Figure 17 Eugene F. McDonald see www.longagoandfaraway.com/EndionHistory.htm (retrieved 25 April 2009).

Figure 18 Zener Cards see http://static.howstuffworks.com/gif/esp-zener.gif (retrieved 25 April 2009).

Graeme Bartram

ACKNOWLEDGEMENTS

In preparing this paper for publication Graeme would like to acknowledge the contribution of Distinguished Professor Harold Cones Ph.D who greatly assisted in the detail of the Zenith experiments of 1937/8 by providing access to the unpublished manuscript he has co-authored with John Bryant entitled 'The Zenith Foundation: Commander Eugene F. McDonald's Radio Experiments in the Paranormal'.

Graeme's wife Jo Earl Ph.D provided invaluable advice on the psychological aspects of the paper and once again assisted in copying the Figures into a JPEG format so they could be appropriately reproduced.

ABOUT THE AUTHOR

Graeme Bartram is a Graduate in Arts and Law from the University of Sydney and is currently Director of Human Resources, South Pacific for a major international company. His interest in radio history started over 25 years ago with the restoration of two of his grandparents' sets from the 1938 and 1948 respectively.

Graeme has previously published in the AWA Review in 2000 and 2008. He is also a member of the Historical Radio Society of Australia and the British Vintage Wireless Society.

AWA Review

Origins of the Edison Medal on its 100th Anniversary

©2009 David and Julia Bart

ABSTRACT

The Edison Medal is the principal medal of the Institute of Electrical and Electronics Engineers (IEEE). It is the most prestigious award given in the United States and Canada in the fields of electronics and electrical engineering. Many of the most important people responsible for developing radio, television and electronic communications received the medal for their groundbreaking contributions. Initiated by Samuel Insull and supported by J.P. Morgan and Andrew Carnegie, the medal was inaugurated with great fanfare. Nevertheless, the medal endured years of neglect, a redesign and controversy. In the end, the Edison Medal was treasured by its recipients and became a legacy of honor to those who made the modern electronic world. This article reveals the previously untold history of the Edison Medal's early years on the occasion of its 100th anniversary.

The Edison Medal is the most prestigious award given in the United States and Canada recognizing meritorious accomplishments in the fields of electronics and electrical engineering. The year 2009 marks the 100th anniversary of the medal named in honor of America's most famous inventor, Thomas Alva Edison. Edison's work exemplifies the development of large scale industrial research laboratories, the creation of new technology and the installation of the first complete electrical systems in the 19th century. Over its history, many of the most important contributors to the development of electronics have been presented the Edison Medal in recognition of their critical roles in laying the foundations of the modern electrical world. This article presents the story of the Edison Medal, its origins and its legacy of honor.

EDISON AT THE TURN OF THE CENTURY

By the end of the 19th century, Thomas Alva Edison had achieved fame, wealth and notoriety. He was known as the "Wizard of Menlo Park" for the many inventions that originated from his research laboratory in New Jersey; including the phonograph and electric light. In 1886, Edison relocated to a new, larger facility in West Orange, New Jersey. A small laboratory was also set up in 1886 at his new summer home in Fort Myers, Florida. Increasingly, he focused his attention on refining the phonograph and on his new film and motion picture businesses. Edison's work on the alkaline battery and his Portland cement operations also looked promising. The 1903 release of the film *The Great Train Robbery* put Edison into the headlines again. Edison's list of accomplishments was well established, and he was a household name in America and in Europe. His long standing and well publicized feud with George Westinghouse and

Nikola Tesla over the effectiveness of alternating versus direct current did not seem to diminish his public image. And, by the opening years of the 20th century, those battles too were subsiding.[1]

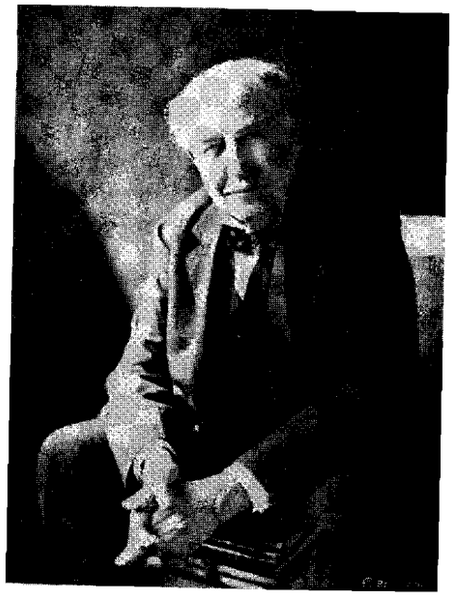


Fig. 1. Thomas Alva Edison. (Photo by Bachrach. Miller, 1931)

ORIGINS OF THE EDISON MEDAL

1904 marked the 25th anniversary of the Edison incandescent lamp. Samuel Insull, Charles Batchelor and a group of Edison's friends, former employees and associates decided to commemorate the anniversary on the occasion of Edison's birthday.[2] The first meetings of the Executive Committee formed to organize the event were held in December 1903 as the group rushed to prepare for Edison's February 11, 1904 birthday. (Documents, Minutes: Dec. 23 and 30, 1903)

The Executive Committee quickly prepared a circular to solicit contributions. The circular, dated January 1, 1904, identified Samuel Insull as the Chairman and Charles Batchelor as Vice-Chairman of the Edison Medal Association. It also named the 30 member Executive Committee and 124 additional members of the Edison Association. Among the notables identified were J. Pierpont Morgan, R.A. Fessenden, W.S. Mallory, Frank Sprague and Nikola Tesla. The group planned to name an endowed academic medal after Edison that would be awarded through the American Institute of Electrical Engineers (AIEE). The AIEE would act as trustee of the medal.

The Edison Medal Association intended to raise $7,000 to fund the medal and expenses of the association, of which $5,000 would represent the principal balance of the endowment. Annual interest on the balance would fund future expenses and annual awards. The Executive Committee set an impossibly short time frame of only 30 days to solicit subscriptions. (Documents, 1904a)

The Executive Committee faced logistical difficulties in completing all their preparations before the February celebration. They selected the National Sculpture Society to assist with the medal design; but, at the close of January 1904, the subcommittees responsible for the medal design had not selected an appropriate image of Edison or decided on a sculptor for the medal. (Documents, Minutes, Jan. 20, 1904) Given the impending date of the celebration, the Committee decided it would formally present the legal agreement establishing the Edison Medal and convey the trusteeship of the Edison Medal to the AIEE without presenting the medal itself. (Documents, 1904b) The Committee rushed to draft their Deed of Gift ("Deed") over the next

Edison Medal Association

Dear Sir:

In view of the fact that the year 1904 marks the twenty-fifth anniversary of the successful introduction and commercial development of the incandescent lamp, it is deemed appropriate to celebrate so significant an occasion. The friends and associates of Thomas Alva Edison, the pioneer with whose work this great event in electrical history is so closely identified, desire, therefore, to pay him some timely tribute in recognition of what he has thus contributed, as well as in other respects by notable inventions and by unremitting effort, to the advance of electrical science, application and industry. No other twenty-five years in history have equaled this period in the benefits bestowed on mankind by the electrical arts, or in the profitable employment given to capital and labor.

New York
January
First

Fig. 2. 1904 Subscription for Edison Medal (Documents, 1904a)

three weeks.

