

Who Was The *Real* Dr. Nikola Tesla?

(A Look At His Professional Credentials)

by

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“We think of his contribution much oftener than that of Ampere and Ohm . . . the induction motor and our power system are enduring monuments to Nikola Tesla.” Dr. E.F.W. Alexanderson¹ (keywords: electrical history)

Unlike with so many narrowly specialized pioneers in electrical history, the query as to who Nikola Tesla really was has many responses, depending upon the perspective of the questioner. Despite the fact that many of his technical publications are still accessible, that several biographies are available, and that he has had a rather widespread impact (not only upon the electrical engineering profession but also society at large) few people today actually have a balanced grasp of who he was and what he did. This is particularly true of his seminal contributions to RF technology. A remarkable number of items have been composed for the general public about Tesla - probably as many as any other single scientist in history. (There exist TV specials, plays, recitals, poetry, and even award winning popular songs about the man.) An annotated Tesla bibliography was published twenty-two years ago that contained over 3,000 references (and the number has grown dramatically since then).² Several magazines,

journals, societies and even “web-rings” have been created as media exclusively devoted to the discussion of his activities. While volumes could (and have) been written about the gentleman, the present authors will view his work from our perspectives as scientists and engineers.

Tesla received his formal education at the Polytechnic Institute at Graz, Austria (he matriculated with degrees in mathematics, mechanical engineering and electrical engineering) and at the University of Prague (where he performed graduate studies in Physics). After a period of professional practice at Budapest (where, in 1882, he conceived the idea of a rotating magnetic field to drive electrical machinery), Strasbourg (where he constructed the first polyphase motor), and Paris, he immigrated to the US at age 28 in 1884. With his discovery of the rotating magnetic field and the publication of his celebrated 1888 paper on a new system of AC motors and transformers, his position in the history of electrical science and technology was forever established.³ After showering words of praise upon the inventor before a meeting of the Royal Society in London in 1892, Lord Rayleigh

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declared that Tesla possessed a great gift for electrical discovery. By 1896, at the Franklin Institute in Philadelphia, Lord Kelvin would say, “*Tesla has contributed more to electrical science than any man up to his time.*” His fundamental discoveries and creations span basic science, systems, technology and components. He was one of the earliest scientists to grasp the distinction between lumped and *distributed* resonance and, after conferring in 1892 with Heinrich Hertz at Bonn, he was the first to patent voltage magnification by standing waves on distributed resonators.^{4,5} (The technique would subsequently be used by David Sloan,⁶ E.O. Lawrence, and Louis Alvarez in the evolutionary development of modern particle accelerators.⁷)

The MKS unit of magnetic induction was adopted in honor of Tesla in 1956. It is common knowledge among power engineers that he was the inventor of the rotating magnetic field, the induction motor, and the AC polyphase power distribution system* currently used throughout the civilized world.† Haraden Pratt, IRE President, and later Chairman of the IRE History Committee, once wrote, “Our existing industrial era would cease to

* Concerning the polyphase AC system, Bernard Behrend, Vice President of the AIEE, has said, “Not since the appearance of Faraday's Experimental Researches in Electricity has a great experimental truth been voiced so simply and so clearly . . . He [Tesla] left nothing to be done by those who followed him.” (Minutes of the May 1917 AIEE meeting.)

† Dr. Charles F. Scott, past President of the AIEE (now the IEEE) and Chairman of the Electrical Engineering Department at Yale University, has said, “The evolution of electric power from the discovery of Faraday in 1831 to the initial great installation of the Tesla polyphase system in 1896 [at Niagara Falls] is undoubtedly the most tremendous event in *all* engineering history.” [Electrical Engineering, August, 1943, pp. 351-355.]

function without Tesla's first and greatest contributions.”⁸

However, most electrical engineers are unaware that, as late as 1943, on the basis of his “Apparatus” patents, he (*not* Marconi‡) was recognized by the US Supreme Court as having priority in the invention of “Radio”.^{9,10,11,12} Even fewer computer scientists are aware that, when certain computer manufacturers attempted to patent digital logic gates after World War II, the US Patent Office asserted Tesla's (turn of the century) priority in the electrical implementation of logic gates for secure communications, control systems, and robotics. As a result, a monopoly on electronic logic was unable to be privately secured in the 1950's.

