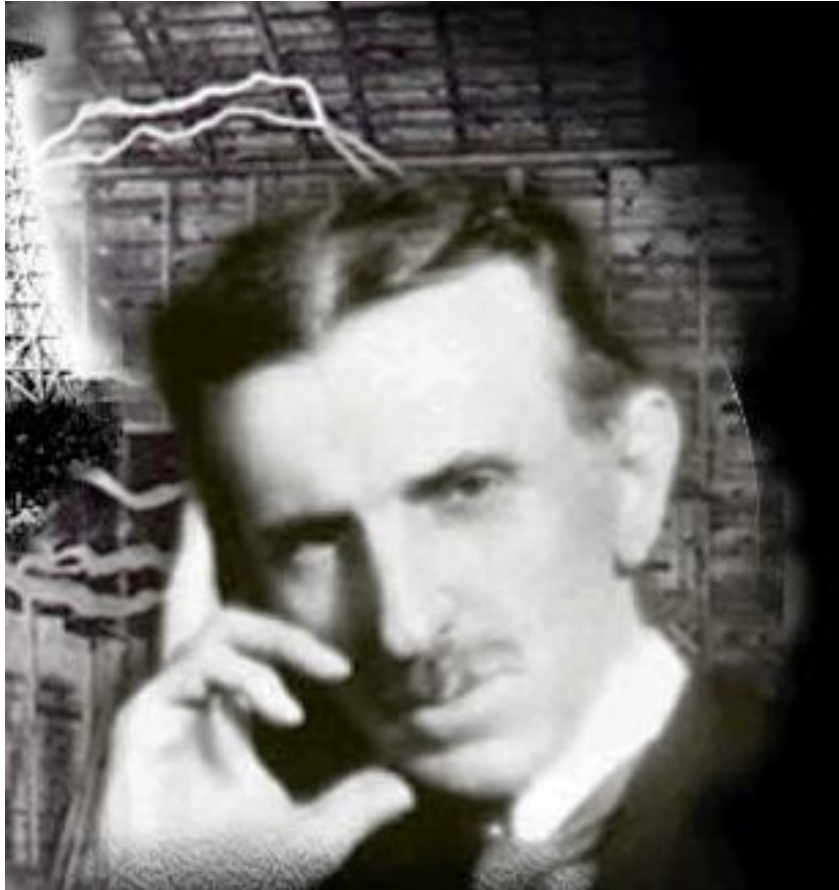




Universidad Católica, Facultad de Física
Ciclo de Charlas 2006.



***Nikola Tesla (1856-1943):
El inventor que iluminó
al mundo.***

**Rafael Benguria,
Viernes 29 de Septiembre, 2006.**

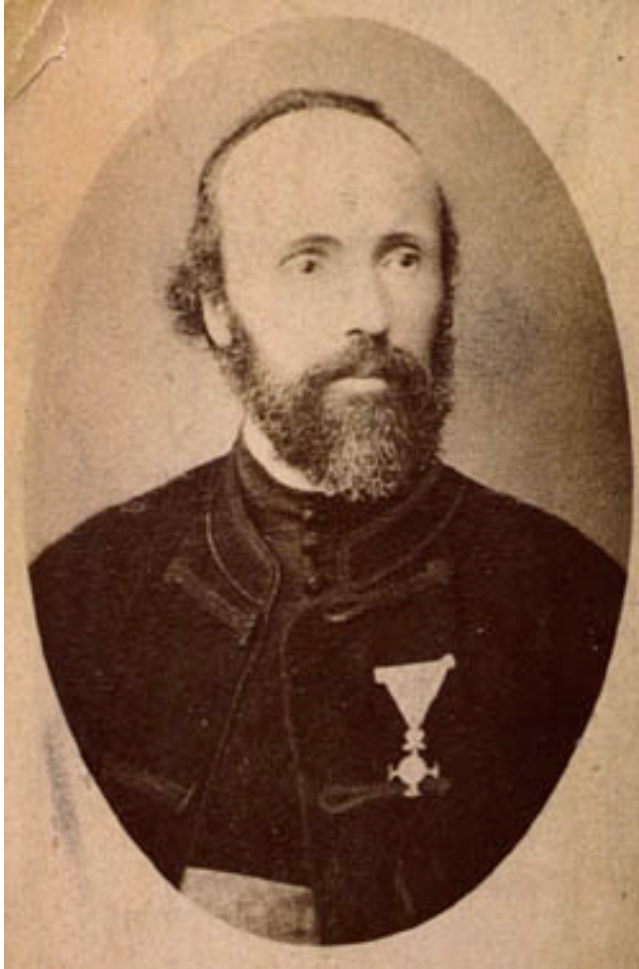


El será el hijo de la tormenta....

*Casa donde nació N. Tesla,
el 10 de Julio de 1856,
en Smiljan, Lika, Croatia*



...nó, el será el hijo de la luz.



Milutin Tesla, padre de N. Tesla

*Los padres de N. Tesla fueron
Milutin Tesla (+1879)
y Georgina-Djuka (Mandich)
(1822-1892).*

*Milutin y Djuka se casaron
en 1847 y tuvieron 5 hijos.*

Nikola, fue el cuarto hijo.



Regions of Croatia

- | | |
|-----------------------------------|--|
| 1. Istria County | 10. Požega and Slavonia County |
| 2. Rijeka County | 11. Virovitica and Podravina County |
| 3. Karlovac County | 12. Osijek and Baranja County |
| 4. Zagreb County | 13. Sisak and Moslavina County |
| 5. Krapina and Zagorje County | 14. Slavonski Brod and Posavina County |
| 6. Varazdin County | 15. Vukovar and Srijem County |
| 7. Međimurje County | 16. Lika and Senj County |
| 8. Koprivnica and Krizevci County | 17. Zadar County |
| 9. Bjelovar and Bilogora County | 18. Šibenik and Knin County |
| | 19. Split and Dalmatia County |
| | 20. Dubrovnik and Neretva County |
| | 21. The City of Zagreb |

