New York, April 10 1893

My dear Mr. Broughton,

I need not assure you that I feel much indebted to you for your valuable help at the occasion of my lecture in St. Louis.

I beg you to accept the photo which I enclose as a proof of my friendly feelings towards you.

Yours sincerely

N. Tesla.

H. P. Broughton Esq.

TS A WEEK.

THE ELECTRIC CLUB.

A Balance Left to Start a Library—Tesla's Lecture.

The first general meeting of the Electric Club since the National Convention was held last night. President Robert McCullough reported that the funds provided by the people of St. Louis for entertaining that body was $3,310, and he had great pleasure in announcing that the expenditures had been kept within that sum with a few dollars to spare. He thought that the contributors would have no objection if the balance were to be applied in starting an electrical library for the club. The President also stated that the lunch-counter was paying expenses.

By invitation Mr. Harry Broughton gave his impressions of Tesla, and explained at length, and interestingly, the apparatus which he employed in his lecture in St. Louis. Mr. Broughton assisted Tesla in preparing for the lecture, and was therefore able to describe the conditions under which he performed his great experiments. Mr. Wagner, who was present at Dr. Wellington Adams' dinner to Tesla, spoke of Tesla's fascinating powers of conversation, not only in electricity, but in whatever subject was broached.

Prof. Nipher discussed the scientific significance of some of Tesla's experiments, especially those in which phosphorescent effects were the feature. The problem is to produce a great amount of light with little energy—conditions that are found to perfection in the firefly—and Tesla seemed to be working along in that direction. The firefly's light is certainly produced in atmospheric air, and Tesla's idea of producing a similar light is not at all visionary.

A discussion then ensued over Tesla's receiving as he does, without injury, such enormous voltage of electricity, and various theories were proposed. Prof. Nipher suggested that the current did not pass through the lecturer's body; in fact, with such rapid alterations, the current was diffused over the surface. It was a well understood law that the greater the frequency the greater the resistance.

About a dozen applications for membership were approved.

January 1, 1953

Mr. Hubert E. Ingalls, Sec. OOTC
WINQ, Where the Tall Pines Grow
RFD, Epping, N. H.

Subject:
The Old, Old Timers Club
K2AE; Henry P. Broughton

De[redacted]ert:

Please refer to paragraph 3 of my February 21, 1950 letter to you concerning the qualifications of father to become a regular member of the Old, Old Timers Club. The purpose of this letter is to document vital supplementary evidence which goes much further than that previously submitted in building up father's ham radio experience record.

In order to appreciate the unusual significance of father's early wireless experience, an insight is essential into his unique association with the world famous Yugoslav-American radio superman, Nikola Tesla (1857-1943). In this connection the accompanying exhibits are to a degree self explanatory.

From a study of the life of Nikola Tesla it becomes abundantly evident that he was in a large measure responsible for an astounding proportion of the fundamental radio inventions now accepted as commonplace and unjustly attributed to the work of others. For example, Tesla's wireless communications demonstrations antedated those of Marconi more than three years. His revolving magnetic field concept and polyphase alternating current power system were initially opposed by such renowned scientists as Lord Kelvin and Thomas A. Edison; ultimately, of course, their worth prevailed and they are now accepted as standard throughout the world.

It was Tesla who settled upon 60 cycles as the best engineering compromise for the standard electric power frequency. In 1890 he built the first high-frequency a-c dynamo, - the forerunner of the Alexanderson alternator used for transatlantic radiotelegraphy. His oil-immersed Tesla coils showed the way for the high-voltage power transformers which are essential parts of present-day long-distance electric-power transmission systems, which he forecast. Not only did he repeatedly demonstrate the spectacular detection at a distance of radiated radio-frequency energy, but also the actual transmission of electric power over appreciable distances without wires. His high-potential high-frequency low-pressure gaseous-discharge high-intensity lamps are represented today by our high-efficiency fluorescent lamps.

Not covered above, or in Exhibit A, among the myriads of other inventions and original developments of this fantastic genius were: laboratory and lecture demonstrations and explanations of the fundamental principles of electromagnetic induction associated both with spark discharges in tuned circuits and with coupled magnetic paths; descriptions of the interrelation of the physical dimensions of oscillatory circuits to their natural frequency, involving the concepts

of tuning and resonance; studies of corona ("brush") discharges, and their effects upon condenser design and electrostatic shielding and field propagation; the beaming of high-frequency r-f radiation by means of parabolic relectors; - and finally the actual construction and application to radio-signal uses of the electronic vacuum tube itself!