The Deed and corresponding rules governing the Edison Medal specified that the Edison Medal Association would annually recognize a student graduating from any U.S. or Canadian university or military academy who presented the best thesis on an original topic about theoretical or applied electricity and magnetism. Competition was restricted to no more than two students from any one institution. Each student had to complete at least two years of residence and coursework at the university and be no older than 25 years of age. The thesis was restricted to 6,000 words (approximately 20 typed pages). The award would be presented annually on Edison's birthday, February 11. The Deed also specified that the Edison Medal Association, under the auspices of the National Sculpture Society, would host a competition to finalize the medal's design after Edison's birthday. (Science: 1904a and 1904c)

EDISON CELEBRATION

Five hundred people attended the commemorative dinner on February 11, 1904 celebrating Thomas Edison's 57th birthday and the 25th anniversary of the Edison incandescent light. The affair was held at the Waldorf Astoria Hotel in New York. Addresses were made by the President of the AIEE, J.B. Arnold, and A.E. Kennelly of Harvard University, C.F. Brackett of Princeton University, Joseph McCall and C.L. Edgar. Samuel Insull presented the Deed of Gift inaugurating the Edison Medal. (Science, 1904b; New York Times, 1904)

Edison sat under a display of flags and 57 electric lamps. According to eyewitness accounts, he was reserved in public and was too modest to speak. Sugar models of his inventions were placed on tables in front of him. Edison's original telegraph key and quadruplex sender sat on the table in front of Edison positioned at his right hand. Wires stretched across the room to a Marconi wireless transmitting apparatus. Thousands of electric bulbs were strung along the galleries. Over one hundred waiters served ices "contained in models of motors, phonographs, switchboards, automo-

biles, incandescent apparatus, dynamos, megaphones and batteries, the ices themselves being in the form of incandescent bulbs." Each guest went home with a small ivory box with a woman bearing a light and inscribed "Genius with the Lamp" or a miniature incandescent lamp pin. The menus included a picture of a bronze bust of Edison with the words "The Wizard" with Edison's autograph below the image. (Jones, 1908; New York Times, 1904)

Congratulatory messages were received from notables around the world. Andrew Carnegie called Edison the "King of Telegraphers". President Theodore Roosevelt congratulated Edison "as one of those Americans to whom America owes much..." Lord Kelvin cited his "gratitude to Edison [for his] useful and well worked-out inventions for the public". Finally, Edison's own message of thanks was read aloud. It stated, in part, "...Your expressions of goodwill gratify me greatly...This medal is founded to encourage young men to devote their best thought and work to electrical development. I rejoice in this stimulus to harder study...God bless them and you, my dear friends, and this American Institute of Electrical Engineers." (Jones, 1908)

The highlight of the evening occurred when Edison telegraphed "73 - Congratulations and best wishes" on his original quadruplex telegraph instrument. The message was carried across the wires and broadcast by the Marconi wireless equipment. (New York Times, 1904; Jones, 1908) Samuel Insull, Chairman of the Edison Medal Association, then formally presented the Deed of Gift to Professor Arthur Kennelly who received it on behalf of the AIEE.

THE MEDAL'S FIRST YEARS

The medal was intended to "serve as an honorable incentive to the youth of America to maintain by their works the high standard of accomplishment by the illustrious man whose name and features shall live while human intelligence continues to inhabit the world." (Science, 1904c) The annual student award was to include a parchment certificate and a gold medal funded by the annual interest earnings on the gift. Unfortunately, after the 1904 celebration, little progress was made.

The gift fund was deposited with Continental Trust Company of New York. But three years passed and no medals were awarded. In February 1907, the Edison Medal Committee appointed a subcommittee "to propose a statement of the difficulties that the Committee had experienced in obtaining competitors for the medal under the present Deed of Gift and to recommend to the Medal Committee such modifications...as might seem proper in their judgment under the circumstances." (Gherardi, 1907)

THE JOHN FRITZ MEDAL

Meanwhile, as the Edison Medal languished, the John Fritz Medal, the highest American award in the engineering profession, was being presented each year. Established in 1902, it recognized scientific or industrial achievement in any field of pure or applied science. Fritz had achieved fame and recognition for his development of American iron and steel manufacturing. The John Fritz Medal was established on Fritz's 80th birthday by the American Institute of Mining Engineers (AIME), the American Society of Civil Engineers (ASCE), the American Society of Mechanical Engineers (ASME), and the American Institute of Electrical Engineers (AIEE).[3]

Fig. 3. John Fritz Medal. (John Fritz Legacy, 2005)

The Fritz Medal eventually included the American Association of Engineering Studies (AAES) as well, and rotated among all five engineering societies that made up the successor organizations. The first four Fritz Medals were given to John Fritz (1902), Lord Kelvin (1905), George Westinghouse (1906) and Alexander Graham Bell (1907).

Thomas Edison received the fifth Fritz Medal in 1908 for his "invention of the duplex and quadruplex telegraph; the phonograph; the development of a commercially practical incandescent lamp; the development of a complete system of electric lighting, including dynamos, regulating devices, underground system protective devices and meters." (John Fritz Medal, 1910)

EDISON MEDAL RESTRUCTURED

In 1908, the Executive Committee of the Edison Medal Association now decided to revamp its medal's rules and intended purpose. Arthur Kennelly later explained that between 1904 and 1908 a shortage of applicants led to the absence of qualified candidates under the existing rules which focused the award on student recipients. (Presentation to Tesla, 1917) The Committee responded by redefining the medal's purpose and executed an Amended and Substitute Deed of Gift Creating The Edison Medal ("Amended Deed") in New York on March 26, 1908.[4]

The new deed re-established the Edison Medal in partnership with the New York Trust Company and the American Institute of Electrical Engineers (AIEE). It reasserted that the medal "should, during the centuries to come, serve as an honorable incentive to scientists, engineers and artisans, to maintain by their works the high standard of accomplishment set by the illustrious man whose name and features shall live while human intelligence continues to inhabit the world." The Amended Deed also re-wrote the rules and established that the AIEE would present the medal as its award for "...MERITORIOUS ACHIEVEMENT *[emphasis in document]* in Electrical Science or Electrical Engineering or the Electrical Arts, whenever in the judgment of said Committee [there is someone] properly deserving of such award..." (Documents, 1908a) Revisions to the Committee's bylaws commenced in October 1908, and the final draft was presented to the Board of Directors on December 11, 1908. (Edison Medal Committee, 1909) The Board approved the minutes on May 18, 1909, making operative

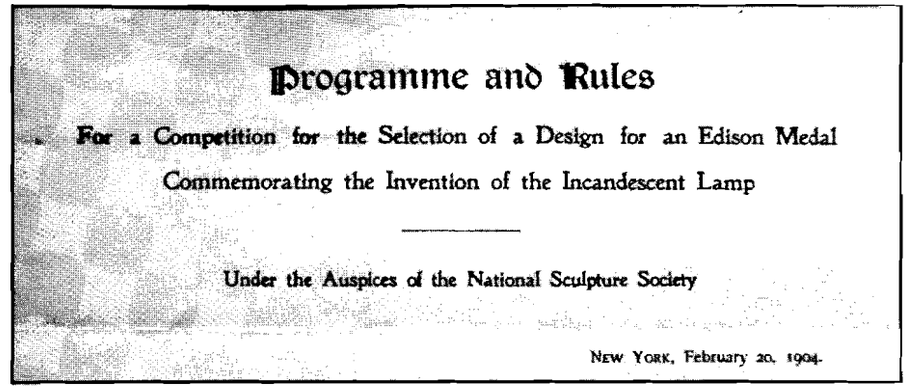
Fig. 4. Signature Blocks from Amended and Substituted Deed of Gift Dated 1908 Reestablishing Terms for the Edison Medal.[5]

the revised by-laws and new rules. (Edison Medal Committee, 1910) Later, the AIEE appointed a jury of 24 members to select the recipient of the award. (Presentation to Nikola Tesla, 1917)