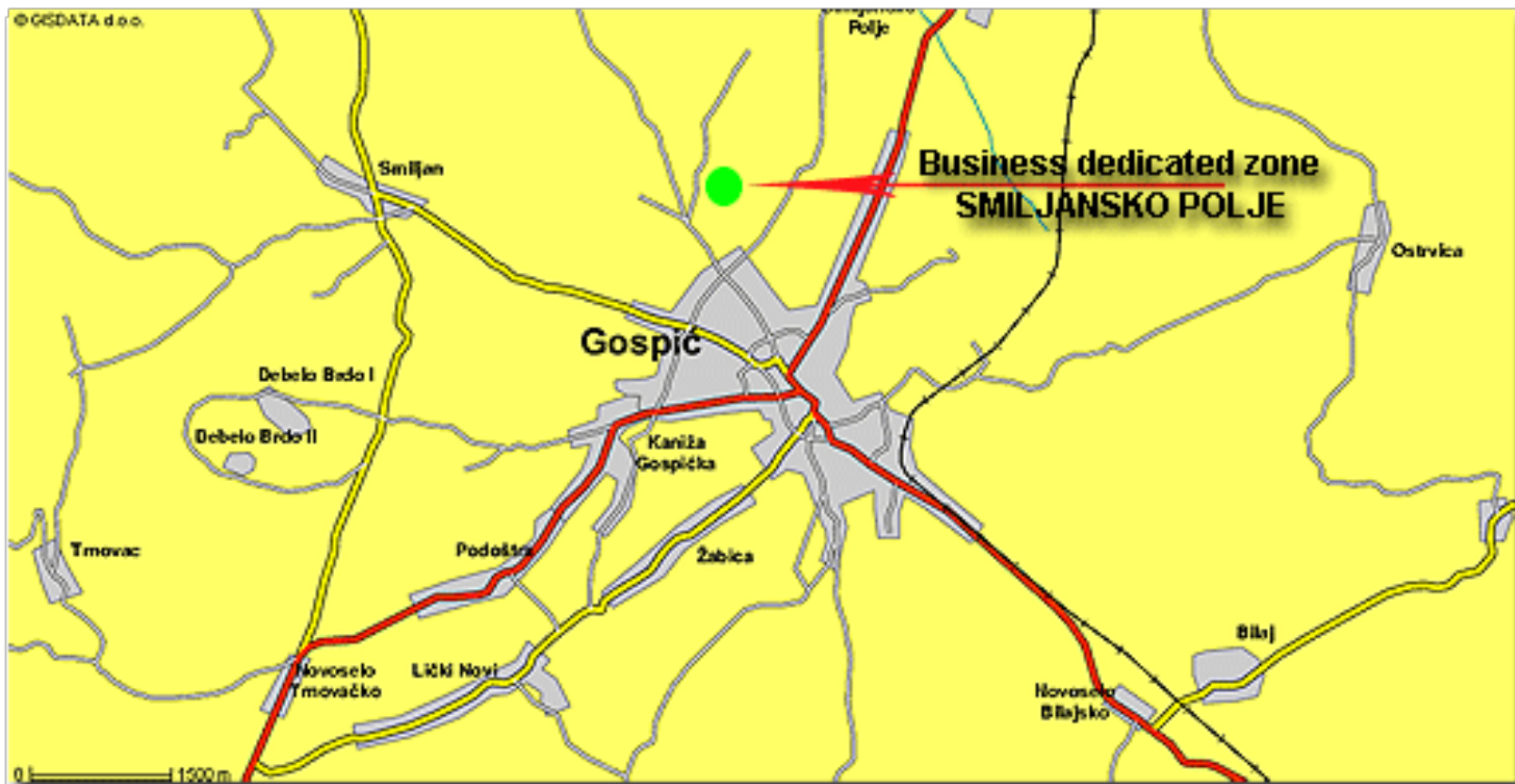




*Un pueblo en la región
costera de Lika, sobre
el Adriático*



Gospic, Croatia





El interior de la casa de Tesla en Smiljan



“A Story of Youth, told by Age”, carta de N. Tesla a Miss Pola Fotitch, 1939.

En 1862, la familia Tesla se traslada a Gospic, y Nikola realiza su educación primaria.





Vista general de Gospic (Croacia).



Entre 1871 y 1873, Tesla hizo sus Estudios secundarios (Realgymnasium) en Rakovac cerca de Karlovac.

Su profesor de Matematicas, Martin Sekulic, ejercio gran influencia sobre el.

En 1873/74, Nikola Tesla estuvo gravemente enfermo de colera.

Su padre entonces accede a que Nikola pueda ir a una escuela Politécnica.

En 1874-1875 se recupera en el pueblo de Tomigaj, cerca de Gracac.

*En 1875, se matricula en la Universidad Tecnica de Graz
(en principio por tres años: 1875-1878).*



Graz, ca. 1875

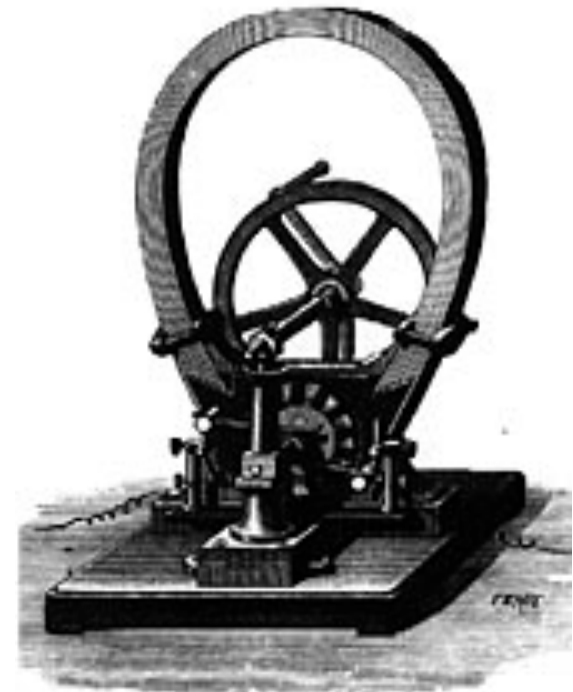
Su profesor de física en Graz fue Jakob Pöschl:

*“Prof. Pöschl was a methodical and thoroly grounded German.
He had enormous feet and hands like the paws of a bear but
All his experiments were skillfully performed with a clock-like precision
And without a miss”...*



U. Técnica de Graz.

Dynamo de Gramme (1877).





Vista general de Graz, hoy.

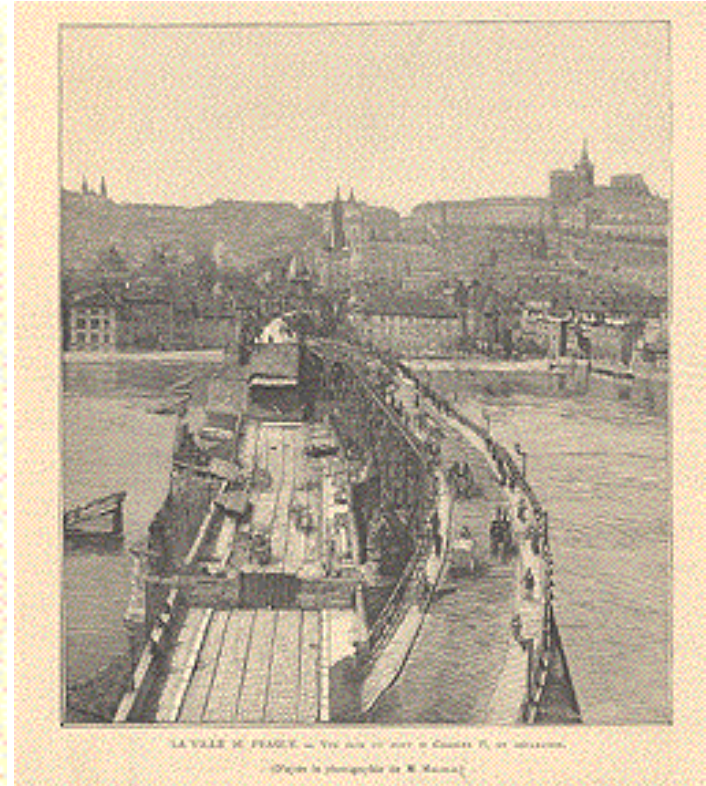
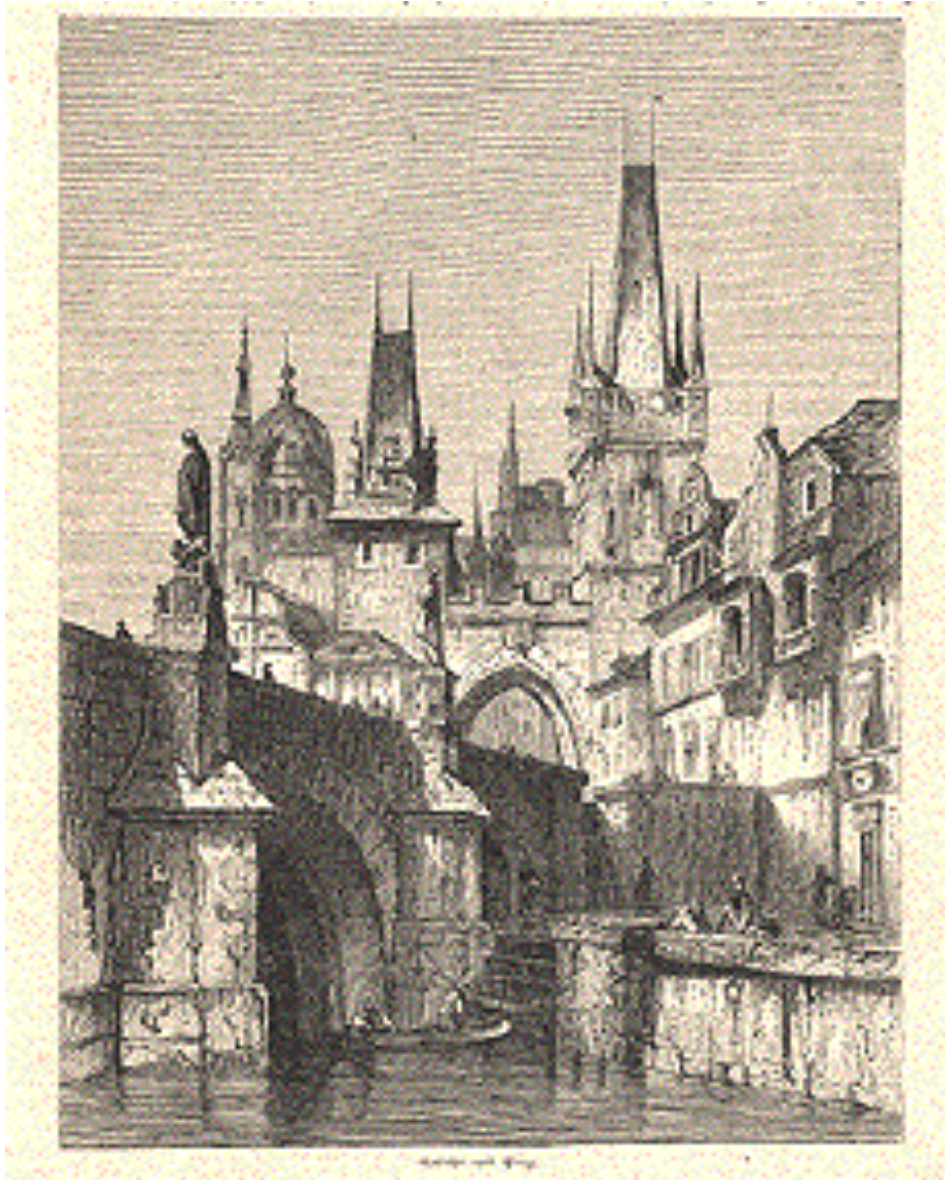


