
The Rise and Fall of the De Forest Companies

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Abstract

Much has been written about Lee De Forest and the various companies he helped to create, most of which focuses on the man, his radio apparatus and his accomplishments. This paper is a review of how and when his many companies were formed, how they transitioned from one to another, and how and why they failed—often spectacularly. It details how De Forest, whose goal was to achieve success and fame in the field of radio telegraphy and telephony, was willingly duped into forming a number of companies by conspiring with known stockjobbers whose goal was to sell as much stock and pocket as much of the proceeds as possible. As a result, De Forest was left with precious few resources for developing the necessary apparatus, much less for assembling the necessary infrastructure consisting of stations and operating personnel required to provide reliable communication services. Interspersed among interesting facts and figures about the rise and fall of each company, with their attendant accomplishments and failures, are stories of the shenanigans of colorful but deceitful cohorts of De Forest.

Introduction

It is not known for certain how many De Forest-related radio companies were created in the years between 1902 when the first De Forest company was organized (Wireless Telegraph Company of America), and 1924 when the last De Forest radio company was formed (De Forest Radio Company). The better known De Forest-related companies listed in Table 1 were selected for chronicling because each succeeding company in the table was created just as the preceding company began to

fade or fail, so that the stories of these companies result in a rather seamless account of the rise and fall of Lee De Forest and his companies. Other lesser-known radio companies such as the De Forest Great Lakes Wireless Co., Atlantic De Forest Wireless Co., and Occidental and Oriental Wireless Co. were subsidiaries of one or more of the companies listed. These lesser-known companies will be mentioned as appropriate but not accorded the status of sections denoted by Roman numerals.

Table 1. De Forest-related Companies Chronicled in Titled Paragraphs.

De Forest-Related Wireless Telegraphy and Radio Companies	Incorporation	
	State	Date ¹
Wireless Telegraph Company of America	NJ	9/21/1901
De Forest Wireless Telegraph Co.	ME	2/19/1902
American De Forest Wireless Telegraph Co.	ME	12/3/1902
De Forest Radio Telephone Co.	NY	3/7/1907 ²
Radio Telephone Co.	NJ	5/17/1907 ³
North American Wireless Corp.	ME	11/4/1909
Radio Telephone & Telegraph Co.	DE	12/10/1913
De Forest Radio Telephone & Telegraph Co.	DE	9/26/1914
Lee De Forest Inc.	CA	3/27/1920
De Forest Radio Co.	DE	9/27/1924

¹ Dates taken from state incorporation documents unless otherwise noted

² *New York Times*, March 7, 1907, p. 13.

³ *New York Times*, May 18, 1907, p. 11.

The De Forest companies in this table are divided into two categories. The first three companies focused on wireless telegraphy while the remainder focused on wireless telephony, that is to say, communication by voice for applications to radiotelephony and/or broadcast radio. This article addresses the first three De Forest companies appearing in the table, while a subsequent article will address the remaining companies.

It should be noted that the spelling of the De Forest company name in the filing papers of all De Forest companies listed in this table appear as “De Forest,” spelled with a capital “D” and a space between “De” and “F.” While alternate forms of the De Forest spelling have been used for the De Forest company names—often quite indiscriminately—the De Forest form

is used here because it is the most common form and because the De Forest spelling appears in most of the filing papers, providing an indication of intent. The De Forest spelling will also be used for Lee’s surname in the general narrative for reasons indicated in the first reference.¹ The spelling of Lee’s surname used in cited references, quotations, and reproductions of historical documents is reproduced here exactly as it appears in the cited material, a practice that is recommended by most style manuals.

While much has been written about the De Forest-related companies, little has been written about how and why the companies were created, how one company transitioned to the next, and how and why they failed. More to the point, much of the information written about this topic is either inconsistent

with original documents describing these events or has never been chronicled. Accounts of the De Forest-related companies given here were generated from original documents found in the following sources: documents from the Lee and Marie de Forest Papers at History San Jose Research Library, George Clark's Radioana Collection held by the Museum of American History, the "Lee De Forest papers, 1884–1955" held by the Manuscript Division of the Library of Congress. Citations from De Forest's diaries held by the Library of Congress are referenced hereinafter as "De Forest Diaries" followed by the date of entry.² Also included are incorporation documents from the respective secretaries of state in which each company was incorporated, electrical magazines and newspapers of the day that chronicled activities of the wireless telegraph companies, and documents from the author's collection chronicling the sworn testimony of De Forest employees and other witnesses in two different litigations, the principal one being the National Electric Signaling Co. (NESCO) suit against the American De Forest Wireless Co. alleging infringement of Reginald Fessenden's electrolytic detector patent.³

Finally, both versions of De Forest's autobiography were used including *Father of Radio* that was published in 1950,⁴ and the original unpublished 1186-page draft version of De Forest's autobiography dated 1949 held by History of San Jose.⁵ The unpublished version of his autobiography was found to be significantly more accurate than

the published version, which is fatally flawed by numerous errors and omissions that were created by the publisher during the editing process. For example, 1) two of the more relevant companies are not even mentioned—the Wireless Telegraph Co. of America and Lee De Forest, Inc., 2) the American De Forest Wireless Telegraph Company is misidentified as the De Forest Wireless Telegraph Company in several places, and as a result, activities of the De Forest Wireless Telegraph Company do not appear anywhere in the book,⁶ and 3) many vignettes have errors in dates and time intervals.⁷

Organization

This article is organized according to the roadmap outlined in Fig. 1 in which each of the four shaded boxes corresponds to one of the four major titled sections. The first section covers the activities of the first company, the Wireless Telegraph Company of America, which was organized on September 21, 1901. The second section covers the activities of the De Forest Wireless Telegraph Company organized on February 19, 1902, the first company to use the De Forest surname. The dashed line indicates that this company was not a successor to the Wireless Telegraph company—instead its assets were transferred to the new De Forest Wireless company by means of a 99-year lease executed on May 5, 1902, almost three months after the new company was organized.