A DESIGN FOR THE MEDAL

The 1904 Edison Medal Committee had initiated a Programme and Rules governing its competition to select an appropriate design for the medal. (Documents, 1904c) Working under the auspices of the National Sculpture Society, designs were invited within a general scheme that specified Thomas Edison's portrait would dominate the face of the medal and an allegorical design would appear on the reverse side. Edison's image would date from the time of his incandescent light, approximately 25 years earlier. A prize of $1,000 would be awarded to the selected artist for production of the selected medal. Designs were due from April 25-30, 1904, with a decision to be rendered within one month. The jury for the competition included Daniel C. French[6], Augustus Saint Gaudens[7] and J.Q.A. Ward[8] of the National Sculpture Society and Edward Adams and T. Commerford Martin on behalf of the Edison Medal Association. (Documents, 1904c)

The design contest was administered late in 1904, and on Nov. 11, 1904, James Earle Fraser[9], a New York sculptor and medallion designer, was informed by St. Gaudens that he was the unanimous selection of the jury. St. Gaudens asked Fraser to provide several sketches "showing modifications to your present idea, or of new ones that may occur". (Freundlich, 2001)



Programme and Rules

For a Competition for the Selection of a Design for an Edison Medal Commemorating the Invention of the Incandescent Lamp

Under the Auspices of the National Sculpture Society

New York, February 20, 1904.

Fig. 5. 1904 Programme and Rules for the Edison Medal Design. (Documents, 1904c)

The final design featured both Edison and an allegorical symbol of merit. The obverse (face) features Edison's portrait and is inscribed "Awarded By The American Institute of Electrical Engineers for Meritorious Achievement In Electricity". The reverse (back) depicts "The Genius of Electricity Crowned by Fame" showing an angel standing behind a male nude and a glowing Edison light sitting on a pedestal.[10] (New York Times, 1909; Freundlich, 2001) The Amended Deed specified that the AIEE would retain a die for future production and reproduction of the gold medal. (Documents, 1908a)

FIRST RECIPIENT IN 1909

Prior to issuing the Amended Deed which redefined the Edison Medal, five graduate students who had qualified to compete for the medal under the old 1904 rules had submitted their theses. Since the medal had been restructured to focus on lifetime achievement instead of student work, the five candidates were asked to withdraw from the medal competition in 1908. They were allowed to resubmit their theses in a special contest to receive a Diploma of Merit plus a $150 cash award issued by the AIEE. (Edison Medal Committee, 1909) On May 18, 1909, Trygve Jensen, a graduate student at the University of Illinois, won the Diploma of Merit for his research on the "Operation of a 100,000 Volt Transformer." (Edison Medal Committee, 1910)

Finally, five years after the initial 1904 organization of the Edison Medal Association, the Committee was ready to officially name its first Edison Medal recipient.[11] Dr. Elihu Thomson was cited for his "meritorious achievement in electrical science, engineering and arts as exemplified in his contributions thereto during the past 30 years." (Edison Medal Committee, 1910; Brittain, 2004) Thomson's accomplishments included approximately 700 patents, work on electric arc lighting, establishing the Thomson-Houston Electric Company (which would eventually merge with the Edison General Electric Company to become General Electric Com-

Fig. 6. The First Edison Medal Awarded to Elihu Thomson In 1909. (IEEE Global History Network, Images 410 and 535)

pany), the Thomson Electric Meter, alternating current devices, the electric air drill, and methods of electric arc welding. In the 1890s, Thomson investigated X-rays and performed research on fused quartz for use in reflecting astronomical telescopes. Thomson was active in the AIEE, contributed to many other societies and received the John Fritz Medal in 1916. He later became the President of the Massachusetts Institute of Technology.[12] The Edison Medal Association presented Thomson with a parchment certificate constituting official notice of the award at the AIEE's annual dinner on February 24, 1910. He received the gold Edison Medal at the AIEE's annual meeting on May 17. (Edison Medal Committee, 1910)

CONFLICTS AND CONTROVERSY

The Edison Medal has been awarded annually since 1909 with the exception of 1915, 1926, 1964 and 2003. The 1926 medal was actually rejected by the named recipient, Dr. William Coolidge, who refused to accept the medal in light of a U.S. Circuit Court decision invalidating his patent on ductile-tungsten. The decision stated that a patent (for an invention) could not be awarded for a scientific discovery. The Edison Medal Committee still tried to award the medal, but Dr. Coolidge refused to "detract from the luster of that medal which should stand as one of the most coveted prizes for meritorious work in the electrical field." (New York Times, 1927)

Ironically, most of the Edison Medal awards in its first ten years went to pioneers or supporters of alternating current and arc lighting technologies even though Edison's long standing opposition to alternating current systems was well known and had garnered many newspaper headlines. (Jonnes, 2003; McNichol, 2006) The rules did not require Edison to present the award, and he was not involved with the award committee's selection of recipients. The following innovators of alternating current technology received Edison Medals during its first decade: Elihu Thomson (1909), Frank Sprague (1910), George Westinghouse (1911), William Stanley (1912), Charles Brush (1913), Nikola Tesla (1916) and Michael Pupin (1920). (See Note 11)

George Westinghouse received the 1911 Edison Medal for his groundbreaking work developing alternating current systems for power distribution and lighting. After nearly 25 years of battling Westinghouse over the alternating current versus direct current systems, Edison offered Westinghouse no congratulations at the ceremony. (McNichol, 2006) Westinghouse ignored Edison stating that "If I have had any success in life it has been due to my wife." (Jonnes, 2003)

In 1917, the Edison Medal was presented to another former Edison rival, Nikola Tesla, for his development of polyphase and high frequency electric currents. (Edison Medal, 2009; IEEE Internet Site, 2009c) Rumors had circulated in 1915 that both Tesla and Edison might jointly share the Nobel Prize in Physics. Though unconfirmed by the Nobel Committee, Tesla allegedly rejected the award and would have nothing to do with Edison. Contradictory stories followed. Soon thereafter, the 1915 Nobel Prize was presented to two British scientists.[13]

The following year, the Edison Medal Association selected Tesla as its 1916 medal recipient. Although Tesla was listed on the original 1904 Edison Medal General Committee subscription (Documents, 1904a), he was now unwilling to receive an award named after Edison. Tesla further thought that his contributions to wireless telegraphy and radio had been slighted since Guglielmo Marconi had already received the Nobel Prize in 1909 with Carl F. Braun. Tesla initially refused the nomination in anger, but later agreed to accept the Edison Medal after his friends at the AIEE pled with him to overcome years of hostility, bitterness and competitive rivalry with Edison. (Cheney, 1981 and 2001) Tesla stunned the audience at the presentation ceremony when he graciously accepted the award and complimented Edison, who did not attend the ceremony, as "this wonderful man, who had had no theoretical training at all, no advantages, who did all himself, getting great results by virtue of his industry and application." (Presentation to Tesla, 1917)

Tesla treasured the Edison Medal during his final years. Poverty stricken, he gave up virtually all of his personal possessions, but kept the medal in a safe at his subsidized Hotel New Yorker apartment. Tesla is reported to have proudly shown the medal to many visitors. After his death on January 7, 1943, Tesla's nephew opened the safe to discover that the medal was missing. It has never been recovered. (Cheney, 1981 and 2001; Tesla Memorial Society, 2009a)