En 1879 muere su padre. En 1879, Tesla se mueve a Maribor y luego a Gospic, desempleado.

Por un tiempo, hace clases en el realgymnasium de Gospic.

En 1880, vuelve a estudiar, pero esta vez como oyente en la Universidad de Praga.

N. Tesla de 29 años



Litografias de Praga, ca. 1880.



Praga, ca. 1870

The glow retreats, done is the day of toil;
It yonder hastes, new fields of life exploring;
Ah, that no wing can lift me from the soil
Upon its track to follow, follow soaring!

W. Goethe, "Fausto"

*En 1881 N. Tesla vive en
Budapest, y consigue trabajo en la
Oficina Central del Telegrafo.
En Budapest, en 1882 ideó el mecanismo
del campo magnético rotatorio.*



En 1882, consigue trabajo en Paris es una compañía de T. A. Edison.

En 1883 viaja a Estrasburgo y Stuttgart, e inventa el motor de inducción sin commutadores (de “jaula de ardilla”).

El 10 de Junio de 1883, exhibe el motor de jaula de ardilla.

Carta de Charles Batchelor a Edison (1884).

My Dear Edison: I know two great men and you are one of them. The other is this young man!"

Tesla viajó a Norteamérica en Junio de 1884, se presentó a Edison con la carta de Batchelor y le describió el trabajo de ingeniería que él había hecho y sus planes sobre los motores de corriente alterna.

Edison le prometió US\$ 50,000, por mejorar sus generadores de Corriente Continua y lo contrató en su empresa: "Edison Machine Works".



En 1884, Nikola Tesla llega a la ciudad de Nueva York.