The third section covers the activities of the American De Forest Wireless

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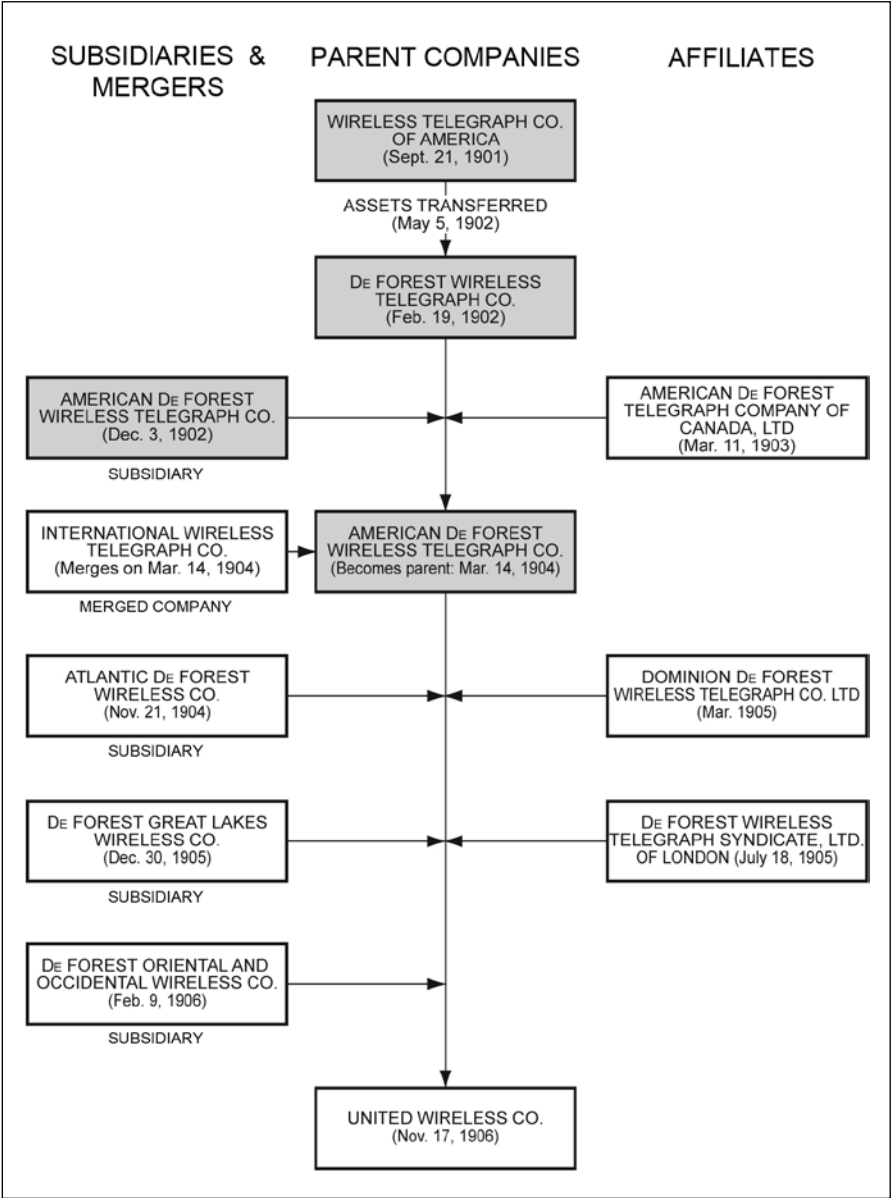


Fig. 1. This roadmap represents the organization of the article, in which the four major divisions are indicated by the shaded boxes designating the three major De Forest-related telegraph companies; companies in the first column were either organized as subsidiaries of, or merged into, the indicated parent companies appearing in the middle column, while companies appearing in the third column were foreign affiliates. The American De Forest Wireless Telegraph Company was organized as a subsidiary and later became the parent.

Telegraph Company, which was organized as a subsidiary of the parent De Forest Wireless Telegraph Company on Dec. 3, 1902. The parent and subsidiary actually operated as if they were a single company with the same assets, the same president, the same business offices, and a majority of the same directors. Since the activities of both companies were indistinguishable, they are treated together as one entity until March 14, 1904 when the parent De Forest Wireless company and the International Wireless Telegraph Company were merged into the then-subsubsidiary, the American De Forest company. The stock in the Canadian affiliate owned by De Forest Wireless was also transferred to American De Forest. The affiliates in this roadmap are distinguished from the subsidiaries in that they were not under the control of the De Forest companies whereas the subsidiaries were.

The fourth and last section covers the exploits the American De Forest company from the time it became the parent on March 14, 1904, until the time it and its three subsidiaries were merged into the United Wireless Telegraph Co. on November 17 1906. The financial interests in the two foreign affiliates were also transferred to United Wireless at that time. Lee De Forest's employment at the American De Forest company was terminated on November 28, 1906, eleven days after formation of United Wireless, so all connections between Lee De Forest and his wireless companies ended with his termination, as does this article.