It was against this breath-taking backdrop of dazzling prodigies that father was privileged to act as Tesla's assistant and close associate during his entire 5-day stay in St. Louis (Feb. 28 - March 4, 1893). His visit was for the purpose of delivering before the National Electric Light Association his world-acclaimed "London Lecture" and demonstration of high-potential high-frequency experiments (Exhibit B; later revised and republished, Exhibit C). Not only did father render to Tesla continuous assistance in setting up and testing his various apparatus in preparation for the lecture, but also functioned as Tesla's sole assistant on-stage during the whole lecture (Exhibit B). In this honored capacity father and Tesla performed together many of the experiments referred to herein, in particular those relating to radio-frequency phenomena, including the transmission and detection of r-f energy at distances of several yards across the stage.

After 60 years, naturally father's recollection of details is dim. However, the following important experiment stands out among those they performed at the Lecture, and is described in Tesla's book, Exhibit B: Primary commercial electric power at 2,000-volts 60-cycles single-phase was brought in to a 5-kw pole-type transil-oil-filled step-down power transformer located just off stage. From the secondary of this transformer two 110-volt wires connected through a knife switch and fuses to the primary winding of an oil-immersed Tesla coil having condenser-tuned damped oscillatory input, and very high-potential high-frequency output. Design considerations are set forth by Tesla for this piece of apparatus in Exhibit B, pages 35-43. The radio-frequency output of this Tesla coil excited an electromagnetic field radiating system or antenna, which was tuned to resonance by the test procedure outlined on pages 23-24. One type of radio-frequency detection equipment used is pictured and described by Tesla (pages 139-142); it was a vacuum tube device depending for its action upon intense streams of electrons caused to oscillate and impinge collectively against three separate indicating media: low-pressure gas molecules, movable mica disc, and fluorescent-sensitive glass. Thus direct visual indications were obtained of the presence of r-f fields. As with the transmitting equipment, so also a part of this receiving equipment was a tuned antenna input system. Radio signalling was accomplished between father and Tesla across the lecture stage by opening and closing the Tesla-coil power-input knife switch (power-transformer primary-circuit keying!), and alternately by antenna decoupling and detuning (Poulsen-arc keying principle!).

Surely then, during this Lecture, father and Tesla "had in operation a wireless communication apparatus", - and of real pioneering design too! Exhibits D, E, F, G, and H lend further substantiating atmosphere to this presentation.

Therefore, I submit that for the last 20 years, father has been and is now eminently qualified for immediate admission into your venerable organization as a full-fledged Regular Charter Member of prime standing as the oldest in years (born July 7, 1865), and the earliest in accredited experience (March 1, 1893).

73 -

Wm. G. Broughton
W2IR

CC: Irving Vermilya, Pres. OOTC
WIZE, on Cape Cod
Mattapoisett, Mass.

Roland Bourne, V. P. OOTC
WIANA; 27 Sulgrave Road
West Hartford, Conn.

O. W. Greene, Jr., Treas. OOTC
WICPI; Wakefield, R. I.

LIST OF EXHIBITS

Exhibit	Title
A	"Prodigal Genius", the Life of Nikola Tesla (quotations)
B	Experiments with Alternate Currents of High Potential and High Frequency by Nikola Tesla; A Lecture
C	New Edition with an Appendix. Just Published. "Experiments with Alternate Currents of High Potential and High Frequency" by Nikola Tesla
D	Photographic copy of portrait of Nikola Tesla personally inscribed by him in his own handwriting "To Mr. H. P. Broughton with sincere regards from Nikola Tesla"
E	Photographic copy of personal letter in his own handwriting from Nikola Tesla to H. P. Broughton under date of April 10, 1893
F	Photographic copy of newspaper clipping from the March 11, 1893 edition of the St. Louis Post Dispatch
G	Statement of Henry P. Broughton relating to Tesla's St. Louis Lecture
H	References to Tesla in Autobiography of Dr. Lee de Forest

PRODIGAL GENIUS,
The Life of Nikola Tesla
by John J. O'Neill
1944

Ives Washburn, Inc. 29 West 57th St.,
New York 19, N. Y.

Pages 3-5

"Tesla created the modern era; he was unquestionably one of the world's greatest geniuses, but he leaves no offspring, no legatees of his brilliant mind, who might aid in administering that world; he created fortunes for multitudes of others but himself died penniless, spurning wealth that might be gained from his discoveries. Even as he walked among the teeming millions of New York he became a fabled individual who seemed to belong to the far-distant future or to have come to us from the mystical realm of the gods, for he seemed to be an admixture of a Jupiter or a Thor who hurled the shafts of lightning; an Ajax who defied the Jovian bolts; a Prometheus who transmuted energy into electricity to spread over the earth; a Mazda who created a sun in a tube; a Hercules who shook the earth with his mechanical vibrators; a Mercury who bridged the ambient realms of space with his wireless waves--and a Hermes who gave birth to an electrical soul in the earth that set it pulsating from pole to pole.