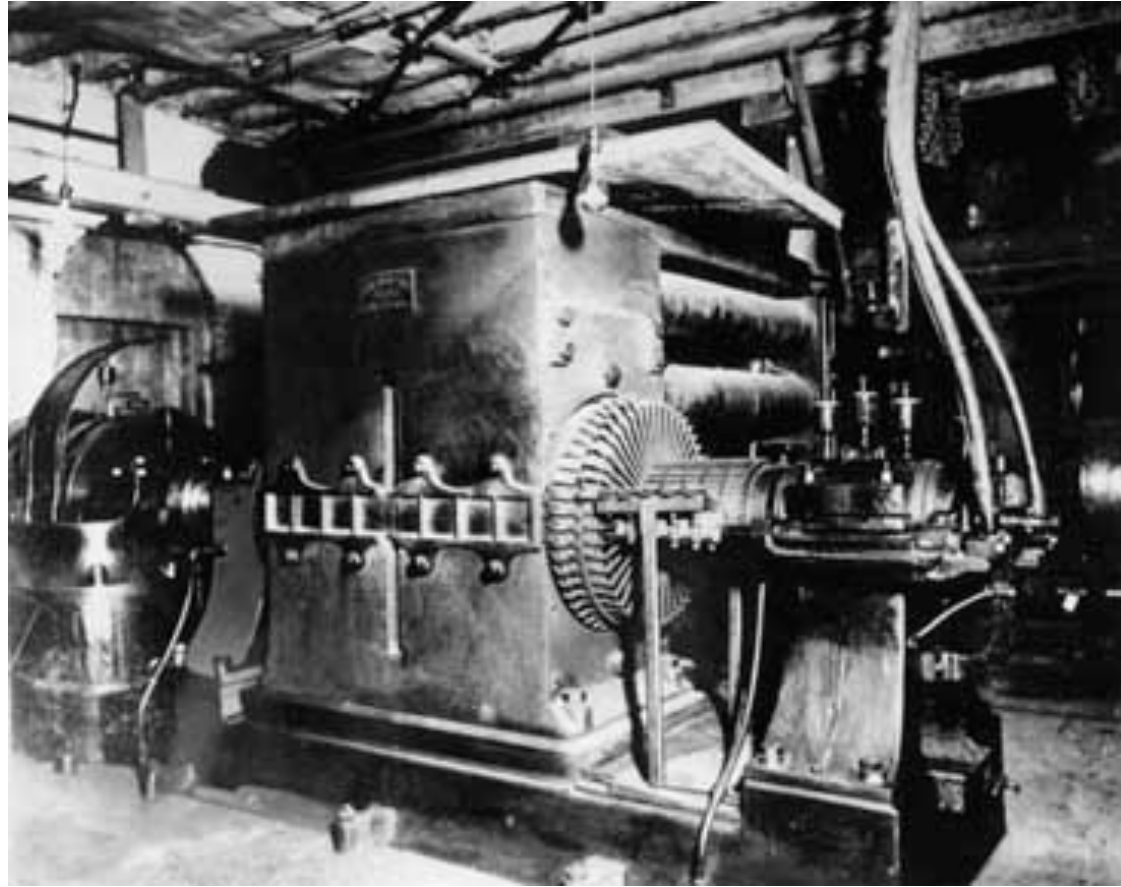


*Fotografía de T.A. Edison
(1847-1931),*

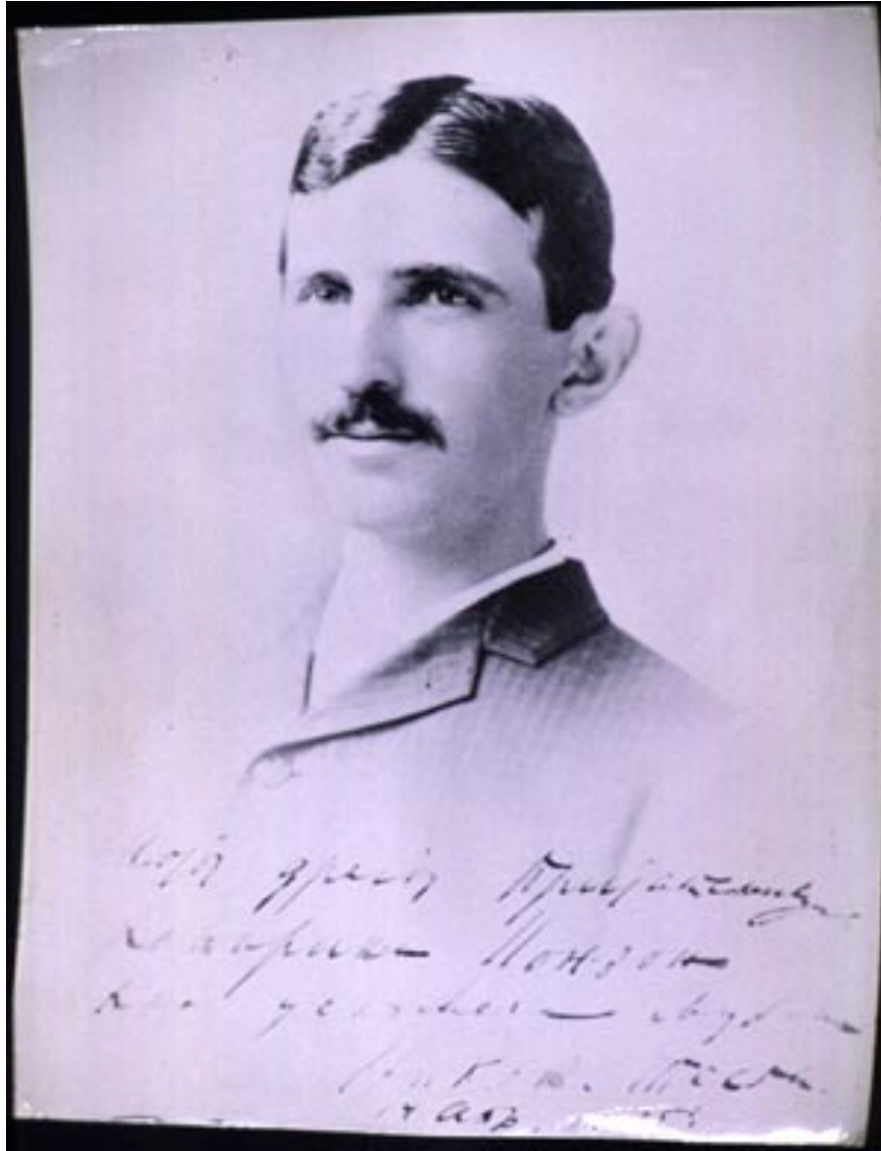
dedicada a Tesla.



Casa de Edison en Menlo Park, NJ.



Generador DC, de Edison en Pearl Street, NY.



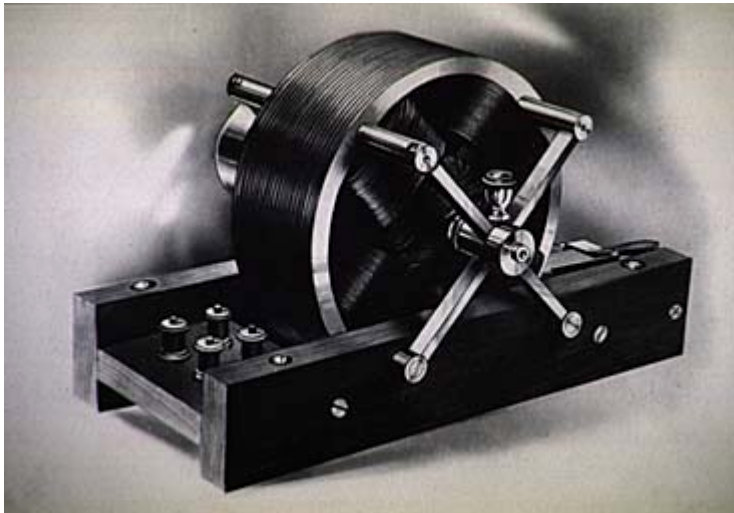
*Nikola Tesla,
a la edad de 29 años.*

En 1885, se retiró de la compañía de Edison y fundó su propia empresa dedicada a perfeccionar las lámparas de arco.

El 25 de Marzo de 1885, presentó su primera patente sobre lámparas de arco.

En 1886 hubo una crisis económica en EE.UU., y su empresa quebró, y por un tiempo trabajó en las alcantarillas de Nueva York.

Tesla introdujo sus motores y sistemas eléctricos en un artículo clásico: “A New System of Alternating Current Motors and Transformers” que presentó ante el [American Institute of Electrical Engineers](#) en 1888 (*). Uno de los más impresionados en la audiencia fue el industrial e inventor George Westinghouse. Un día el visitó el laboratorio de N. Tesla y quedo impresionado con lo que vió. Tesla había construido un sistema polifásico que consistía de un generador de corriente alterna, dos transformadores (de subida y de bajada), y un motor de corriente alterna en el otro extremo. A partir de esa visita se generó una asociación entre Tesla y Westinghouse para proveer de energía eléctrica a través de EE.UU.



One of the two two-phase induction motors demonstrated by Tesla in his historic lecture of May, 16, 1888, before the American Institute of Electrical Engineers at Columbia University. The motor developed 1/2 horsepower and showed that brushes and commutators could be eliminated.

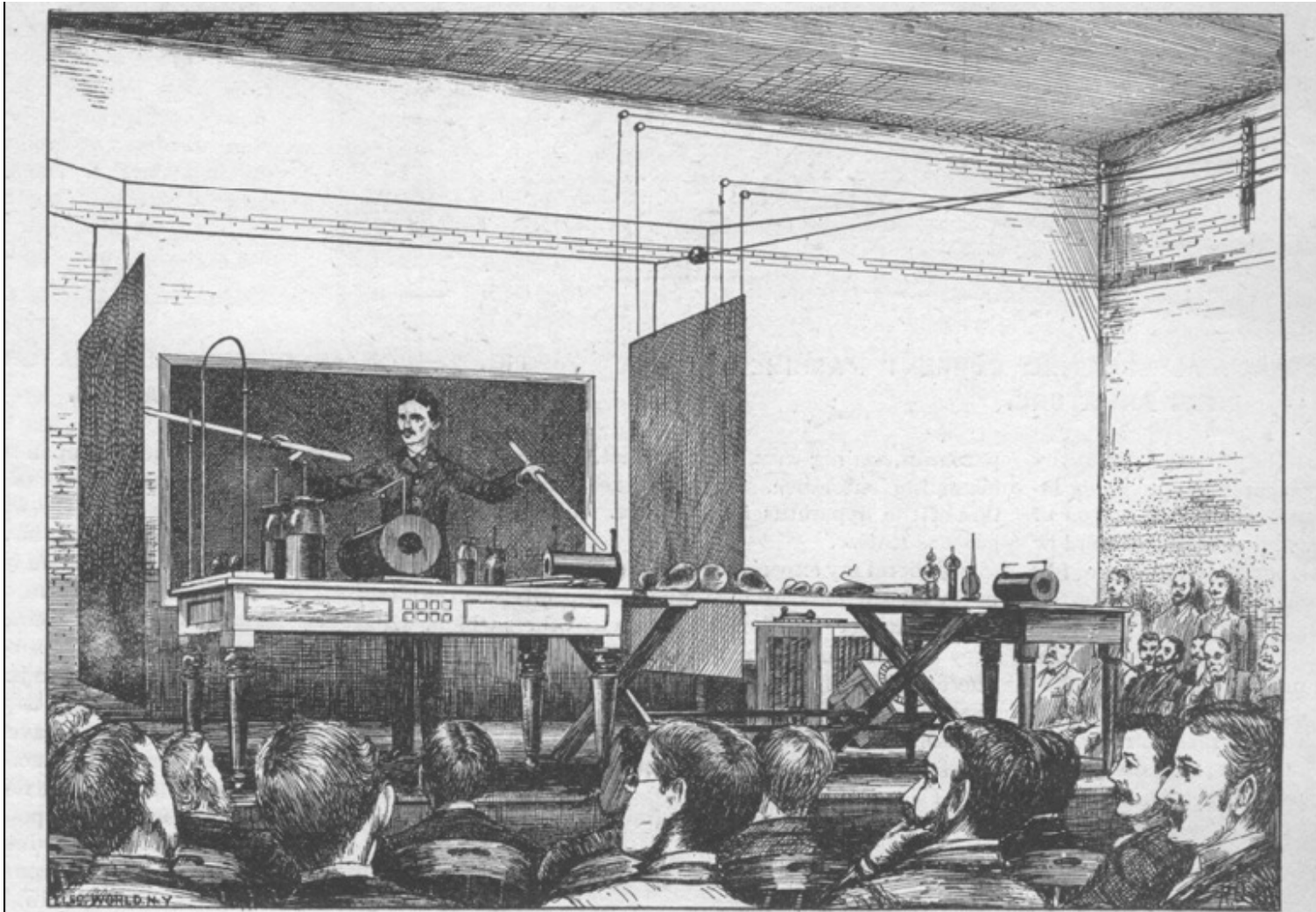
(*) AIEE Transactions, Vol. 5, 1888, pp. 305-327.