The Edison Medal for 1947 was presented to Lee De Forest by none other than David Sarnoff, President of the powerful Radio Corporation of America (RCA) and a one-time litigant both with and against De Forest over patent rights. Sarnoff heaped glowing praise on De Forest's grid-controlled electron vacuum tube as "one of the twenty great inventions of all time". (New York Times, 1947)

CONNECTIONS

The Edison Medal winners are well represented among the recipients of the John Fritz Medal, and many were also members in

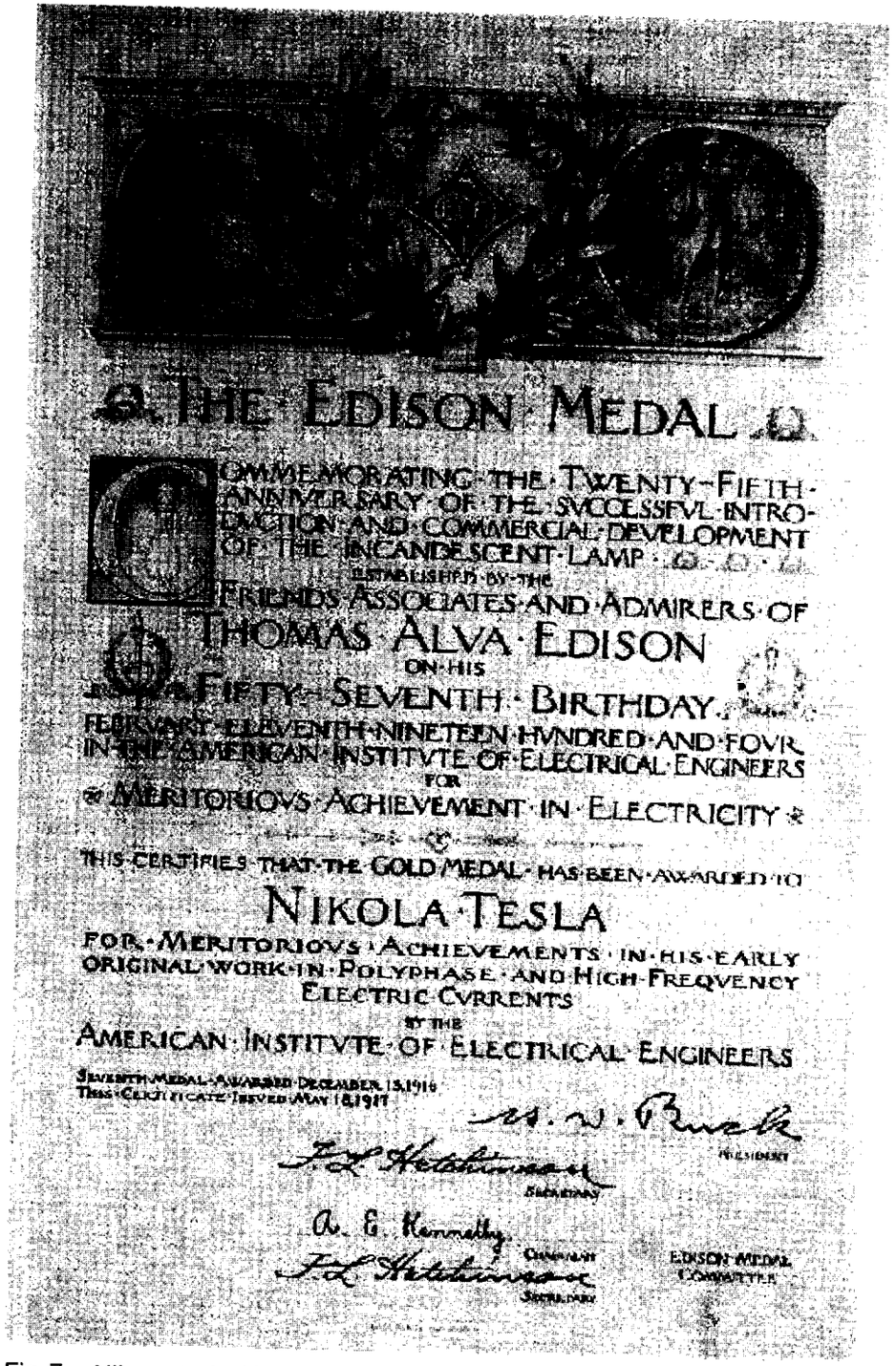


Fig. 7. Nikola Tesla 1916 Edison Medal Award Certificate. (Kesler, 2006)

the most prestigious national engineering honor society in the U.S., Tau Beta Pi. Of the 103 John Fritz Medal winners from 1902-2008, 52 are also Tau Beta Pi members. Of the 13 people that won both the John Fritz Medal and the Edison Medal, six were Tau Beta Pi members. These include Michael Pupin (who won the Edison Medal in 1920), Frank Jewett (1928), Vannevar Bush (1943), Charles Kettering (1958), Walker Cisler (1965) and George Brown (1967). The remaining medalists include Elihu Thomson (1909), Frank Sprague (1910), John George Westinghouse (1911), Alexander Graham Bell (1914), Carty (1917), Willis Whitney (1934) and Philip Sporn (1945).[14]

The Edison Medal was awarded to a number of people for their critical roles in developing radio and television communication, including Michael Pupin (1920) for his work in mathematical physics and its application to the electric transmission of intelligence; Frank Conrad (1930) for radio broadcasting and short wave radio transmission; Arthur Kennelly (1933) for the theory of electrical transmission and international electrical standards; Edwin Armstrong (1942) for the regenerative, super-regenerative and super-heterodyne circuits and frequency modulation FM radio; Lee De Forest (1946) for the grid-controlled vacuum tube; and Vladimir Zworykin (1952) for the television. (Edison Medal, 2009; IEEE Internet Site, 2009c)

ARMSTRONG AND MILLIKAN

Edwin Armstrong was particularly introspective upon his receipt of the 1942 Edison Medal after his many years spent in litigation with De Forest, RCA and others over radio patents and public acknowledgement of who invented various radio circuits. The AIEE awarded Armstrong an honorary lifetime membership (the first of which had been extended to Lord Kelvin in 1892) together with the Edison Medal. Armstrong's Edison Medal citation noted the importance of his work stating, "This keystone of radio development was later to become involved in fourteen years of litigation and which, in the end, was decided by lay courts based on errors of fact and judgment which were contrary to the scientific facts." (Lessing, 1956)

Alan Hazeltine presented the award to Armstrong stating "...one development stands out from all others...the application of the three-electrode vacuum tube...the original electronic tube was the two-electrode vacuum tube of Edison, in whose honor the Edison Medal was established. Others subsequently applied the "Edison Effect" in radio detection [but] the real foundation for the unlimited development was laid by the Edison Medal recipient, Dr. Edwin Howard Armstrong." (Hazeltine, 1943)

Armstrong's acceptance speech began, "It is not possible for me to find the words to tell you what this honor means to me. To have belonged to the generation which learned the meaning of volts and amperes when Edison was at the height of his career, to be able to follow in the footsteps of my old instructor - Michael Pupin - who stood here twenty-two years ago, and to have my own work appraised, during these difficult days, as worthy of the Edison Medal, gives it an inspiring meaning that can never be described." (Armstrong, 1943)