This spark of intellectual incandescence, in the form of a rare creative genius, shot like a meteor into the midst of human society in the latter decades of the past century; and he lived almost until today. His name became synonymous with magic in the intellectual, scientific, engineering and social worlds, and he was recognized as an inventor and discoverer of unrivaled greatness. He made the electric current his slave. At a time when electricity was considered almost an occult force, and was looked upon with terror-stricken awe and respect, Tesla penetrated deeply into its mysteries and performed so many marvelous feats with it that, to the world, he became a master magician with an unlimited repertoire of scientific legerdemain so spectacular that it made the accomplishments of most of the inventors of his day seem like the work of toy-tinkers.

Tesla was an inventor, but he was much more than a producer of new devices: He was a <u>discoverer of new principles</u>, opening many new empires of knowledge which even today have been only partly explored. In a single mighty burst of invention he created the world of power of today; he brought into being our electrical power era, the rock-bottom foundation on which the industrial system of the entire world is builded; he gave us our mass-production system, for without his motors and currents it could not exist; he created the race of robots, the electrical mechanical men that are replacing human labor; he gave us <u>every essential of modern radio</u>; he invented the radar forty years before its use in World War II; he gave us our modern neon and other forms of gaseous-tube lighting; he gave us our fluorescent lighting; he gave us the high-frequency currents which are performing their electronic wonders throughout the industrial and medical world; he gave us remote control by wireless; he helped give us World War II, much against his will--for the misuse of his superpower system and his robot controls in industry made it possible for politicians to have available a tremendous surplus of power, production facilitie

labor and materials, with which to indulge in the most frightful devastating war that the maniacal mind could conceive. And these discoveries are merely the inventions made by the master mind of Tesla which have thus far been utilized--scores of others remain still unused."

Page 129-130

When Tesla left the Westinghouse plant in the fall of 1889, he had immediately turned to the next phase of his development of the alternating-current field--a new system of distributing energy by means of high-frequency alternating currents which would be a far more magnificent discovery than his polyphase system. Within the next two years he had explored the principles by which energy could be distributed broadcast without the use of wires, and these he had demonstrated with powerful coils in his laboratory. The distribution of intelligence, later called "wireless," was but a single phase of the larger project.

Tesla described, in 1892, the first electronic tube designed for use as a detector in a radio system, and demonstrated its characteristics in his lectures in London and Paris in February and March of that year. (The tube, however, had been developed in 1890.) He described in February and March of the following year, 1893, his system of radio broadcasting, presenting its principles in detail, in lectures before the Franklin Institute in Philadelphia and at the convention of the National Electric Light Association held in St. Louis.

Tesla's electronic tube, his 1890 invention, was the ancestor of the detecting and amplifying tubes in use today. His demonstration of this tube is a matter of record in the archives of four societies before which he exhibited it in February and March of 1892--the Institute of Electrical Engineers and the Royal Society of London and the Physical Society of France and the International Society of Electrical Engineers in Paris. He stated in these lectures:

'If there is any motion which is measureble going on in space, such a brush ought to reveal it. It is, so to speak, a beam of light, frictionless, devoid of inertia.

I think it may find practical applications in telegraphy. With such a brush it would be possible to send dispatches across the Atlantic, for instance, with any speed, since its sensitiveness may be so great the slightest changes will affect it.'

The "brush" in Tesla's tube was a beam of electrons. The electron, however, had not yet been discovered. Nevertheless, Tesla gave an accurate description of its nature, demonstrating the remarkable accuracy of his interpretation of strange phenomena. So sensitive was this electronic beam that a small horse-shoe magnet an inch wide at a distance of six feet caused movement of the electron beam in either direction, depending on the position in which the magnet was held.

If anyone approached the tube from a distance of many feet the beam, or brush, would swing to the opposite side of the tube. If one walked around the tube even at a distance of ten feet, the beam would move likewise, keeping its center and always pointed at the moving object. The slightest movement of a finger, or even the tensing of muscle, would bring a swinging response from the beam.

In the same 1892 lecture in which he described this first electronic tube, Tesla demonstrated lamps which were lighted without wire connections (wireless light) and also a motor which operated without wire connections to the energizing coils (wireless power); and he had again presented these developments at his exhibition at the Chicago Columbian Exposition early in 1893.

Page 134

Tesla thus presented in these lectures the principles which he had learned in his laboratory experiments, during the previous three years, were necessary for successful wireless communication.

Several fundamental requirements were presented which will be understood by any non-technical person who has had even slight experience with radio receiving sets: 1. An antenna, or aerial wire; 2. A ground connection; 3. An aerial-ground circuit containing inductance and capacity; 4. Adjustable inductance and capacity (for tuning); 5. Sending and receiving sets tuned to resonance with each other; and 6. Electronic tube detectors. He had still earlier invented a loud speaker.