I. The Wireless Telegraph Company of America (1901–1902)

The story of the Wireless Telegraph Company of America begins with a newspaper article in the July 20, 1901 issue of the *Chicago Tribune* reporting the successful test of a new wireless telegraph system invented by Dr. Lee De Forest, E. H. Smythe, a young Western Electric engineer, and Professor Clarence E. Freeman, a professor of electrical engineering at the Armour Institute of Technology. Artistic sketches of the new system of telegraphy accompanying the article (Fig. 2) made an impression on many readers, and this article propelled the young De Forest into the spotlight. The reporter used the De Forest spelling for the first time in print—the spelling that was repeated in newspapers for years to come.⁸ Over a two-year period, De Forest and Smythe collaborated on the design of the receiver, often referred to as a “responder,” while Freeman designed a unique transmitter. The term “responder” describing a radio receiver was actually coined by the *Electrician* of London in October 1900.⁹ The three participants filed four patents between September 1, 1900 and July 5, 1901 on apparatus that collectively became known as the De Forest-Smythe System: U.S. patents No. 716,203 and No. 716,000 covering the receiver, which were filed jointly by L. De Forest and E. H. Smythe on September 1, 1900, and July 5, 1901, respectively; U.S. patent No. 773,069 covering the transmitter, which was filed on January 14, 1901 by C. E. Freeman; and U.S. patent No.

NEW WIRELESS TELEGRAPH SUCCEEDS IN FOUR-MILE TEST IN THE CITY.

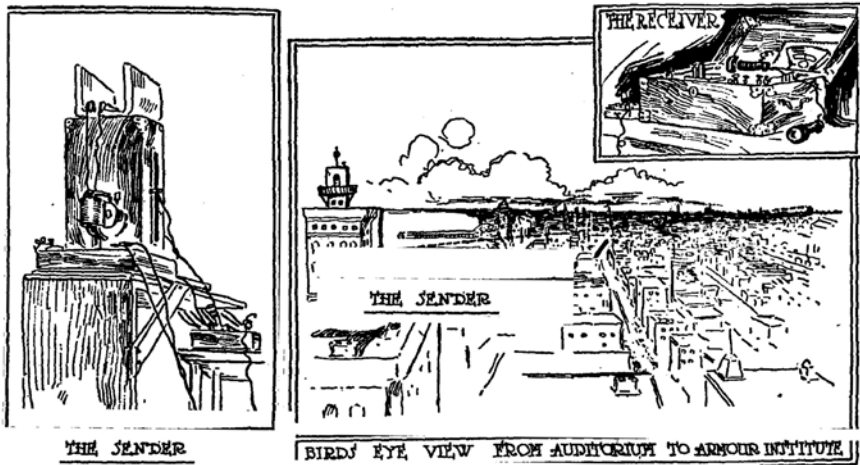


Fig. 2. These sketches of De Forest's successful wireless test across the city of Chicago published in July 1901 sparked the imagination of the public, helping to launch his career. (*Chicago Tribune*, July 20, 1901, p. 4)

720,568, also covering the receiver, which was filed on March 6, 1901, by L. De Forest. The Freeman sending apparatus and De Forest-Smythe receiver or responder covered by these patents are shown in Fig. 3 and described in the *Western Electrician*.¹⁰

The new De Forest-Smythe responder was a form of an electrolytic detector that was used in conjunction with headphones as an indicating device. The responder shown in his patent consisted of two opposing conducting cylinders (see Fig. 4) in which the space between the two was filled with an electrolyte or "electrically-decomposable" liquid containing metal particles—a paste which De Forest often referred to as "goo." In this regard, De Forest's electrolytic goo detector was distinctly different from the electrolytic detector

chronicled by Pupin and patented later by Fessenden.¹¹

The principal novelties of De Forest's responder were the fact that the detector was self-restoring (as opposed to Marconi's coherer, which required tapping back to restore sensitivity), and it used earphones rather than the Morse inker used by Marconi. These differences made possible a much higher word rate than the coherer used by Marconi and others. De Forest's new receiver was often described in the press as an anti-coherer because the resistance of the device increased rather than decreased when responding to electromagnetic waves. While the De Forest-Smythe System would achieve a degree of acceptance in the U.S., De Forest's new responder was relatively insensitive and also subject to clogging, which would

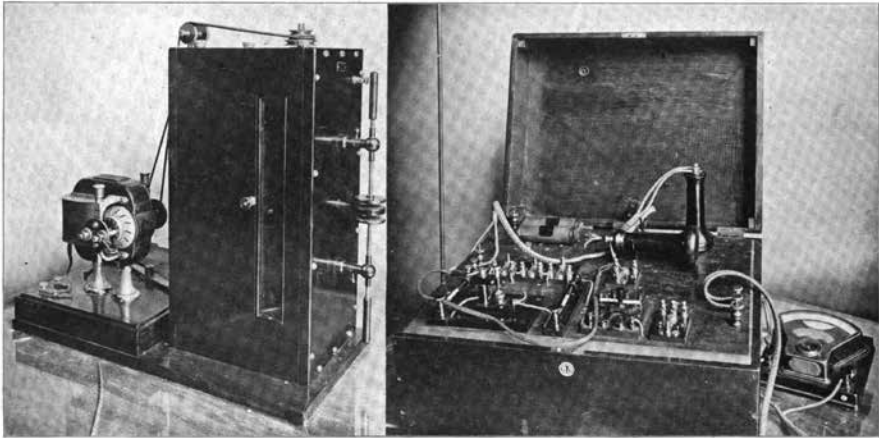


Fig. 3. Photographs of the earliest forms of the Freeman transmitter and the De Forest-Smyth receiver, or “responder,” were characterized as “a new system of space telegraphy.” (*Western Electrician*, July 27, 1901, p. 50)

ultimately cause De Forest to discard it in favor of other detector technologies.