In 1922, Robert Millikan won the Edison Medal "for his experimental work in electrical science". He was the first recipient to be honored primarily for scientific contributions rather than engineering or invention. The selection committee is rumored to have been influenced by his leading role in the mobilization of science and engineering to carry out military research during World War 1. The award proved timely, since the following year he received the Nobel Prize in Physics, becoming the first and only Edison Medalist to win this prestigious recognition. (Brittain, 2006; IEEE Global History, 2009)

EDISON'S 1928 CONGRESSIONAL MEDAL

Thomas Edison is revered as one of the great American inventors. He is recognized in the applied fields of industrial research, engineering and electronics for his many inventions and in science for his discovery of the "Edison Effect". Edison was long recognized as holding the largest number of U.S. patents awarded to any American, eventually obtaining 1,093 patents.[15] The U.S. Congress presented Edison with a gold medal in 1928, three years before his death, "for development and application of inventions that have revolutionized civilization in the last century." (Act, 2007) Among those present to witness President Coolidge's presentation of the Congressional Medal were Dr. Elihu Thomson, the Edison Medal's first recipient, and the first Chairman of the Edison Medal Association, Samuel Insull. (New York Times, 1928)

THE LEGACY OF THE EDISON MEDAL

In 1963 the Institute of Radio Engineers (IRE) and the AIEE merged to form the Institute of Electrical and Electronics Engineers (IEEE). The IRE's former Medal of Honor, its highest award first given to Edwin Armstrong in 1917, was selected to be the IEEE's "highest award". The Edison Medal was selected to become the IEEE's "principal medal".[16] Its purpose remains the same today as in 1909. As Arthur Kennelly stated over seventy years ago, the Edison Medal was intended to identify those "great and noteworthy" and those "great and notorious and worthy of merit", serving as a "Who's Who" in the field of electronics and electrical engineering. (Presentation to Tesla, 1917)

Today, the Edison Medal is the oldest award in the areas of electrical and electronics engineering. Samsung Electronics Co., Ltd. agreed to sponsor the IEEE Edison Medal in 2006 and is committed to the sponsorship through 2016. (IEEE Foundation, 2005) The Edison Medal is considered the highest American award "for a career of meritorious achievement in electrical science, electrical engineering or the electrical arts." (IEEE Internet Site: 2009b and 2009c)

Nominations and the selection of award recipients are governed by the IEEE Medals Council of the IEEE Awards Board. The award is based on "leadership, individual contributions, originality, breadth, patents/publications, other achievements, honors, duration of dominance, quality of nomination". (IEEE Internet Site: 2009c and 2009d)

The original award included a gold medal, bronze replica, small

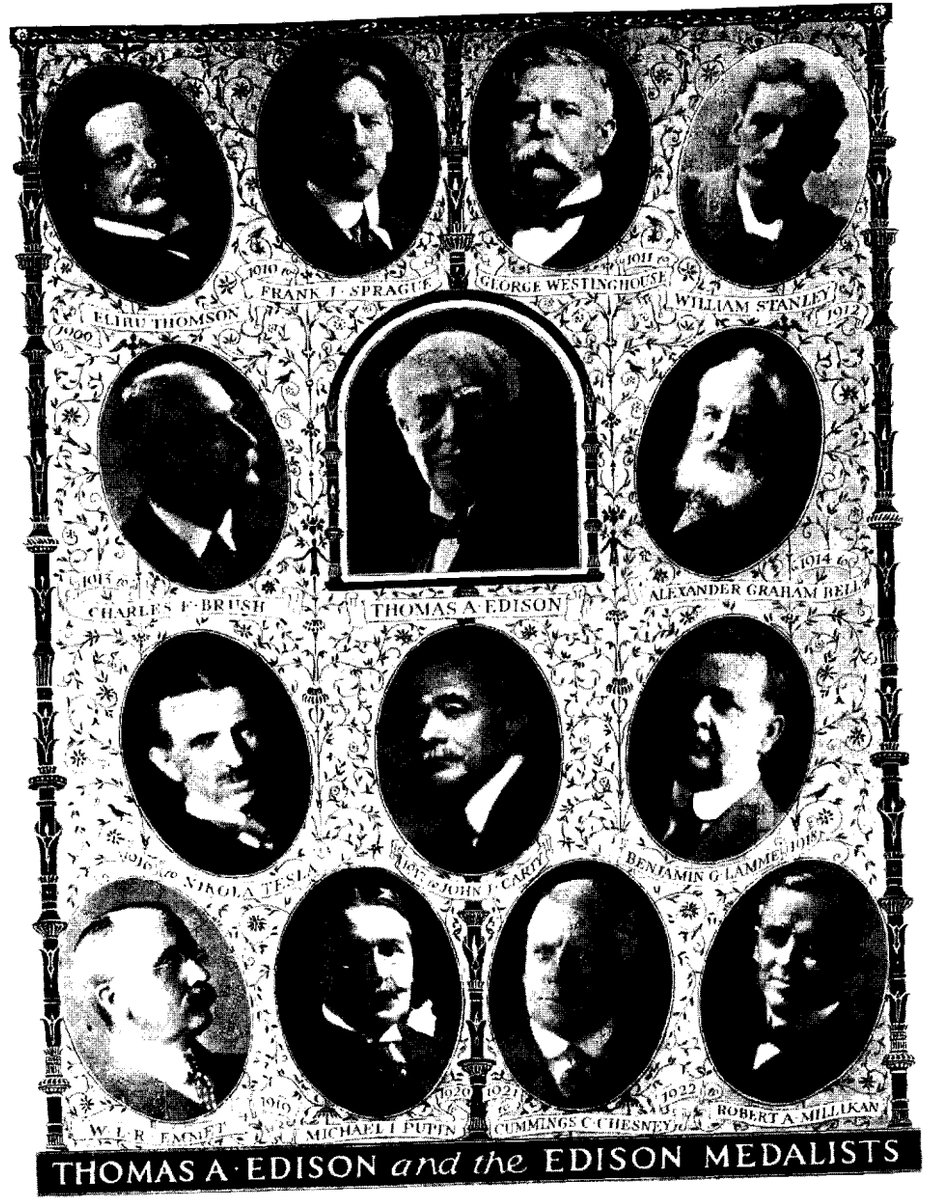


Fig. 8. Edison Medal Winners 1909 through 1922. (Tesla Memorial Society, 2009b)

gold replica, certificate and honorarium. (IEEE Edison Medal, 2009) Today's prize includes a $10,000 honorarium, gold medal, gold pendant and certificate. (IEEE Foundation, 2005)

The 2009 Edison Medal was awarded to Tingye Li, a retired division manager of the Communications Infrastructure Research Laboratory at the AT&T Laboratories in Holmdel, New Jersey. (IEEE Medal Recipients, 2009c) His work in the field of broadband