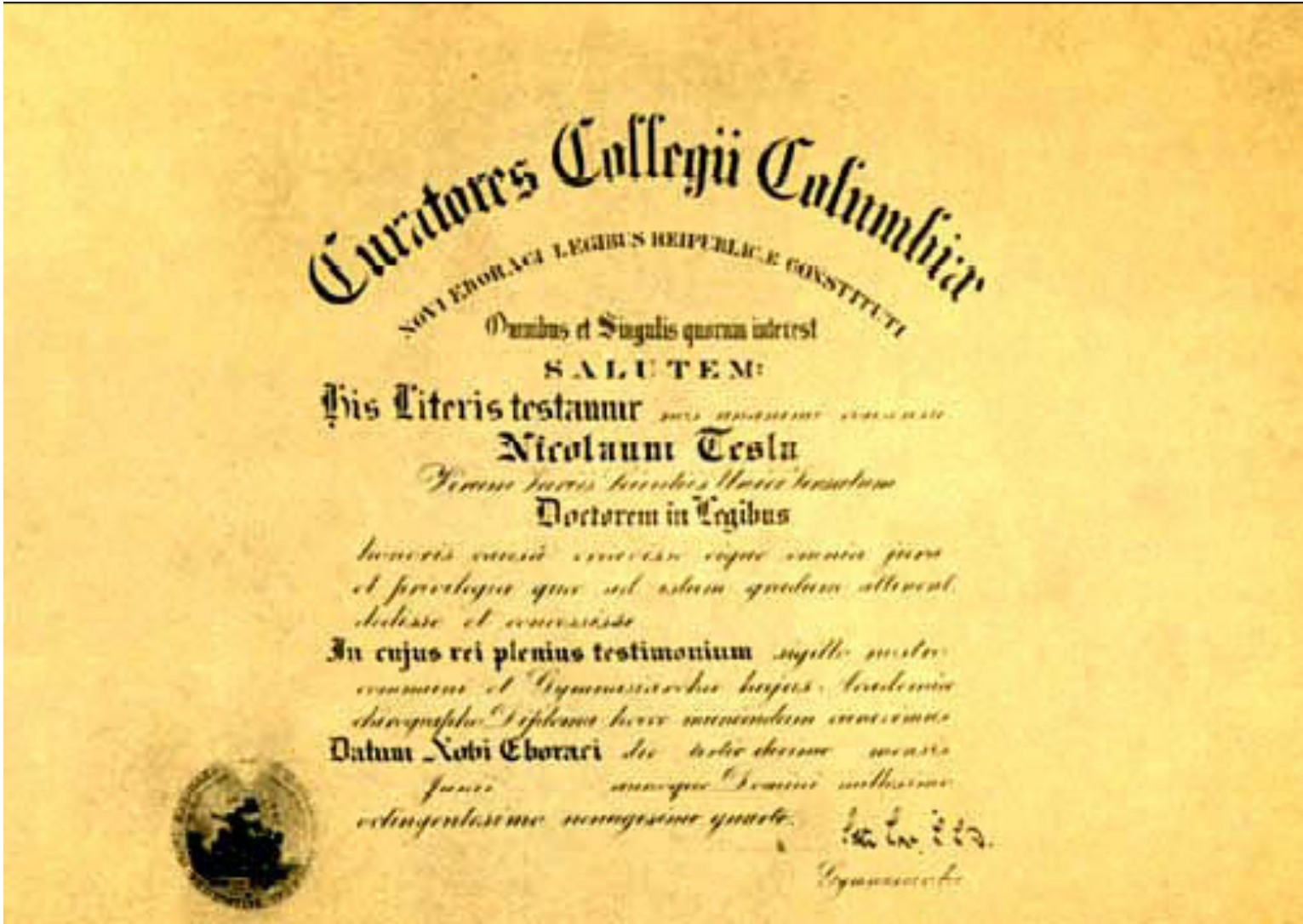
George Westinghouse, 1906.



Uno de los primeros motores de inducción de Tesla, fabricados por Westinghouse Electric Co.



MR. NIKOLA TESLA'S LECTURE BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS
AT COLUMBIA UNIVERSITY MAY 20, 1891



Doctor Honorario, Columbia University, NY, Feb. 1894



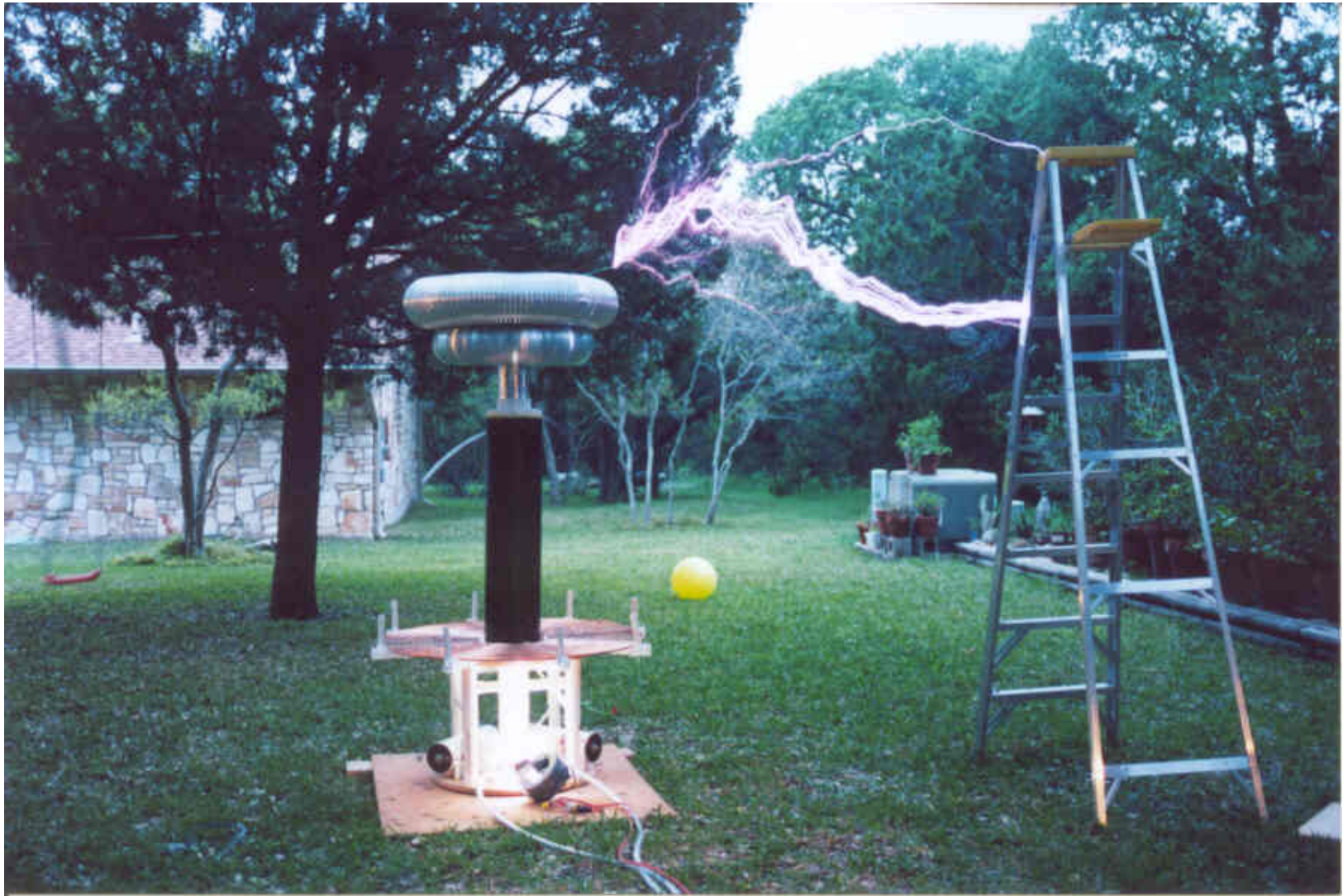
Professor Michael Idvorsky Pupin (1854-1935)