After his initial success in Chicago, De Forest felt it was time to challenge Marconi, who was planning to report on the America’s Cup races to be held off the coast of Sandy Hook, New Jersey, between September 28 and October 4, 1901. De Forest believed that he could overshadow Marconi by transmitting information farther and faster, thereby attracting the attention of the public and investors alike. In his autobiography he states: “From the start, I had the one aim in view, to make my name at least rank with that of Marconi.”¹² He continued with, “Efficiency shall be the key to success and fame . . .” His visions of grandeur dictated that he move his operation east—against the wishes of his partners Smythe and Freeman. Over their protests, he came to

the New York City area circa August 7, 1901,¹³ where he roomed with his Yale classmate Manning (Max) F. Stires, Jr. in his Jersey City home.

Max Stires found that Marconi had already contracted with the *Associated*

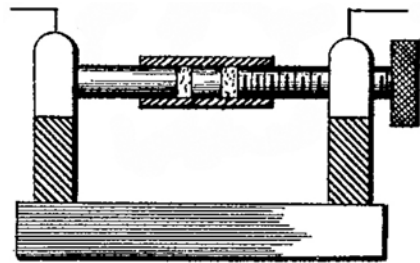


Fig. 4. The detector used in the De Forest-Smyth receiver consisted of two opposing conducting cylinders in which the space between the two was filled with an electrolyte or “electrically-decomposable” liquid containing metal particles—a paste which De Forest often referred to as “goo.” (De Forest Patent No. 716,000)

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Press and *New York Herald* to report the races, so Stires introduced De Forest to representatives of the Publishers' Press Association, with whom De Forest was able to arrange a competing contract for reporting the races. Stires also introduced De Forest to Charles Seidler, a former mayor of Jersey City and willing investor, who advanced \$1,000 to De Forest, thereby allowing him to construct a copy of the Freeman transmitter. Seidler would later be elected the first president of the Wireless Telegraph Company of America at its first shareholder meeting on Dec. 14, 1902.¹⁴

The Wireless Telegraph Company of America is Incorporated

While De Forest was busy fabricating the needed apparatus, Max Styles, a practicing attorney in New York City, was busy incorporating the Wireless Telegraphy Company of America in New Jersey on behalf of the five incorporators and subscribers (shareholders) listed on the Certificate of Incorporation (Table 2). According to the minutes of the company, the Certificate of Incorporation was recorded

on September 23, 1901, just five days before the yacht races were to begin on September 28. Only 60 shares were authorized at a par value of \$50 per share, resulting in a total capitalization of a mere \$3,000. De Forest, Freeman and Smythe paid for their shares by assigning three of the four patents mentioned previously to the Wireless Telegraphy company. According to the *Minute Book of the Wireless Telegraph Co. of America* held by History San Jose,¹⁵ the fourth patent mentioned previously, No. 716,203 was not included in the assignment. Seidler had already advanced \$1,000 prior to the formation of the company, which De Forest used to fabricate the Freeman transmitter, leaving a capital contribution at the time of incorporation of only \$150—and that is assuming that Stires paid for his stock with cash. Clearly the company had no financial resources at the time of the races.

While Lee De Forest was able to assemble a working system by the time the yacht races began, it is known only too well that the coverage of the yacht races by both Marconi and De Forest was a complete fiasco, not only because the two systems interfered with each other, but also because employees of the American Wireless Telephone & Telegraph Co. (formed in 1899), who were also attempting to report the races but without a sponsor, took great delight in interfering with the two companies with contracts.¹⁶ De Forest's hopes for fame and fortune were instantly dashed, leaving him and the Wireless Telegraph company with no resources and no

Table 2. Incorporators and Subscribers of the Wireless Telegraph Company of America.

Subscriber	No. Shares	Par Value
Lee De Forest	16	\$800
Clarence E. Freeman	16	\$800
Edwin H. Smythe	16	\$800
Charles Seidler	9	\$450
Manning F. Stires, Jr.	3	\$150
Total	60	\$3000.00

immediate prospects for improving its financial situation. Charles Seidler, who had advanced De Forest \$1000 before the race, refused to provide any additional financial support.

Lee De Forest Seeks Financing

In the months immediately following the races, De Forest claimed he visited no less than 25 offices of investment bankers to solicit financing for the fledgling company, but with no tangible results. De Forest wrote in his autobiography that his "financial affairs were in desperate straights." Indeed, the entire enterprise was in such dire straights that De Forest also wrote he had contemplated asking Marconi for a job. Between his visits to Wall Street asking for financial support, he worked in White's machine shop in New Jersey to develop a new transmitter to replace the Freeman transmitter, which De Forest felt was worthless. Sometime in late 1901, De Forest met John Firth, who was working in the same machine shop, and the two struck up a conversation. The upshot was that Firth introduced him to E. R. Holden & Co., a group of questionable financial agents that raised capital for various types of enterprises, particularly those that were not financially sound.

While the E. R. Holden Company initially made a proposal to obtain financing for De Forest's new company, even the Holden company, which was accused of various stock swindles over time,¹⁷ had its limits. The E. R. Holden Company soon withdrew the offer and referred De Forest to Henry B. Snyder,

the owner of H. B. Snyder & Company, a group of bankers and brokers specializing in speculative stocks that were sold "on the curb." Snyder made an offer involving upfront payments of \$5,000 at a rate of \$1,000 per month that De Forest could not refuse.¹⁸ De Forest desperately needed the cash for his salary and for developing the new transmitter, and wanted to engage Snyder's company to access the minimal upfront cash, notwithstanding the huge stock commission that the offer entailed. Snyder proposed to create a company with a capital stock at a par value of \$1,00,000 to be distributed as follows: 35% to the original owners of the Wireless Telegraph company, 30% to the treasury of the new company for sale to the public, and a whopping 35% to H. B. Snyder & Company as a commission.