Table 1. 100 YEARS OF THE EDISON MEDAL

1909	Elihu Thomson
1910	Frank J. Sprague
1911	George Westinghouse
1912	William Stanley
1913	Charles F. Brush
1914	Alexander Graham Bell
1915	(no award)
1916	Nikola Tesla
1917	John J. Carty
1918	Benjamin G. Lamme
1919	William L. Emmet
1920	Michael I. Pupin
1921	Cummings C. Chesney
1922	Robert A. Millikan
1923	John W. Lieb
1924	John W. Howell
1925	Harris J. Ryan
1927	William D. Coolidge
1928	Frank B. Jewett
1929	Charles F. Scott
1930	Frank Conrad
1931	E. W. Rice, Jr.
1932	Bancroft Gherardi
1933	Arthur E. Kennelly
1934	Willis R. Whitney
1935	Lewis B. Stillwell
1936	Alex Dow
1937	Gano Dunn
1938	Dugald C. Jackson
1939	Philip Torchio
1940	George Ashley Campbell
1941	John B. Whitehead
1942	Edwin H. Armstrong
1943	Vannevar Bush
1944	E. F. W. Alexanderson
1945	Philip Sporn
1946	Lee De Forest
1947	Joseph Slepian
1948	Morris E. Leeds
1949	Karl B. McEachron
1950	Otto B. Blackwell
1951	Charles F. Wagner
1952	Vladimir K. Zworykin
1953	John F. Peters
1954	Oliver E. Buckley
1955	Leonid A. Umansky
1956	Comfort A. Adams
1957	John K. Hodnette
1958	Charles F. Kettering
1959	James F. Fairman
1960	Harold S. Osborne
1961	William B. Kouwenhoven
1962	Alexander C. Monteith
1963	John R. Pierce
1964	(no award)
1965	Walter Lee Cisler
1966	Wilmer L. Barrow
1967	George H. Brown
1968	Charles F. Avila
1969	Hendrik W. Bode
1970	Howard H. Aiken
1971	John W. Simpson
1972	William H. Pickering
1973	B. D. H. Tellegen
1974	Jan A. Rajchman
1975	Sidney Darlington
1976	Murray Joslin
1977	Henri Busignies
1978	Daniel E. Noble
1979	Albert Rose
1980	Robert Adler
1981	C. Chapin Cutler
1982	Nathan Cohn
1983	Herman Paul Schwan
1984	Eugene I. Gordon
1985	John D. Kraus
1986	James L. Flanagan
1987	Robert A. Henle
1988	James Ross MacDonald
1989	Nick Holonyak
1990	Archie W. Straiton
1991	John Louis Moll
1992	G. David Forney, Jr.
1993	James H. Pomerene
1994	Leslie A. Geddes
1995	Robert W. Lucky
1996	Floyd Dunn
1997	Esther M. Conwell
1998	Rolf Landauer
1999	Kees A. Schouhamer Immink
2000	Jun-Ichi Nishizawa
2001	Robert H. Dennard
2002	Edward E. Hammer
2003	(no award)
2004	Federico Capasso
2005	Peter Lawrenson
2006	Fawwaz T. Ulaby
2007	Russel D. Dupuis
2008	Dov Frohman-Bentchkowsky
2009	Tingye Li

Source: IEEE Internet Site, 2009c. (See Note 11)

optical fiber communications seems far removed from Thomas Edison's incandescent light first commemorated by Edison's friends and associates 105 years ago.

The tremendous progress achieved in electronics and electrical science over the past century, which is characterized by the recipients of the Edison Medal, has made it a living testament to the life and work of its namesake, Thomas Edison.

REFERENCES

Act Commemorating the LITE, or Lifetime Innovations of Thomas Edison. (Introduced in U.S. Senate) S 2329 IS 110th Congress 1st Session S. 2329. To establish the Thomas Edison National Historical Park in the State of New Jersey as the successor to the Edison National Historic Site. In The Senate Of The United States dated November 8, 2007.

Adams (2009, May 5). John Quincy Adams Ward. *Wikipedia Internet Site.* See www.wikipedia.org.

Armstrong, E.H. (1943, April). Vagaries and elusiveness of invention. Proceedings, American Institute of Electrical Engineers. *Electrical Engineering.* Vol. 62. Reprinted in *The Legacies of Edwin Howard Armstrong*, (1991), The Radio Club of America.

Brittain, J.S. (2004, Jan.). Hall of fame for electrical enginee: Elihu Thomson. *Proceedings of the IEEE.* Institute of Electrical and Electronics Engineers, Inc. Vol. 92, No. 1.

Brittain, J.S. (2006, June). Electrical Engineering Hall of Fame: Robert Millikan. *Proceedings of the IEEE.* Institute of Electrical and Electronics Engineers, Inc. Vol. 94, No. 6.

Cheney, M. (1981). *Tesla, Man Out of Time.* Englewood Cliffs, N.J.: Prentice-Hall.

Cheney, M., Uth, R. (2001). *TESLA: Master of Lighting.* New York: Metro Books.

Documents. Edison Medal Association. Collection of David & Julia Bart.

____Minutes of Executive Committee, Various dates as noted.

____(1904a, Jan. 1). Edison Medal Association Subscription and Form.

____(1904b, Jan. 20). Letter from R. Lozier to E.H. Lewis.

____(1904c, Feb. 20). Programme and Rules For A Competition For The Selection of a Design For An Edison Medal Commemorating The Invention of the Incandescent Lamp.

____(1907, May 23). Letter from T.C. Martin to J.C. Rowe.

____(1908a, March 26). Amended and Substitute Deed of Gift Creating Edison Medal.

____(1908b, May 13). Letter from S. Insull to Messrs. Eaton, Lewis and Rowe.

Edison Medal. (2009, April 28). *Encyclopedia II - Edison Medal – History.* See http://www.experiencefestival.com/a/Edison_Medal_-_History/id/5011080.

Edison Medal Committee. (1909, May 18). *Transactions of the American Institute of Electrical Engineers.* American Institute of Electrical Engineers. June 30-Dec. 31, 1909. Vol. XXVIII Part II.

Edison Medal Committee. (1910, May 17). *Transactions of the American Institute of Electrical Engineers.* American Institute of Electrical Engineers. May 17-Dec. 31, 1910. Vol. XXIX Part II.

Edison Pioneers. (2009, April 28). *Wikipedia Internet Site.* See www.wikipedia.org.

French. (2009, May 5). Daniel Chester French. *Wikipedia Internet Site.* See www.wikipedia.org.

Freundlich, A.L. (2001). *The Sculpture of James Earle Fraser.* Boca Raton, Florida: Universal