These embody the fundamental principles of radio, and are used in every sending and receiving set today.

Radio as it exists today, is, therefore, the product of the genius of Nikola Tesla. He is the original inventor of the system as a whole and of all the principal electrical components.

Page 136

The history of the succeeding years in wireless is the story of the failure of the short waves of Lodge and Marconi and their followers, and the shifting over to the longer waves described by Tesla; and the dropping of their crash method of signaling and its replacement by the refined and highly efficient method of tuning to each other the sending and receiving stations by the methods discovered by Tesla; and adoption of Tesla's continuous waves.

In addition, these groping workers saw in wireless only a point-to-point or station-to-station method of signaling. None of them foresaw the broadcasting system which Tesla described in 1893. The system invented and discovered by Tesla is the one in use today; but who ever heard anyone giving Tesla the slightest credit?

Exhibit B

Experiments
with
ALTERNATE CURRENTS
of
High Potential and High Frequency.
by
Nikola Tesla.

A LECTURE
Delivered Before the
Institution of Electrical Engineers, London.

With a Portrait and Biographical Sketch
of the Author.

NEW YORK:
The W. J. Johnston Company, Ltd.,
167-176 Times Building.
1892.

On the inside fly leaf of Father's copy of this book is inscribed in pen and ink in his own handwriting the following Note:

"H. P. Broughton
March 7th 1893
St. Louis
Mo.

Introduced to Mr. Tesla Feb. 23th 1893 a. m. at Southern Hotel St. Louis. Had charge of work preparing for Lecture delivered at Exposition on night of March 1st 1893, under direction of Mr. Tesla. Assisted on stage during Lecture. Dined at Southern with him in party Messrs. Ayer, Porter Bragg, and Miss Billings March 4th - the day of his departure."

Exhibit C

New Edition with an Appendix. Just Published.

Price $1.00, postpaid.

Experiments
with
ALTERNATE CURRENTS
of
High Potential and High Frequency.

A Lecture Delivered before the Institution of
Electrical Engineers, London.
by
Nikola Tesla.

with an Appendix by the Same Author
on the
Transmission of Electric Energy without Wires,
eviewing his Recent Work, and Presenting Illustrations
From Photographs Never Before Published.

With a New Portrait and a Biographical Sketch
of the Author.

New Edition.

NEW YORK:
McGraw Publishing Company,
114 Liberty Street.
1904.

Exhibit G

Nikola Tesla - of New York City visited St. Louis, Mo., Feb. 28, 1893, and returned to New York City March 4, 1893; for the purpose of delivering a lecture before the annual meeting of the National Electric Light Association. This Association was a group of public-utility electric-light and power companies throughout the country. The Municipal Electric Light & Power Company of St. Louis was a member. As General Manager of this Company, Mr. James I. Ayer was influential in persuading Mr. Tesla to come to St. Louis.

As Mr. Ayer's assistant, and representative of the Association, it was my privilege to be assigned as aid to Mr. Tesla during his visit and to render him all possible help in preparing for the lecture, as well as during the lecture itself.

The Lecture is generally referred to as the "London Lecture", and is published in book form by The W. J. Johnston Co., Ltd., New York, 1892; and called,

"Experiments with
Alternate Currents of
High Potential and High Frequency"
by Nikola Tesla.
A Lecture
delivered before the
Institution of Electrical Engineers, London (Exhibit B).

Reference is made to a book called, "Prodigal Genius, The Life of Nikola Tesla", by John J. O'Neill; copyright 1944 by Ives Washburn, Inc., New York 19, N. Y. (Exhibit A). See page 129, where reference is made to the St. Louis lecture; and pages 131-132-133, which covers some material added to the London Lecture at the St. Louis Lecture. (See also Exhibit C).

Exhibit G (Cont.)

Mr. Tesla's letter to me from New York dated April 10, 1933, along with his autographed photograph are photo-copied herewith (Exhibits D and F).

The St. Louis Post Dispatch printed an account of the meeting of the Electric Club of St. Louis, at which I gave a talk on my experience with Mr. Tesla (Exhibit F).

Henry F. Broughton
12/1/52

Exhibit H

The book: "Father of Radio,
The
Autobiography of Lee deForest"
1950
Wilcox & Follett Co., Chicago
Editors: Linton J. Keith
Arthur Prague
Designer: Stanford W. Williamson
Preface - April 1950 signed Lee deForest.

contains:
References to Nikola Tesla are on pages: 75, 85-86, 90, 220, 452.

On page 452 reference is made to the decision of the Supreme Court of the United States, handed down June 21, 1943 which announced the invalidity of the once famed "four-tuned circuit" patent of Marconi.

In coming to its decision, the Court laid especial emphasis on the early work of Stone and Tesla.