Seidler, Smythe and Freeman objected to the terms of the financing, which they felt were highly unfavorable to the proposed new company. According to a letter by Seidler, he voted against the contract but advised Smythe that the proposed contract could be voided if Snyder could not make good on the offer, which included the upfront cash payments amounting to \$5,000 and the sale of 35% of the stock for the benefit of the company. Further, the directors would have to vote on the transfer assets of the existing Wireless Telegraph company to the new company that Snyder was committed to form. Despite these safeguards, Seidler was sufficiently upset with both De Forest and the Snyder proposal that

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he resigned as president of the Wireless Telegraph company circa Dec. 18, 1901,¹⁹ at which time De Forest became interim president.

Shortly after De Forest became president, De Forest signed the contract with Snyder, although there is no record in the *Minute Book* of the Wireless Telegraph company that such a contract was ever signed or ratified. That the contract was in fact signed is apparent from this entry dated Dec. 22, 1901 in De Forest's diary:

"Now, at last, a contract is signed—by me, as President of the Wireless Telegraph Co. of America. Seidler resigned the post to sell 10% (of his stock) to Bourbon for the magnificent \$1,000 he has sunk in it²⁰—and because he was not satisfied with the terms of the Snyder agreement, he would, forsooth, 'when convenient look further into Snyder's references.' . . . Enough of the 'fatherly interest'—and blocking my steps." He goes on to write, "Never was one so handicapped, bound up & tied down with such complications of 'friends, partners, collaborators, patrons, sponsor, etc. as I have been from the start."²¹

Apparently, Snyder, who had no substantive financial resources of his own, could not meet the terms of the contract, because sometime before January 6, 1902, he would introduce De Forest to Abraham White, president of the Greater New York Secu-

rity Co. located at 90 Wall Street. (Indeed, White's office was located less than a block from Snyder's office on Wall Street, and the two were well acquainted with each other as Freemasons of the same order in New York City.) Abraham White would form a new company for De Forest in February 1902—the De Forest Wireless Telegraph Company. The previously unchronicled story of how the new company was formed is addressed in the next section, along with the exploits of the new company after it was formed. Suffice it to say that White acquired the assets with an imaginative lease arrangement—as opposed to traditional methods of acquiring a company and/or its assets. Two traditional methods were mergers involving an exchange and/or a purchase of stock, and an asset purchase agreement, which was often used to avoid assuming liabilities of acquired companies. A lease arrangement is unique in that it leaves the two companies intact as separate entities after the lease is signed.

The Wireless Telegraph Co. of America Ceases Operations

Even after the lease was signed on May 5, 1902, the Wireless Telegraph Co. of America continued to exist, at least on paper. According to the *Minute Book*, a new slate of directors consisting of Smythe, Freeman and Stires was elected at the annual shareholders' meeting held on May 5, 1902 to serve for the following 12 months.²² The last shareholder meeting was held on July 2, 1903, although the meeting was

adjourned because a quorum was not present. There are no more entries in the company's *Minute Book* following the entry for the July 2, 1903 meeting; thus it appears that the company was essentially abandoned at that time. It is likely that the company's charter lapsed several years later for failure to file the required annual documents with the state of New Jersey and/or for nonpayment of taxes—a very efficient way to dissolve a defunct company.

In its short lifetime, the Wireless Telegraph Company of America failed to produce any tangible results. The only public demonstration of its technology at the yacht races held in 1901 was a complete disaster. Worse yet, the Navy concluded that the difficulties with interference at the yacht races could never be overcome with the apparatus used by the Wireless Telegraph company in the yacht races. The Freeman transmitter turned out to be worthless and the De Forest-Smythe goo responder would soon turn out to be unsuitable for practical wireless telegraphy because of its tendency to clog and its lack of sensitivity—despite public claims by De Forest to the contrary. With no operating capital, no prospects for raising capital as a result of the interference at the yacht races, and patents covering technologies of marginal value, the directors of the company had no alternative but to agree to the asset purchase contract offered by White. They abandoned the Wireless Telegraph Company of America altogether, a story that is detailed in the next section.

II. The De Forest Wireless Telegraph Company (1902–1904)

This account of the De Forest Wireless Telegraph Co. begins on January 3, 1902, the date when noted author Samuel Lubell claims that Lee De Forest first met Abraham White at lunch.²³ Lubell describes how White impressed De Forest with a lavish meal and the gift of a \$100 gold certificate (i.e., a \$100 bill), undoubtedly accompanied by a glowing description of how he could make De Forest's wildest dreams come true by creating and financing a new wireless telegraph company. Whether or not the date or description of their first meeting provided by Lubell is entirely accurate, an entry in Lee De Forest's diary dated Jan 13, 1902 makes it clear that he had met with White prior to that date: "The prospects of getting money from Snyder & White about as fast as we will need it are encouraging." As an aside, the reference here to both White and Snyder in the same sentence provides further evidence that Snyder introduced De Forest to White.