Writing in the massive 50th anniversary issue of the Proceedings of the IRE, R.M. Page identifies Dr. Tesla as the first who “... suggested the use of electromagnetic *waves* to determine the relative position, speed, and course of a moving object,”¹³ and it now seems to be broadly recognized that Tesla, in 1900, was the earliest to propose the modern concept of radar.¹⁴ Certainly, Tesla's interview with H. Winfield Secor¹⁵ appears in the radar lore.^{16,17} He bears legal priority in radio remote control, experimental robotics, and frequency division multiplexed secure communication.¹⁸ The multistage, cascade voltage

‡ Although it took the courts several decades to settle this, the facts were well understood by impartial technical men of the day. Robert H. Marriott, the first President of the IRE (1912), once said that Marconi had “... played the part of a demonstrator and sales engineer. A money getting company was formed, which in attempting to obtain a monopoly, set out to advertise to everybody that Marconi was the inventor and that *they* owned that patent on wireless which entitled them to a monopoly.” [Radio Broadcast, Vol. 8, No. 2, December, 1925, pp. 159-162.]

multiplier technique (“charging condensers in parallel and discharging them in series”), later embellished by Greinacher (1920), and Cockcroft and Walton (1932), with a variant patented in Europe by Marx (1923), was patented in the US by Tesla in 1897.¹⁹ During the 1984 IEEE centennial, the IEEE Professional Activities Committee identified Nikola Tesla among the “twelve apostles” of electrical engineering.²⁰ From the early AIEE Transactions we see that Tesla regularly attended AIEE meetings and frequently participated in lengthy discussions at the close of the paper presentations. He was selected to represent the AIEE at the Electrical Congress held in Frankfurt in 1892, and it was at this time that he traveled to Bonn to confer with Heinrich Hertz about wireless research. Tesla served the electrical engineering profession in its highest offices. In the early 1890's, he was elected as vice-president of what is now the IEEE. (At the time of his election, Alexander Graham Bell presided over the AIEE. Both Bell and Tesla would later receive the AIEE's highest award of honor.) Tesla served two consecutive years as vice-president of the AIEE. The first book written about Tesla was a collection of his public lectures, and it was edited and published by the third President of the AIEE (Thomas Commerford Martin).²¹ It should also be noted that Tesla was elected as a full Fellow of the AIEE (now the IEEE), as well as the American Association for the Advancement of Science, and a dozen other professional societies. He was honored by the Preussische Akademie der Wissenschaften in Berlin, and the President of the (British) IEE once said, “*Tesla was the greatest electrical inventor we have ever had on our role of membership.*”²² He received over 13 honorary degrees (Doctorates and so forth)

from such diverse institutions as Columbia, Yale, and the Universities of Paris, Vienna, Prague, Sofia, and many, many more.

Recently, another fascinating fact about Nikola Tesla has come to light. After all these years, it is now documented that he was nominated for an *undivided* Nobel Prize in Physics in 1937.²³ (Tesla's nominator, Dr. Felix Ehernhaft, of Vienna, had been one of those that nominated Albert Einstein for the Nobel Prize in 1921.)

Tesla possessed a remarkable talent for charming and astonishing his admirers while at the same time enraging his critics. (The phenomenon continues to the present day.) It is unfortunate that, despite the fact that several popular biographies are currently available, there still exists no definitive formal authority (other than his own scattered publications) to consult on the technical issues of his intriguing and colorful scientific career. Tesla was esteemed by his peers as a first class man of science. Those misunderstanding his professional stature should carefully consider the respect and admiration conferred by the foremost living scientists of his own era (Kelvin, Helmholtz, Crookes, Dewar, Rutherford; Noble Prize winners: Rayleigh, Bragg, Bohr, Millikan, Einstein, Compton, Appleton; and many others including university presidents, members of the defense community, and even scientific advisors to the President of the United States). It is impossible to adequately address Dr. Tesla's professional credentials or accomplishments in this brief space. But, it can be said with certainty that no one since Dr. Franklin[§] has so stirred the scientific and engineering world.

[§] Benjamin Franklin and Nikola Tesla both share honors from Yale, the Royal Society (London), and the American Philosophical Society.

NIKOLA TESLA

1856 - 1943

EDUCATION: Undergraduate Studies - Austrian Polytechnic Institute at Graz: Separate Baccalaureate degrees in Physics, Mathematics, Mechanical Engineering and Electrical Engineering. Graduate Studies - University of Prague: Physics.

DOCTEUR HONORIS CAUSA: University of Paris, Columbia University, Vienna Polytechnic Institute, University de Poitiers, University of Beograd, Graz Polytechnic Institute, University of Brno, Yale University, University of Zagreb, Polytechnic Institute of Bucharest, University of Grenoble, University of Sophia, University of Prague.

PROFESSIONAL SOCIETIES: Vice-President of the AIEE (now IEEE) 1892-1894, Life Fellow IEEE (AIEE), Fellow American Association for the Advancement of Science, Fellow American Electro-Therapeutic Association, New York Academy of Sciences, American Philosophical Society, National Electric Light Association, Serbian Academy of Sciences, Societe International des Electriciens, Societe Francaise de Physique, Institution of Electrical Engineers (British).

AWARDS: IEEE (AIEE) Edison Medal (1916), The Franklin Institute's Elliott Cresson Gold Medal (1893), The John Scott Medal (1934), Nominated for an undivided Nobel Prize in 1937.

