognition, only a laboratory experiment, like the Baily's device. That Depre did not know about the concept of the Tesla's idea to use regular, progressive, permanent alternations of the current, was proved by Depre himself in his statement from 1889, after publication of his lecture and after Golla and Gisp's invention of the system of the alternating current for lighting purposes, when he published his second lecture where he criticized that system and stated that one of the biggest obstacles for the system is its impossible application on power

transmission, and added: "Further, I must note that the alternating currents are not usable for power transmission; they are only suitable for lighting."

Finally, the proofs show, as Professor Sylvanus Thompson says in his work on that general subject: "Depre's theorem was not fertile; it remained just a geometrical abstraction."

The main idea expressed and applied in Tesla's patents was that fast successively opposite alterations of the alternating current, that are regular and constant in such different phases, be used not only to prevent them halt the armature, but also to become a source of power. To carry out that idea in practice, alternations had to raise and fall and follow in sequence progressively and continually, as the Claimant's expert says: "like locomotion lever, which has no dead point, but pushes only forward". Tesla's invention, in its essence, consists of permanent rotation or whirling of magnetic forces for generation of power, where two or more shifted or different phases of the alternating current are developed, and transmitted into the motor where they remain separate, and where such shifted phases are used in the motor.

Baily does not describe use of the alternating currents of the shifted phases. He just describes intermittent movement of poles by means of the commutator or switch, and that is what Tesla denies. Neither Siemens nor Bradley describes use of such shifted phases of the alternating currents with their independence maintained in the motor.

What was the state of the art in 1887, when Tesla filed his patent applications?

Nine years passed since the patent was granted to Siemens, which, according to the defendants is "complete disposition of the main contents of the published patents 381968 and 382280" and "reference to them ... in the hands of skilful electricians ... would naturally lead, as can be understood by itself, to the organization of elements that contain the system of electrical power transmission and substantially include the system of the earlier mentioned patents. Eight years passed since Baily's lecture. Four years passed since Marsel Depre's article, who, as the defendants state, "described the same thing that is claimed by the claimant to be Tesla's discovery, and explained the theory of operation", of a device which is "a generator of two-phase alternating current according to its way of function and generates two-phase alternating currents to generate rotating field inside the motor", similar to Tesla's motor.

Before Tesla's invention, alternating current motors were not in use, despite great needs.

.....  
Siemens, who was mainly quoted to support the evidence, does not describe any use of the alternating currents nor reports on use of commutators, but only mentions use of these devices in the function of an electric machine "with suitable modifications" that have never been described in the literature.

Impracticality of the motor with changed current direction, generated by the commutator, shows that Siemens, Baily and others did not have any knowledge about the discovery of the Tesla's invention; they took into

consideration the lighting electrical machines with commutators.

Tesla was the first who discovered the way how to use these alterations for such purposes and demonstrated both the machine and method adapted for such use.

.....  
However, if the evidence presented up to now are not taken into account, and if we consider the alternating currents and the currents of changed direction to be theoretically known equivalents, even then this is not favorable for the Defense. They believe that the great results obtained by replacement of one known equivalent with the other does not make an invention. But, the first substitution or application of such theoretical equivalent for creation of a new or non-equivalent or unexpected result may contain an invention. Tesla applied alternating current to achieve what the current of changed direction could have never given: namely, to produce a new, unpredictable and practical power transmission system."

Careful examination of evidence lead Judge Townsend to a conclusion that Tesla made a new extraordinary discovery, without diminishing the level of Tesla's invention. It was proved that by a new combination and arrangement of the known elements, he obtained a new and useful result that has never been achieved before, thus leading to a new industrial revolution.

\* \* \*

Judge Townsend made his Decision only after long oral judicial proceedings, where the main person of the accused company "New England Granite Co." was B.A. Berend, an expert well-known in practice. We are giving here his statement, that was printed in the second edition of his book "The Induction Motor", published in 1921 in New York, pages 261 and 262 and reads:

"Twenty years ago it seemed that the author of this book supported infringement of the Tesla's patents, in connection with his employment. A large number of the induction motors designed by him during the term of these patents, which was full infringement of the Tesla's inventions, was an undisputable reason to believe that he either did not have trust in the validity of these patents or was deliberately involved in patent right violation.

The company where the author was the chief engineer at that time, had to be highly grateful for its development and growth to his personal endeavors in designing and developing the electric machines, and to his successful organization of the engineering staff comprising a whole range of excellent experts including David Hall, A. B. Feld, W. L. Waters, Bradley T. Mc Cormick, H. A. Bourzon, Alexander Miller Gray, R. B. Williamson, Carl Fecheimer, and others. At that time, the owners of Tesla's patents initiated the proceedings against our company, and the position of the author during these long proceedings was occasionally very unpleasant and brought him into two minds. That is why he, feeling still bitter because of these past proceedings, now asks for permission to publish a letter addressed to the patent lawyer of his company in the epilogue of the:

Cincinnati, Ohio, 23<sup>rd</sup> May 1901. Mr. Arthur Stam Patent Lawyer In the city.

*Dear Sir, herewith enclosed you will find my comments on the report of Feinal Hiring in the case "Westinghouse Electric and Mfg. Co." versus "New England Granite Co."*

*You will see that I am now convinced more than I was earlier that it is not possible for us to submit further evidence which could prove invalidity of the Tesla's patents that are the subject of the judicial lawsuit. Although I am an employed engineer very willing to give you every technical support I can, according to my official duty, on your request and for your requirements, I cannot oblige myself to speak in favor of my employer in this case, because such action would be against my higher believes in this matter. Since you informed me during my last visit to your office that I should be one of the experts, I think it is the best to inform you at the earliest convenience that I am not in position to assume this task.*

*Model maker Mr. V. J. Sultz paid a visit to our office yesterday and I gave him all necessary instructions to make the device that we think should be made for this proceeding. In this way, Mr. Sultz is prepared so that we can have trust in him that this will be made and presented to our headquarters. I remain, Sincerely yours, B. A. Berend, Chief-Engineer, etc..*"\* 1

This recognition of B. A. Berend is of great importance for the truth for two reasons.