White and De Forest soon agreed to form a new company, and they also agreed that the name of the new company would be the De Forest Wireless Telegraph Company. Both the name of the new company and the position of Scientific Director that White offered De Forest were memorialized on a business card De Forest pasted into his personal diary on a page dated February 9, 1902. The business card, which is reproduced as Fig. 5, was accompanied by the following entry: "As this card, long coveted, discloses, I have at last

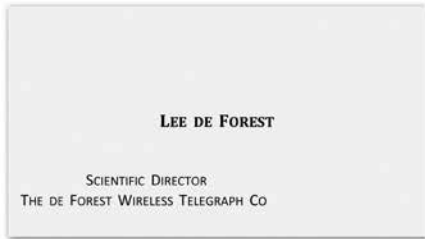


Fig. 5. This business card found pasted on a page dated Feb. 9, 1902 in De Forest's diary was most likely given to De Forest by Abraham White as an inducement to proceed with the creation of the De Forest Wireless Telegraph Co. (Lee De Forest Papers, Manuscript Division, Library of Congress)

found my place—at least nominally. It has been a long, long time of groping in the dark, seeing few lights, small glow in the East—and feeling perhaps but one hand held out for sympathy & encouragement.”²⁴ Assuming the card was printed on or before February 9, 1902, the date in De Forest's diary entry, this card was printed before the new company was incorporated, and was most likely presented to De Forest by White as some sort of inducement for De Forest to proceed with their plan to create a new company. How that plan was executed is presented next.

De Forest Wireless Telegraph Company is Incorporated

Abraham White engaged Millard W. Baldwin and a host of other bankers and brokers to create and incorporate the De Forest Wireless Telegraph Co. with a capitalization value of \$3,000,000 in the State of Maine—three times as much as Snyder had proposed.²⁵ White decided to register the new enterprise in

the state of Maine, most likely because the tax laws made it more attractive to register the stock there. The incorporation costs and franchise tax rates in Maine were the lowest in the nation. For example, the annual franchise tax for a company capitalized at \$3,000,000 was \$150 in Maine versus \$3,000 in New Jersey and \$1,500 in Delaware.²⁶ The incorporation papers were prepared and signed on February 7, 1902, just one month after the two first met. The papers were subsequently filed with the Attorney General's Office of Maine on February 17, 1902 and recorded by the Secretary of State of Maine on February 19, 1902 (Fig. 6).²⁷

The names of the incorporators and the initial subscription of stock among the incorporators are shown in Table 3. It was not unusual to list the incorporators of a public company as the only subscribers (i.e., shareholders) at the time of filing, and to name the directors who would be responsible for operating the company at a later date. While the company was initially capitalized at \$3 million dollars with each share having a par value of \$1, only 1,000 shares were subscribed at the time of filing. The remaining shares were presumably available for sale to the public to fund the growth of the company. At a meeting of the incorporators the next month, the capital structure of the company was altered slightly by a reverse split in which the number of shares was reduced by a factor of 10 to 300,000 shares, and the share price was increased from \$1 to \$10.00 per share, thereby leaving the

total market capitalization remained unchanged.

It will become clear from the *Minute Book* and subsequent events that Abraham White filed the incorporation papers for the De Forest Wireless

COPY.

(Name of Corporation).

De Forest Wireless
Telegraph Company

New York ss.
Registry of Deeds.

Received *February 19* 1902.
at 4 h. 55 m. P. M.

Recorded in Vol. 7 Page 552

ATTEST:

Justin M. Bearitt Register.
By *Grace M. Ridley*, clerk
A true copy of record.

ATTEST:

Justin M. Bearitt Register.
By *Grace M. Ridley*, clerk

STATE OF MAINE.

Office of Secretary of State,
AUGUSTA, *Feb 19* 1902.

Received and filed this day.

ATTEST: *J. Chadborne*
Deputy Secretary of State.

Recorded in Vol. 37 Page 387

Fig. 6. The De Forest Wireless Telegraph Co. was incorporated on Feb. 19, 1902, almost three months before the directors of the Wireless Telegraph Company of America voted on May 5, 1902 to lease its assets to the De Forest Wireless Telegraph Company created three months before. (Office of the Secretary of State, Maine)

Table 3. Incorporators and Subscribers of the De Forest Wireless Telegraph Co. at the Time of Filing.

Initial Subscribers	No. Shares	Par Value
Millard W. Baldwin	992	\$992
Ernest L. Chaney	1	\$1
Herman R. Paul	1	\$1
Edward P. McLaughlin	1	\$1
J. Lewis Shortridge	1	\$1
Hartley Sagar	1	\$1
Frank Sutton	1	\$1
Louis H. Trask	1	\$1
Millard Damren	1	\$1
Unsubscribed	2,999,000	\$2,999,000
Totals	3,000,000	\$3,000,000

Telegraph Company with the State of Maine on February 17, 1902, without the consent or vote of the directors of the Wireless Telegraph Company of America. How the directors of the Wireless Telegraph company learned of the incorporation of the De Forest Wireless company and how White eventually persuaded the directors to approve the transfer the assets of the Wireless Telegraph Company of America to the new De Forest Wireless Telegraph Company are addressed next.

Directors of the Old Company React to Incorporation of the New Company

It is clear from De Forest's diary that Smythe and Freeman were unaware of the incorporation of the De Forest Wireless Telegraph Company until just before it occurred. The account in his diary begins with an entry dated February 18, 1902, one day before the incorporation papers were filed for the new company. De Forest received a telegram from Smythe that day—a very bad day for De Forest even before he received

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the telegram. He had been working on a new transmitter to replace Freeman's hapless transmitter, and his experiments on the new transmitter were not going well. Beginning with a reference to the intermittent performance of his new transmitter, De Forest wrote in his diary somewhat facetiously:

"But not a dot or dash could I receive! To add to my joy and peace of mind comes a telegram from Smythe demanding the name of the new company!"²⁸