*Pupin Hall, Physics Department,
Columbia University*

Bobina de Tesla, NY, 1891

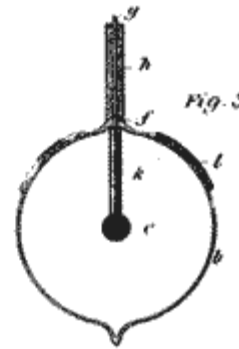
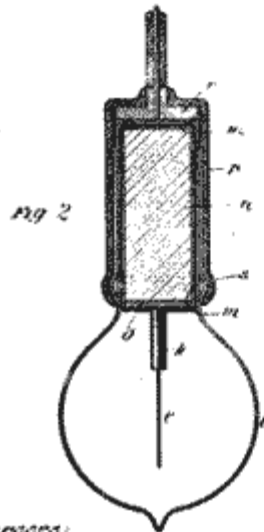
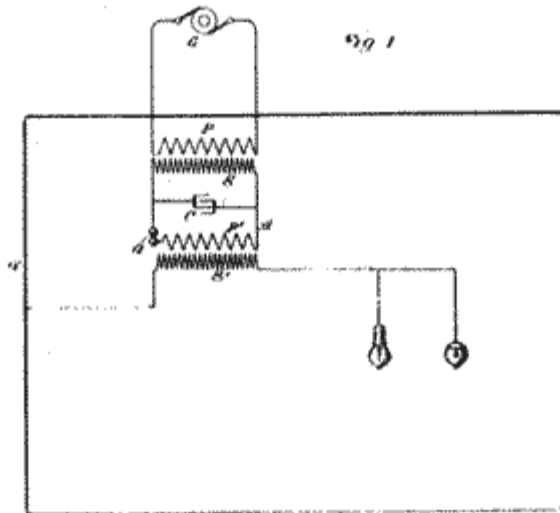




N TESLA
SYSTEM OF ELECTRIC LIGHTING

No 454,622

Patented June 23, 1891.



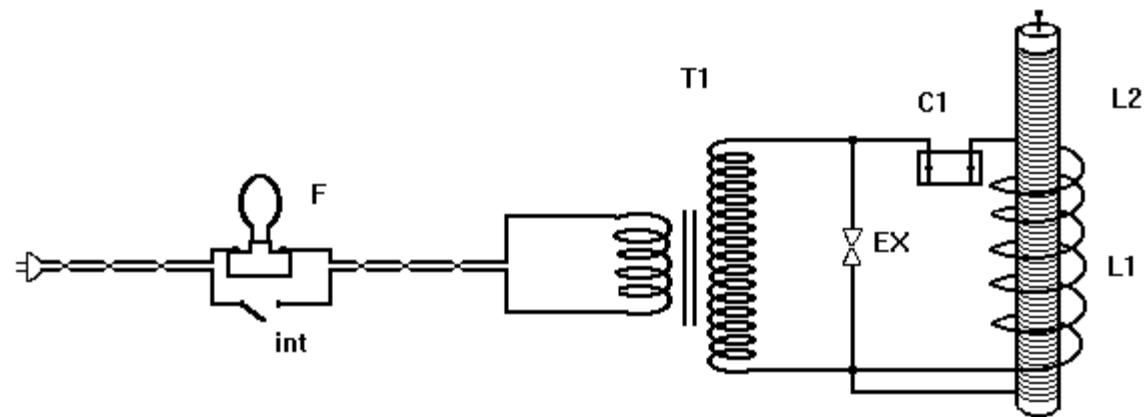
Witnesses:
Raymond West
Emil Hopkinson

Inventor
Nikola Tesla
By
Duncan & Page,
Attorneys

*Diseño de la Bobina de Tesla de la demostración inicial
(José Galaz, Laboratorio Docente, Facultad de Física, PUC, 2006).*

BOBINA DE TESLA

DIAGRAMA ESQUEMÁTICO



- F: Foco
- int: interruptor
- T1: Transformador
- EX: Explosor
- C1: Capacitor
- L1: Bobina primaria
- L2: Bobina secundaria

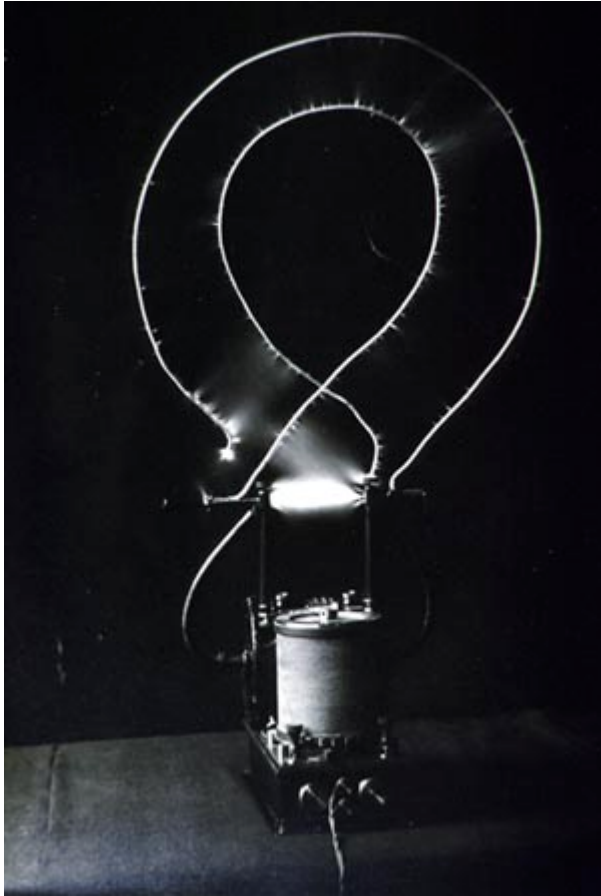


World Columbian Exhibition (Chicago, 1893)