Publishers.
Gaudens. (2009, May 5). Augustus Saint-Gaudens. *Wikipedia Internet Site*. See www.wikipedia.org.
Gherardi, B. (1907, March 16). Letter from B. Gherardi to F.J. Sprague. New York Public Library, Manuscripts and Archives Division, Frank Sprague Papers. *Rutgers University Thomas A. Edison Papers Digital Edition Internet Site*. Document X120C, X120CCR, TAEM 0:0. See http://edison.rutgers.edu/digital.htm.
Hammer, W.J. (1920, March 31). Letter from W.J. Hammer to F. Jehl. Smithsonian Institution, National Museum of American History Archives Center, William J. Hammer Collection. *Rutgers University Thomas A. Edison Papers Digital Edition Internet Site*. Document X098A, X098A082; TAEM 0:0. See http://edison.rutgers.edu/digital.htm.
Hazeltine, A. (1943, April). Presentation of the AIEE Edison Medal. *Electrical Engineering*. Vol. 62. Reprinted in *The Legacies of Edwin Howard Armstrong*, (1991), The Radio Club of America.
ICE. (2009, May 5). The Kelvin Medal. Institution of Civil Engineers Terms of Reference For Institution and Inter-Institution Medals. *Institution of Civil Engineers Internet Site*. See http://www.ice.org.uk/myice/myice_scholarships_inter_institution.asp.
IEEE Century of Honors. (1984). *A Century of Honors 1884-1984: The First 100 Years of Award Winners, Honorary Members, Past Presidents and Fellows of The Institute*. New York: Institute of Electrical and Electronics Engineers, Inc.
IEEE Edison Medal. (2009, April 27). *Wikipedia Internet Site*. See www.wikipedia.org.
IEEE Explore. (2008, Sept. 16). Elihu Thomson. *IEEE Digital Library*. Institute of Electrical and Electronics Engineers, Inc. See http://www.ieeeghn.org/wiki/index.php/Elihu_Thomson.
IEEE Foundation. (2005). Samsung to Sponsor IEEE Edison Medal. *IEEE Foundation Internet Site*. Institute of Electrical and Electronics Engineers, Inc. See http://www.ieee.org/organizations/foundation/2005news.html.
IEEE Global History Network. *IEEE Global History Network Internet Site*. Institute of Electrical and Electronics Engineers, Inc. See http://www.ieeeghn.org.
___(2008, Nov. 11). Edison Medal. Images 410 and 435.
___(2009, Jan. 28). Robert A. Millikan.
IEEE Internet Site. Institute of Electrical and Electronics Engineers, Inc. See https://www.ieee.org.
___(2009a, April 27). Brief History of IEEE.
___(2009b, April 27). Edison Medal.
___(2009c, April 27). Edison Medal Recipients.
___(2009d, April 27). Edison Medal Nomination.
John Fritz and his legacy. (2005, March 15 - May 2). *Lehigh University Special Collections Exhibition*. John Fritz Medal: John W. Fisher Medalist For 2000 Program. See http://dig.lib.lehigh.edu/projects/exhibits.asp?id=5.
The John Fritz Medal. (1910, Aug.). Announcements: public meeting for the presentation of the medal for 1910. *Proceedings of the American Society of Civil Engineers*. American Society of Civil Engineers. Vol. XXXVI, No. 8.
John Fritz Medal. (2009a, April 28). *American Association of Engineering Studies Internet Site*. See http://www.aaes.org/communications/john_fritz_medal.asp.
John Fritz Medal. (2009b, April 28). *Tau Beta Pi Engineering Honor Society Internet Site*. See http://www.tbp.org/pages/About/People/DistinguishedMembers/Fritz.cfm.
Jones, F.A. (1908). *Thomas Alva Edison, Sixty Years of an Inventor's Life*. New York: Thomas Y. Crowell Publishers.
Jonnes, J. (2003). *Empires of Light: Edison, Tesla, Westinghouse, and the Race to Electrify the World*. New York: Random House, Inc.
Kennelly, A.E. (1932). Biographical Memoir of Thomas Alva Edison 1847-1931. *National Academy of Sciences Biographical Memoirs*. Vol. XV, 10th Memoir. Presented at National Academy of Sciences Autumn Meetings, 1932.
Kesler, M. (2006, June 22). Nikola Tesla 150 Years of Genius. *Exhibition: Diplomas of Nikola Tesla At The Assembly Room in Zagreb's Subcommittee of Prosvjeta*. For Tesla's Edison Medal certificate see http://www.nikolatesla.hr/slike/Diploma4.jpg. For Exhibition see http://www.nikolatesla.hr/news.aspx?newsID=69&pageID=14.
Lessing, L. (1956). *Man of High Fidelity: Edwin Howard Armstrong*. New York: J.B. Lippincott Company.
Maney, K. (2005, Dec. 13). You really can find identities of top patent holders. *USA TODAY*. Gannett Co. Inc.
McNichol, T. (2006). *AC/DC: The Savage Tale of the First Standards War*. San Francisco: Jossey-Bass.
Miller, F.T. (1931). *Thomas S. Edison, Benefactor of Mankind*. Chicago: John C. Winston Company.
New York Times Article Archives. *New York Times Internet Site*. See http://www.nytimes.com/ref/membercenter/nytarchive.html.
___ (1904, Feb. 12). Edison Uses Sender For Banquet Speech.
___(1909, Aug. 1). To Award Edison Medal.
___(1915, Nov. 7). Tesla's Discovery Nobel Prize Winner.
___(1918, Feb. 12). Edison, 71, Honored By Old Associates.
___(1927, Feb. 26). Scientist Refuses To Accept Award.
___(1928, Oct. 19). Program Completed For Edison Ceremony.
___(1947, Jan. 29). De Forest Honored As Radio Pioneer.
Presentation of the Edison Medal to Nikola Tesla. (1917, May 18). *Minutes of the Annual Meeting of the AIEE, Held at The Engineering Societies Building, New York City*. American Institute of Electrical Engineers.
Presentation of John Fritz Medal to Professor Elihu Thomson. (1917, Feb.). *Bulletin of the American Institute of Mining Engineers*. American Institute of Mining Engineers. No. 122.
Science. American Association For The Advancement of Science.
___(1902, Nov.). The John Fritz Medal. Vol. XVI.
___(1904a, Jan. 15). Electrical World. Vol. XIX.
___(1904b, Feb. 26). Scientific notes and news. Vol. XIX.
___(1904c, May 27). The Edison Medal. Vol. XIX.
Semple, E.A. (1910, April). James Earle Fraser, Sculptor. *The Century Magazine*. New York: The Century Company.
Tesla Memorial Society of New York Internet Site. Tesla Memorial Society of New York. See www.teslasociety.com.
___(2009a, April 28). Vujovic, Dr. L. Missing Tesla Related Items.
___(2009b, April 28). Thomas A. Edison And The Edison Medalists. Image undated.
Trainer, M. (2008, June). In Memoriam: Lord Kelvin, recipient of the John Fritz Medal in 1905. *Physics in Perspective*. Birkhäuser Basel. Vol. 10, No. 2.

NOTES

1 The "War of Currents", or "Battle of Currents", raged from the mid-1880s through the first years of the twentieth century. George Westinghouse and Thomas Edison became bitter adversaries due to Edison's ruthless

promotion of direct current (D.C.) for electric power distribution over the alternating current (A.C.) systems advocated by Westinghouse and Nikola Tesla. The battle was waged in newspapers, the courts and through various banking and business dealings. Contracts for major lighting and power installations such as the Columbian Exposition and propaganda over the first electric chair provided the public with numerous newspaper headlines. (Jonnes, 2003; McNichol, 2006)

2 A number of these former employees and associates of Edison would later form the Edison Pioneers in 1918. This group was established to memorialize Edison through public works including preserving Edison artifacts and historic places, funding scholarship medals and building memorials. The group met annually on Edison's birthday. The original Edison Pioneers included 28 members and 230 former associates of Edison. The following are noted in particular:

(1) Edison's 'four principal assistants': Charles Batchelor (Chairman of the Edison Medal Assn.), Edward Johnson, John Kruesi and Francis Upton (Edison Medal Assn.);

(2) Edison's 'co-workers': Charles Edgar (Edison Medal Assn.) William Hammer (Edison Medal Assn.), Samuel Insull (Executive Committee of Edison Medal Assn.), Frances Jehl (Edison's assistant at Menlo Park and his biographer), Robert Lozier (Edison Medal Assn.), T. Commerford Martin (Edison Medal Assn. and editor of *Electrical World*), John Ott (Edison Medal Assn.);

(3) Edison's 'associates': Richard Bowker (Edison Medal Association), Henry Ford (founder of The Edison Institute later known as the Henry Ford Museum and Greenfield Village); Arthur Kennelly (awarded Edison Medal in 1933), Frank Sprague (awarded Edison Medal in 1910), Nikola Tesla (awarded Edison Medal in 1916) and Theodore Vandeventer. (New York Times, 1918; Hammer, 1920; Miller, 1931; Kennelly, 1932; Edison Pioneers, 2009)

3 For a complete history of John Fritz and the Fritz Medal including its winners, see *Science*, 1902; John Fritz Medal: 2009a and 2009b; John Fritz Medal, 1910; Trainer, 2008.