First of all, it proves that publication of Tesla's patent in USA was immediately followed by building the large number of induction motors, and that their producers did not pay attention to what extent they were in conflict with Tesla's patents. Patented inventions had such effects on further development of the electronic engineering so that some companies did not hesitate to be involved in the judicial proceedings believing the benefits of the unauthorized use of Tesla's patents would far outweigh the losses in connection with the charges they pay for lost lawsuits. They did not shrink from any means to contest patent rights and prove existence of the polyphase systems not covered by them.

The leading experts of that time, the most prominent of whom were Brown, Berend and others, were aware that they built multi-phase motors and generators fully infringing Tesla's patents. Berend was not only a famous designer, but also a theoretician in the field of polyphase system and he published a whole range of scientific papers, which resulted in, so called, pie-diagram, which is partly known in literature as Highland's diagram. That diagram is theoretical explanation of relations in an induction motor operating under different loads, and gave great results in calculation of motors of various sizes for different kinds of drive. Recognition from such expert is undoubtful evidence that in the history of the polyphase system many efforts were made to diminish Tesla's credits and to link Tesla's inventions to other names. Ferraris, Dolivo Dobrowolsky and many other inventors are among

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\* 1 The Induction motor and other Alternating Current Motors, by B. A. Behrend, fellow, and past senior vice president, American Institute of electrical engineers fellow, American academy of arts and sciences, etc.

Mc Graw – Hill Book Company, New York: 370 senect avenue, 1921, p. p. 261 – 262.

those who are in literature credited for discoveries and inventions, clearly explained in Tesla's patents.

Townsend's decision is important from the professional aspect and illustrates that he is top patent expert.

The most important is his explanation of the term "independent" that relates to the multi-phase electrical circuits. Townsend had quite correct view that the application of multi-phase currents for generation of the rotating magnetic field in the motor essentially requires electrical circuits to provide necessary "independence" of each phase in its action and that the current generated in a generator in one phase acts as such in the motor.

The second important statement is that there is significant difference between the alternating and direct current. According to Townsend, this significant difference between these two ways of generation of the rotating magnetic field consists of inability to use high voltages in case of direct current, while the alternating current can be successfully used for this purpose along very long distances. Direct current is requires a commutator, for generation and change of direction. In addition to it, a commutator which rotates by means of a special mechanical device must be used for change of direction. Alternating currents do not need commutators and the voltage can be changed by transformers when necessary, while always maintaining the alternating character of the current.

The third statement is that Tesla's basic patents include multi-phase generators and multi-phase motors. It is clear from the patent claims that were denied, because they refer to the combination of multi-phase generators and motors. The discovery of multi-phase currents is related to multi-phase generators, which do not include the generators with separate groups of windings as were earlier used for supplying different electrical circuits in the arc lamps. Townsend's decision says that Tesla is the inventor of multi-phase generators and motors, no matter they are two-phase or three-phase currents, or three, four or more conductors are used for transmission of these currents.

The fourth statement is of principal significance, that neither Tesla nor other owners of his patents can have the right to preclude sales of the generators and motors, but only their production. At this point, the Judge demonstrates his knowledge of the patent system, because he does not approve so called "market function of the patent" that hinders every development.

## VII. CONCLUSION

It is difficult for the small nations to have great people because a genius needs great environment to develop his ideas. The best example is Tesla. Large country facilitated creation of his patents which were the driving force for the Second Industrial Revolution and the inclusion of his name among the builders of the world civilization. He is a winner not only because of the Townsend's decision, but because the world generally recognizes that Tesla invented the system for the long distance transmission of electrical power.

However, it was not easy. Human malice and greed for money destroyed Tesla materially, but his spiritual values

were still shining with full radiance to the welfare of the human kind. These values could not be diminished by the astronomer Arago from Paris, or Ferraris – professor from Turin, who were attributed the invention of the rotating magnetic field. Siemens' patents from 1878, Baily's experiment from 1879 in London, "one way to generate Arago's rotation", and the research work of the great French scientist Depre from 1880, who used higher voltages for transmission of electrical power, are insignificant because they all fail to describe the use of the alternating current. The patents of Bradley, a great American inventor, from 1889, did not have anything to do with the ingenious Tesla's work. Although Dolivo Dobrowolsky together with the German inventors Schuckert and Haselwander and the Swiss Brown, made "the first polyphase system" near Frankfurt in 1891, the credit was on Tesla because later they themselves admitted that all technical innovations belonged to Nikola Tesla.

There remains the shameful decision of the State Court of the German Reich from 1898, which made a lot of problems for Tesla and almost ruined him financially. Invalidation of Tesla's patents excused by their "failure to work" means certain kind of compulsory license is introduced. The Court probably assessed that this was the best way to help German companies AEG, SIEMENS and HALCKE that stole Tesla's patents and close HELIOS and other German companies which had legal production in accordance with Tesla's patents. The forces of greed destroyed only Tesla's material values and all lawbreakers with their confessions and remorse only made his spiritual values greater.

Available time prevented us to address the fraud by Edison and Marconi, a judicial proceeding in connection with Tesla's radio patents, and the roles of the courts in USA and Great Britain that consumed many decades. In his book to be published soon, the author explains in details the German, American, French and British judgments.