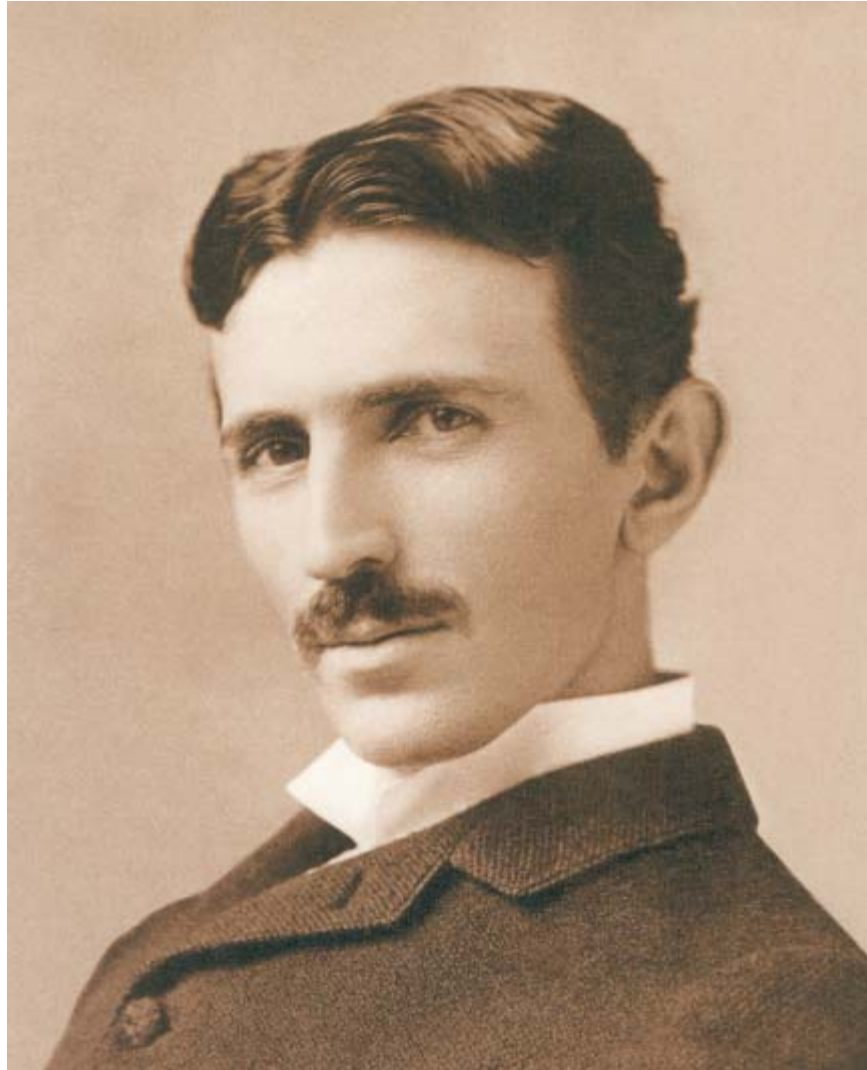
Westinghouse uso los generadores de Tesla para iluminar la Exposición Universal de Chicago.



Vista iluminada de la Exposición Universal de Chicago (1893).



Small Tesla coil presented by Lord Kelvin to the British Association in 1897. The device, only eight inches high, developed two square feet of streamers with 25 watts from a 110-volt DC supply.



*Nikola Tesla
de 38 años.*



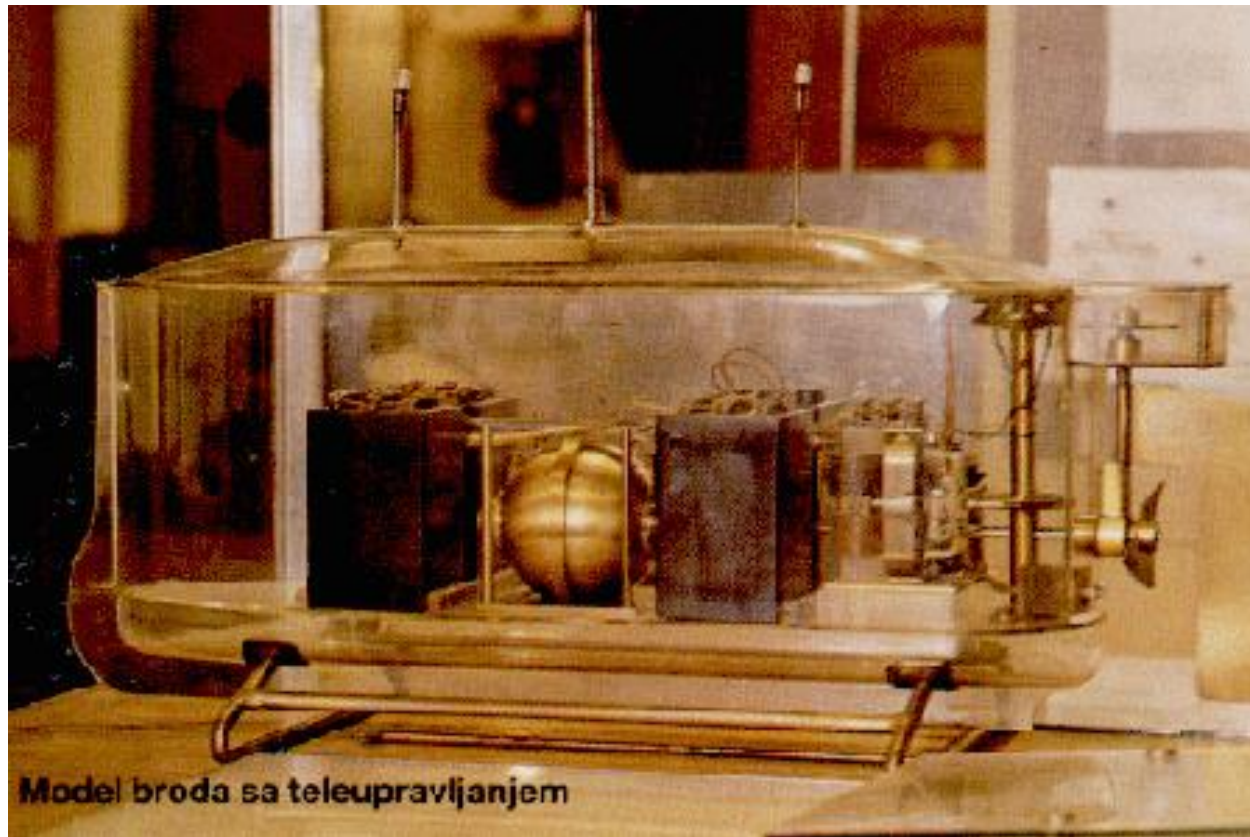
Generadores de Tesla, Cataratas del Niagara, ca. 1896.



*Estación Experimental
de Colorado Springs
donde N. Tesla realizó
sus primeros experimentos
de transmisión de
electricidad sin cables.
(1899).*

Trasmisor de 200 kW

*En 1898, en Nueva York, inventó el Control Remoto,
Exhibiendo por primera vez un bote a control remoto
En el Madison Square Garden de NY.*



Returning to New York in 1900, Tesla began construction on Long Island of a wireless world broadcasting tower, with \$150,000 capital from the U.S. financier J. Pierpont Morgan. Tesla claimed he secured the loan by assigning 51 percent of his patent rights of telephony and telegraphy to Morgan. He expected to provide worldwide communication and to furnish facilities for sending pictures, messages, weather warnings, and stock reports. The project was abandoned because of a financial panic, labour troubles, and Morgan's withdrawal of support. It was Tesla's greatest defeat



N. Tesla hizo muchos otros inventos, como las luces de neón, la radio, y muchos otros.

A lo largo de su vida inscribió aproximadamente 700 patentes.



*Nikola Tesla
a los 79 años.*



*Hotel New Yorker, NY, EE.UU.
donde N. Tesla vivió los
últimos años de su vida*





*Funeral de N. Tesla,
Iglesia, St. John the Divine,
12 de Enero de 1943, NY.*





HERE DIED, ON JANUARY 7, 1943,
AT THE AGE OF 87, THE GREAT
YUGOSLAV-AMERICAN SCIENTIST-INVENTOR,
NIKOLA TESLA, WHOSE DISCOVERIES
IN THE FIELD OF ALTERNATING ELECTRIC
CURRENT ADVANCED THE UNITED STATES
AND THE REST OF THE WORLD INTO THE
MODERN INDUSTRIAL ERA.

YUGOSLAV-AMERICAN BICENTENNIAL
COMMITTEE, JANUARY 7, 1977.