250 PATENTS: The invention of the Rotating Magnetic Field, The Induction Motor, The AC Polyphase Power Distribution System, the Fundamental System of Wireless Communication (Legal Priority for the invention of Radio), RF Oscillators, Voltage Magnification by Standing Waves, Robotics, Logic Gates for Secure RF Communications, X-Rays, Ionized Gases, High Field Emission, Charged Particle Beams, Voltage Multiplication Circuitry, High Voltage Discharges, Lightning Protection, the Bladeless Turbine, VTOL aircraft.

HONORS: The name "*TESLA*" was adopted as the unit of Magnetic Induction (1956). The Tesla Award was created by the IEEE (1976).

TRIBUTES TO NIKOLA TESLA

(1856-1943)

Lord Kelvin: "Tesla has contributed more to *electrical science* than any man up to his time."

Sir J.A. Fleming: "Tesla captured the attention of the whole scientific world by his fascinating experiments."

W.H. Eccles [Flip-Flop circuit]: "Tesla was the *greatest inventor in the realm of electrical engineering.*"

• **Noble Prize Winners:** [Dr. Tesla was nominated for an undivided *Nobel Prize* (in Physics) in 1937.]

Niels Bohr: "With deepest admiration we think of how Tesla could accomplish such great achievements."

Ernest Rutherford: "... all scientific men will be delighted to extend their warmest congratulations to Tesla and to express their appreciation of his great contributions to science."

Albert Einstein: "[Tesla is] an eminent pioneer in the realm of high frequency currents... I congratulate [him] on the great successes of [his] life's work."

W.H. Bragg: "[Dr. Tesla's] experiments were the most original and daring... I shall never forget."

Arthur Holly Compton: "Tesla is entitled to the enduring gratitude of mankind."

Robert A. Millikan: "I am sending [Dr. Tesla]... my gratitude and my respect in overflowing measure."

• **IEEE Presidents:** [Dr. Tesla was a *Life Fellow* of the AIEE and the 1917 recipient its highest award.]

Thomas Commerford Martin: "Tesla's influence may truly be said to have marked *an epoch* in the progress of electrical science."

J.S. Stone: "He did more to excite interest and create an intelligent understanding [of RF]...than anyone."

L.W. Austin: "I am glad to express... my feeling of the great debt that the *radio* art owes to [his] genius."

H.W. Buck: "The work of Nikola Tesla... in *his great conception of the rotary field* seems to me one of the greatest feats of imagination which has *ever been attained by the human mind.*"

Ernst F.W. Alexanderson: "In almost every step of progress in electrical *power engineering* as well as in *radio*, we can trace the spark of thought back to Nikola Tesla."

Charles Proteus Steinmetz: "I can find no mistakes in Tesla's thoughts."

Lee de Forest: "If I could be any other man I would be Nikola Tesla."

Michael Pupin: "The credit of showing the practical importance of AC for motors belongs entirely to *Tesla.*"

G. Dunn: "[Dr. Tesla] solved the greatest problem in electrical engineering of his time."

Haraden Pratt: "Our existing *industrial era* would cease to function without *Tesla's great contributions.*"

Arthur E. Kennelly: "... what he showed was *a revelation* to science and art unto all time."

Charles F. Scott: "The evolution of electric power from the discovery of Faraday to the initial great installation of the *Tesla polyphase system* in 1896 is undoubtedly *the most tremendous event in all engineering history.*"

• **IEEE Vice-Presidents:** [Tesla served *two years as an IEEE (AIEE) Vice-President:* 1892 to 1894.]

Bernard A. Behrend: "Were we to seize and to eliminate from our industrial world the results of Mr. Tesla's work, *the wheels of industry would cease to turn*, our electric cars and trains would stop, our towns would be dark, our mills would be dead and idle."

Edwin Howard Armstrong: "[He was] a prophet of the *wireless-controlled* engines of war."

Jonathan Zenneck: "[Dr. Tesla's] lectures opened a new physical world to me... [He was] one of the kindest men I've ever encountered. The hours which I was permitted to spend together with [him] will always be among *the fondest memories of my life.*"

Other IEEE executive officers [R.H. Marriott (1st IRE President), Fritz Lowenstein (1st IRE Vice-President and Tesla aide), Vannevar Bush, Valdemar Poulsen, and John Hays Hammond, Jr.] were all no less lavish when extolling Dr. Tesla, as were also his personal friends **Sir William Crooks**, **Lord Rayleigh**, **Sir James Dewar**, **Hermann von Helmholtz**, and a galaxy of other celebrated scientists and prominent engineers.

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- ¹⁵ H.W. Secor's name is found on the first IRE record book listing the Institute's earliest members. (Member #101)
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