It is clear that Smythe and Freeman were unaware of the name of the new company, which means they had not seen the incorporation papers nor had they assigned the assets of the old company to the new company. Second, there is no record in the *Minute Book* of the company about any vote or discussion by the directors about the incorporation of a new company or transfer of assets prior to the recording of the new company. De Forest was clearly angry and agitated by the telegram, and continued by writing:

"At last! I replied, it is also deemed wise and eminently fitting that my name be used in this connection. A hyphenated title with the 'Wireless Telegraph Company' would be unwieldy and cumbersome, and in as much as I have been from the first, & by long odds, the main factor in this enterprise, it is just that my name should be used."²⁹

The words "At last" appearing at the beginning of the citation in his diary is clearly an indication of his long-standing frustration with Smythe and Freeman, and that he was ready to make his frustrations known to them. Indeed, he made his frustrations known to Smythe in a six-page letter dated February 18, 1902—the very same day. He began by stating his position on the company name: "It is also deemed wise, and eminently fitting that my name be used in this connection." He then goes on to assert that nothing would have come of "the scheme" if it were not for him, that he had "sacrificed position, chance of promotion, with years of grubbing thereto . . ." and that he had done "nineteenths of the work in the laboratory and practically all of it in interesting capital and launching the business." He then rails against the injustices he has suffered under the yoke of Smythe and Freeman. He closes the letter by stating that: "It is important also, from every consideration, that we assign those patents to the new company."

According to the next entry in De Forest's diary dated March 21, 1902, there was a turbulent period following the incorporation in which Smythe and Freeman traveled to New York City to have very frank discussions with De Forest and White about the name and organization of the new company. Freeman and Smythe wanted to have their names added to the name of the new company, or in the alternative, to have De Forest's name deleted. Smythe and Freeman were also insistent on becoming directors and employees of the new

company. However, De Forest would not agree to any of their demands. White put pressure on De Forest to acquiesce to their demands, but De Forest would not hear of it. According to his diary, he threatened to resign if White were to include their names in the company name or allowed them to remain as directors or employees.

Smythe and Freeman initially refused to assign their patents to the new company, believing that the assets of the Wireless Telegraph Company of America could not be transferred to the new company without a vote of the directors. Smythe and Freeman by themselves had 32 of the 60 votes needed to pass such a resolution. De Forest made it abundantly clear that he would not tolerate the presence of Smythe and Freeman in the new company as employees or directors, or allow their names to appear in the name of the company, lest he resign. To avoid the need for director approval, White prepared an imaginative lease agreement that would allow De Forest as President to sign an agreement on behalf of the Wireless Telegraph company to *lease* its assets to the De Forest Wireless company for a period of 99 years. The following language appears in the 2nd paragraph of this agreement, the first page of which appears in Fig. 7:

“WHEREAS, the second party [Wireless Telegraph Co. of America] has leased unto the first party [De Forest Wireless Telegraph Co.] for a period of ninety-nine (99) years, that is to say until the

28th day of February,³⁰ in the year Two Thousand and One (2001), all its rights title and interest in and to certain patents, patent rights, and assets, to wit . . . [three patents listed plus a Mechanical Syntony Device]; also similar inventions for the purpose of Wireless Telegraphy which may be hereinafter acquired by second party, foreign rights to the same, and all assets of second party consisting of machinery and instruments; . . .”³¹

This was a bodacious clause because it allowed for the Wireless Telegraph Company of America to continue in business and continue to develop and patent new wireless technology that the De Forest Wireless Telegraph Company would have the right to use for the next 99 years. Best of all, there was nothing in the bylaws of the company preventing the president to sign such a lease.

However, by the time of the next shareholder meeting of the Wireless Telegraph Co. of America held on March 28, 1902, both Smythe and Freeman must have become aware of this draft agreement and realized that the bylaws did not preclude De Forest, who had previously been appointed President, from signing the licensing agreement without approval of the majority of directors or shareholders. As a result, Smythe and Freeman requested that another shareholder meeting be held on March 31, 1902 to consider several amendments to the by-laws of the company, the most important one being an amendment that would preclude

ARTICLES OF AGREEMENT entered into this _____ day of June, Nineteen Hundred and Two (1902), between the DeForest Wireless Telegraph Co., a corporation of the State of Maine, hereinafter called first part; the Wireless Telegraph Company of America, a corporation of the State of New Jersey, hereinafter called second party, and the Greater New York Security Company, a corporation of the State of New York, hereinafter called third party; WITNESSETH:

WHEREAS, the second party has leased unto the first party for a period of ninety-nine (99) years, that is to say until the 28th day of February, in the year Two Thousand and One (2001), all its right, title and interest in and to certain patents, patent rights, and assets, to-wit, U.S. Patent Application #50,078; U.S. Patent Application #67,136; U.S. Patent Application # 43,096; a Mechanical Syntony Device; also similar inventions for the purposes of Wireless Telegraphy which may be hereinafter required by second party, foreign rights to the same, and all assets of second party, foreign rights to the same, and all assets of second party consisting of machinery and instruments; which lease is dated the 28th day of February, 1902; and,

WHEREAS, the total authorized capital stock of the first party, amounting to \$3,000,000.00 divided into 300,000 shares of the par value of \$10.00 each, has been issued or is about to be issued in the name of and for the second party in payment for aforesaid patents, patent rights, and assets; and,

WHEREAS, of the said 300,000 shares of the capital stock of the first party, the second party has agreed to return into the treasury of the first party 90,000 shares, to be held as treasury stock, and to be disposed

Fig. 7. This page is the first of a seven-page lease agreement in which the De Forest Wireless Telegraph Company leased the assets of the Wireless Telegraph Company of America for 99 years.