4 The Amended Deed was executed in triplicate by the full Executive Committee including William S. Andrews, Charles Batchelor, Richard R. Bowker, Andrew Carnegie, Charles A. Coffin, Richard N. Dyer, Sherburne B. Eaton, Charles L. Edgar, William E. Gillmore, William J. Hammer, Frank S. Hastings, Charles T. Hughes, Samuel Insull, Arthur E. Kennelly, H. Ward Leonard, John W. Lieb Jr., Robert T. Lozier, W.S. Mallory, T. Commerford Martin, J. Pierpont Morgan, John Ott, Frank J. Sprague, Francis R. Upton, and Schuyler S. Wheeler. Alex S. Webb signed as Vice President of the New York Trust Company and Henry G. Stott signed as President of the AIEE. Eugene H. Lewis, who had executed the original 1904 deed, had since died. John Ott's signature was omitted from Samuel Insull's copy of the Amended Deed, which was delivered to the Edison Medal Association's lawyers as the final copy. (Documents: 1908a and 1908b)

5 Signatures are in alphabetical order on the Deed of Gift (see Note 4), but are shown in the following order in the excerpts: (Left column top) Sprague, Upton, Wheeler; (Left column middle) Webb, Stott; (Left column bottom) Andrews, Batchelor, Bowker, Carnegie; (Right column) Coffin, Dyer, Eaton, Edgar, Gillmore, Hammer, Hastings, Hughes, Insull, Kennelly, Leonard, Lieb, Lozier, Mallory, Martin, Morgan.

6 Daniel French designed several renowned public monuments including *Abraham Lincoln* at the Lincoln Memorial in Washington, D.C., the *Minuteman Statue* in Concord, Massachusetts and *Republic*, the centerpiece of the World's Columbian Exposition in Chicago, 1893. (French, 2009)

7 Augustus Saint Gaudens was a sculptor and artist who designed many public monuments including *William Tecumseh Sherman* in New York City's Central Park, *Diana* and *Hiawatha* at the Metropolitan Museum of Art in New York City, the *Robert Gould Shaw Memorial* on Boston Common and *The Puritan* in Salem, Massachusetts. He also designed the Double Eagle $20 U.S. gold coin as well as the $10 Indian Head gold eagle. (Gaudens, 2009)

8 Artist and sculptor John Quincy Adams Ward is best known for his statue of *George Washington* on the steps of Federal Hall on Wall Street in New York City. (Adams, 2009)

9 James Earle Fraser was the leading American sculptor of public monuments of his generation. Today, no other artist has more public sculptures on display in the U.S. He is best known for the U.S. Buffalo Nickel as well as *Theodore Roosevelt* at the American Museum of Natural History in New York City, *Benjamin Franklin* at the Franklin Institute in Philadelphia, the entry sculptures and pediment reliefs at the U.S. National Archives building in Washington, D.C., *Alexander Hamilton* at the U.S. Treasury in Washington, D.C., and the *End of the Trail* sculpture now at the National Cowboy & Western Heritage Museum. Fraser also executed the Thomas Edison bust and seated Edison statue at the Henry Ford Museum in Dearborn, Michigan. (Semple, 1910; Freundlich, 2001)

10 The original design for the reverse (back) of the Edison Medal depicted a nude male sitting on steps holding a glowing Edison light bulb. Fraser actually cast Edison's own arm holding the light bulb for this version of the medal. (Freundlich, 2001)

11 The Edison Medal award dates in this article are based on the dates each recipient was selected, as reported by the IEEE, and not the dates the awards were presented, as reported by some of the reference materials. Since recipients were selected at the close of each calendar year and the medal presentation was made the following year, there is some inconsistency referring to the year of each award.

12 Dr. Elihu Thomson is not related to Sir William Thomson, known as Lord Kelvin. In addition to the Edison Medal, Thomson was the first American recipient of the Kelvin Gold Medal issued by the Institute of Civil Engineers in Great Britain in 1923. The Kelvin Medal is awarded for "distinguished service in the application of science to engineering." (Presentation to Thomson, 1917; Brittain, 2004; IEEE Explore, 2008; ICE, 2009)

13 See New York Times (1915) for the original article and Cheney (1981 and 2001) for the complete story which involved many unsupported newspaper articles and interviews about the Nobel Prize award. On November 14, 1915, the Nobel Prize Committee announced the 1915 prize for physics would be awarded to Professor William Henry Bragg of the University of Leeds in England and his son W.L. Bragg of Cambridge University for their use of X-rays to determine the structure of crystals.

14 See IEEE, 2009c; John Fritz Medal, 2009a and 2009b; IEEE Century of Honors, 1984; IEEE Edison Medal, 2009.

15 A 2005 study concluded that the largest number of U.S. patents (1,432) belong to Shunpei Yamazaki working at the Semiconductor Energy Laboratory in Tokyo, Japan. The second highest

number of patents (1,322) belongs to Donald Weber, primarily involving flower pot and flower bundling technology. Thomas Edison now ranks third with 1,093 U.S. patents. (Maney, 2005)

16 The American Institute of Electrical Engineers (AIEE) was founded in 1884. The focus of the AIEE would largely become dominated by topics of electric power generation and wire communications. The Institute of Radio Engineers (IRE) was formed in 1912, modeled on the AIEE, but was devoted to radio, wireless telegraphy and electronics. In the 1940s the interests of the two societies began to significantly overlap and many engineers were members of both societies. A merger occurred in 1963, and the resulting organization was renamed the Institute of Electrical and Electronics Engineers (IEEE). (IEEE Century of Honors, 1984; IEEE Internet Site, 2009c) See also Edison Medal, 2009 and IEEE Edison Medal, 2009.

This article was peer-reviewed.

ABOUT THE AUTHORS

David and Julia Bart reside in the Chicago area. Together, they have published numerous articles on radio and broadcasting history and telegraph communications.

David received both his Bachelor of Arts Degree in Anthropology and Statistics (1985) and his Masters Degree in Business Administration (1993) at the University of Chicago. He is a member of the Board of Directors of the Antique Wireless Association, Technical Curator for the Museum of Broadcast Communications in Chicago, and President of the Antique Radio Club of Illinois. He has made presentations on communications history at the New York Historical Society, the American Association of Physics Teachers and American Association For The Advancement of Science Joint AAPT/AAAS Meetings, and the Antique Wireless Association. He is also a member of the Michigan Antique Radio Club and the Indiana Historic Radio Society.

Julia received her Bachelor of Arts Degree in Behavioral Sciences (1987) from the University of Chicago and a Master of Arts in Reading from Concordia University (2007). Julia is a long time member and past Treasurer of the Antique Radio Club of Illinois where she continues to play an active role as a volunteer. Julia is also a member of the Michigan Antique Radio Club and the Indiana Historic Radio Society.

David and Julia recently became founding members of the new Webster Club which will explore the history of scientific instruments at the Adler Planetarium in Chicago. David and Julia have collected radio, telephone, phonograph and telegraph devices for over 20 years; and, with their two sons John and Michael, have enjoyed providing numerous demonstrations and programs for the Boy Scouts of America, school groups and local historical societies.

Julia and David Bart