Whereas, the Empire State is fortunate to be the center of invention, ingenuity and progress, having been home to countless inventors and entrepreneurs whose ideas gave way to the world's greatest and most coveted goods and services; in that regard, we are proud to recognize the accomplishments of inventors such as Nikola Tesla - a prolific creator who, in cooperation with George Westinghouse and J.P. Morgan, introduced humanity to the practicality and benefits of electricity; and

Whereas, Nikola Tesla immigrated from Serbia in the former Austria-Hungary to the United States in 1884 at the age of 28; he received degrees from Columbia and Yale Universities and lived most of his life in New York City where he worked on the more than 700 inventions he patented; and

Whereas, Tesla found support for his idea of alternating current electricity and a broader spectrum of inventions that lifted mankind's physical burden and gave them the tools to live in safety and comfort; while he has many inventions to his credit, Tesla is best known for revolutionizing electromagnetic technology and developing the system of the alternating current, upon which is based the entire system of electricity in the United States; and

Whereas, Tesla's prolific, successful decades in this State earned him the recognition of his peers, many of whom considered him the greatest inventor ever; in 1893, George Westinghouse, who financed many of Tesla's inventions, provided the first World's Fair with electricity using Tesla's alternating current system; Tesla's miracle of science and subsequent ideas paved the way for the development of robotics, computers, microwaves and satellites; and

Whereas, humanity owes a debt of gratitude to one whose inventions innovated and enhanced our lives so permanently; it is fitting that all New Yorkers acknowledge Nikola Tesla's work, which modernized life for all Americans and all mankind;

Now, Therefore, I, George E. Pataki, Governor of the State of New York, do hereby recognize July 10, 2001 as

NIKOLA TESLA DAY

in the Empire State.



George E. Pataki
@governor

Office of the Mayor
CITY OF NEW YORK

Proclamation

WHEREAS: NIKOLA TESLA IS BEING HONORED IN OUR CITY ON THE TENTH OF JULY, THE 141ST ANNIVERSARY OF HIS BIRTH. TESLA WAS BORN IN 1856 TO SERBIAN PARENTS IN CROATIA, THEN PART OF THE AUSTRO-HUNGARIAN EMPIRE. HE STUDIED ELECTRICAL ENGINEERING AND, REALIZING THE PROBLEMS ASSOCIATED WITH THE USE OF DIRECT CURRENT, BEGAN TO DESIGN AN ALTERNATING CURRENT MOTOR. HE WAS RECOMMENDED FOR A POSITION IN THOMAS ALVA EDISON'S RESEARCH LABORATORY IN NEW YORK AND MOVED HERE IN 1884. EDISON HIRED TESLA, BUT DID NOT AGREE WITH HIS THEORIES, SO TESLA LEFT AFTER ONE YEAR AND ESTABLISHED THE TESLA ELECTRIC COMPANY IN 1887. SOON HE PATENTED HIS ALTERNATING CURRENT MOTOR AND WAS HIRED BY GEORGE WESTINGHOUSE. THE 1893 COLUMBIAN EXPOSITION IN CHICAGO WAS ELECTRIFIED BY WESTINGHOUSE USING TESLA'S SYSTEM OF POLYPHASE ALTERNATING CURRENT. ALSO IN PARTNERSHIP WITH WESTINGHOUSE, TESLA DESIGNED THE WORLD'S FIRST HYDROELECTRIC GENERATING PLANT, DISTRIBUTING ELECTRICAL CURRENT TO THE CITIES OF NIAGARA FALLS AND BUFFALO; AND

WHEREAS: IN 1897 TESLA, WHO EXPERIMENTED WITH RADIO WAVES, DEMONSTRATED WIRELESS COMMUNICATION OVER 25 MILES; AND THE NEXT YEAR DEMONSTRATED ELECTRICAL ENERGY TRANSMISSION WITH RADIO-CONTROLLED MODEL BOATS. HE INVENTED SEVERAL GENERATING MACHINES AND THE TESLA COIL, WHICH PRODUCED CURRENTS AT A GREAT NUMBER OF FREQUENCIES AND MAGNITUDES. THESE AND OTHER INVENTIONS INSPIRED LATER RESEARCH SCIENTISTS; AND

WHEREAS: NIKOLA TESLA SPENT HIS LAST FOUR DECADES LIVING IN OBSCURITY IN OUR CITY. HE HAD PATENTED MORE THAN 700 INVENTIONS IN THE UNITED STATES, AND HIS WORK MADE POSSIBLE INCREASED PRODUCTIVITY IN INDUSTRY, THE MODERN APPLICATIONS OF ALTERNATE CURRENT ELECTRIC POWER, MODERN COMMUNICATIONS, AND SUCH ADVANCES AS ROBOTICS, COMPUTERS, SATELLITES, AND MICROWAVES.

NOW THEREFORE, I, RUDOLPH W. GIULIANI, MAYOR OF THE CITY OF NEW YORK, IN RECOGNITION OF HIS POUNDBREAKING WORK, DO HEREBY PROCLAIM THURSDAY, JULY 10, 1997 IN THE CITY OF NEW YORK AS

"NIKOLA TESLA DAY"




Rudolph W. Giuliani
RUDOLPH W. GIULIANI
MAYOR

IN WITNESS WHEREOF I HAVE HEREUNTO SET MY HAND AND CAUSED THE SEAL OF THE CITY OF NEW YORK TO BE AFFIXED.

THE INVENTORS

65
HIRAM MAXIM
1840-1916


HE CHANGED THE WAY WE wage war. In 1884, Hiram Maxim, an American-born British inventor, developed a recoil mechanism that made it possible to load and eject cartridges from a machine gun without using a hand crank. The fully automatic magazine dis-




charged up to 600 rounds of ammunition per minute. Recognizing its advantages, the British army and royal navy were among the first to adopt the new weaponry—in 1889 and 1892 respectively. Other nations soon followed, to such an extent that World War I came to be called the “machine gun war.”

31
ALEXANDER GRAHAM BELL
1847-1922

WHEN ALEXANDER GRAHAM Bell patented the telephone in 1876, he was certain he could transmit sounds between two distant places, but he hadn't yet been able to relay human speech. The legend goes: Three days after the patent was issued, he spilled battery acid on his




magnetic field and alternating current (AC, as in AC/DC, the patents for which he sold to George Westinghouse in 1885) helped electrify the world by enabling power to travel over wires to customers great distances away. A tireless and eccentric inventor, Nikola Tesla came up with some things—for instance, a “death ray” to shoot down attacking aircraft—that don't seem nearly as farfetched now as they must have in his day.



clothes while working near a transmitter in his lab. His shout for help to his assistant became the first phone transmission of voice. The Scottish-born Bell left the development of his invention to others and refocused his energies on another passion: creating helpful devices for the deaf, including his wife, Mabel.


15
HENRY FORD
1863-1947

WHEN HENRY FORD SET UP shop in Detroit in 1903, all he wanted to do was make



20
ORVILLE & WILBUR WRIGHT
1871-1948 & 1867-1912

THE WRIGHT BROTHERS, WHO designed and made bicycles for a living, were so distressed after hearing that the German scientist Otto Lilienthal had died in a gliding experiment, that they determined to pursue his dream of flight. For eight years the brothers studied flying buzzards, tested wing models in a homemade wind tunnel, built engines, and launched gliders, most of them doomed, on the windy bluffs of Kitty Hawk, N.C.




57
NIKOLA TESLA
1856-1943

HE MAY BE SECOND ONLY to his ex-boss Thomas Edison as the most farsighted inventor of the electric age. His work on the rotating

27
GUGLIELMO MARCONI
1874-1937

Finally, in 1903, Orville and Wilbur succeeded in flying the first powered airplane. Flight time: 12 seconds. By 1908, the Wrights were making warplanes. Mankind's view of the world—and of its own power—had changed forever.



IN THE EARLY DAYS OF TELEPHONES and telegraphs, the thought of sending messages through thin air (sans wires) was all but inconceivable. Then, in a bold leap of faith, a young Italian proved it could be done. Guglielmo Marconi's transmission of a signal—the Morse Code letter S—across the Atlantic in 1901 was a worldwide sensation. It opened the airwaves for today's complex network of global communications—from radar to orbiting satellites. Interglobal, too, NASA now pulls in data messages from the roving pattering across the surface of Mars.

Nikola Tesla, en la revista Life.





FIN