any encumbrance or transfer of patent rights without a vote of the majority of shareholders. The wording of the amendment appearing in the *Minute Book* of the company is as follows:

“The board of directors in this corporation shall not have the authority to bargain, sell, assign, mortgage, lease, convey, transfer, or otherwise dispose of any letters patents, patent rights or invention, or any interest therein or right thereunder belonging to this company without the assent in writing of the majority of stockholders of the corporation.”³²

This amendment was easily adopted because Smythe and Freeman had a majority of the votes. White was left with the task of negotiating a severance agreement with Smythe and Freeman whereby they received an undisclosed amount of cash and/or stock in the new company in return for an agreement to vote for ratification of the lease agreement, which was required by the recently-modified bylaws. White also agreed to buy the stock of Smythe, Freeman and Seidler in the Wireless Telegraph Co. of America, although none of the three was offered any position in the new company. The lease agreement was put to a vote by the directors of the company at a special meeting held on May 5, 1902, at which time the agreement was unanimously affirmed and ratified by all directors. The contract was signed by Lee De Forest as president of the Wireless Telegraph Co. of

America and Abraham White as the president of both the De Forest Wireless Telegraph Company and the Greater New York Securities Company, the latter company also being a party to the agreement.

The nine directors listed in Table 4 were elected at a shareholder meeting held on May 20, 1902. Abraham White was named president, Manning Stires was named Secretary, and James Stewart was named Treasurer. It is notable that Smyth, Freeman and Seidler, who had an adversarial relationship with De Forest in the old Wireless Telegraph Company of America, were no longer directors. The three that had helped De Forest secure funding for the new company were named directors in the new company—namely Stires, Firth, and Snyder, who are shown in bold font in the table. White appointed four of his friends and associates as directors (Galbraith, Stewart, Avery, and Dexter) to make sure he had a voting majority. None of the nine incorporators originally listed as directors on the Certificate of Organization remained as a director.

There is no record of how much stock each director listed in the table was initially granted, but the distribution of much of the remaining stock was

Table 4. Directors of De Forest Wireless Telegraph Co. as of May 20, 1902.

Names of Directors	
Abraham White, President	
Charles C. Galbraith	James Stewart
Lee De Forest	George W. Avery
Manning F. Stires	Henry B. Snyder
John Firth	Henry B. Dexter

specified in the lease. The language of the agreement is an amazing exercise in obfuscation. One thing is clear, namely that one third of the stock (100,000 shares) was to be sold to the Greater New York Securities Co., which had an option to purchase 75,000 shares with a par value of \$10 per share for 8⅓¢ on the par dollar.³³ It is not likely that much of the proceeds of this stock found its way into the company treasury.

That the transfer of assets from the Wireless Telegraph company to the De Forest Wireless company was, in fact, accomplished by means of a 99-year lease can be confirmed by a later lawsuit over the subsequent transfer of this lease from De Forest Wireless to American De Forest, which purportedly occurred on January 1, 1904. Henry Snyder brought a suit in an attempt to block the transfer of this 99-year lease to the American De Forest company that would have diluted his stock.³⁴

De Forest Wireless Telegraph Company Objectives

White and De Forest got along very well because their technology goals were the same despite the vast difference in their strategic goals. De Forest's strategic goal was to achieve fame and fortune by developing superior wireless technology exceeding that of Marconi in particular and other competitors in general. White's strategic goal was to amass a fortune by selling as much stock as possible in the fledgling field of wireless telegraphy, and retaining as much of the proceeds as reasonably possible. Neither one displayed any

genuine interest in building an extensive wireless communication system. The technology goals of both were aligned: 1) improving transmitter and receiver technology resulting in better performance (longer ranges, higher word rates and improved reliability) to provide better demonstrations for prospective investors; 2) building station pairs to test and evaluate receiver and transmitter technologies and to demonstrate communication capabilities to potential investors and customers (military, government and commercial), and 3) selling wireless communication components, systems and services to major customers in order to gain a competitive edge over Marconi and to elicit testimonials from customers for purposes of selling stock.

The fledgling De Forest Wireless company made progress in all three technological categories during the last half of 1902. The major accomplishments of Lee De Forest and De Forest Wireless during this period were as follows: 1) Lee De Forest improved the De Forest System by completing the development of his new transmitter that replaced the hapless Freeman transmitter used in the yacht races in 1901, 2) De Forest reported developing an improved goo responder in August 1902, and filed a patent for a new "needle responder" with a filing date of December 24, 1902, 3) the company erected three wireless stations for purposes of testing its equipment and demonstrating its capabilities to potential investors, and 4) the company received two government contracts,

the first from the U.S. Signal Corps to support Army/Navy Maneuvers taking place circa August 1902, and a second from the Navy to demonstrate the capability to communicate between Navy stations at Annapolis and the Navy Yard in Washington circa December 1902. Progress in these four areas is summarized below.

De Forest Improves the De Forest System Transmitter

Lee De Forest actually began to develop the new transmitter in late 1901 immediately following the disastrous yacht races. The new transmitter consisted of a motor-generator set delivering 500

volts at 60 Hz, which was interrupted by a Morse key and then stepped up to 25,000 volts by a special transformer, the output of which was applied to a double spark gap shunted by 6 or 8 quart Leyden jars in parallel (Fig. 8).³⁵ The transmitter could also be operated from an AC power main when available. De Forest began by developing a 1 kW transmitter, which was later followed by 2 kW, 5 kW, 25 kW and 40 kW versions. (It should be noted that it was the custom at the time to characterize the power of a transmitter by the rating of the power source rather than the radiated power.) A simplified diagram of the transmitter is shown in Fig. 9.³⁶

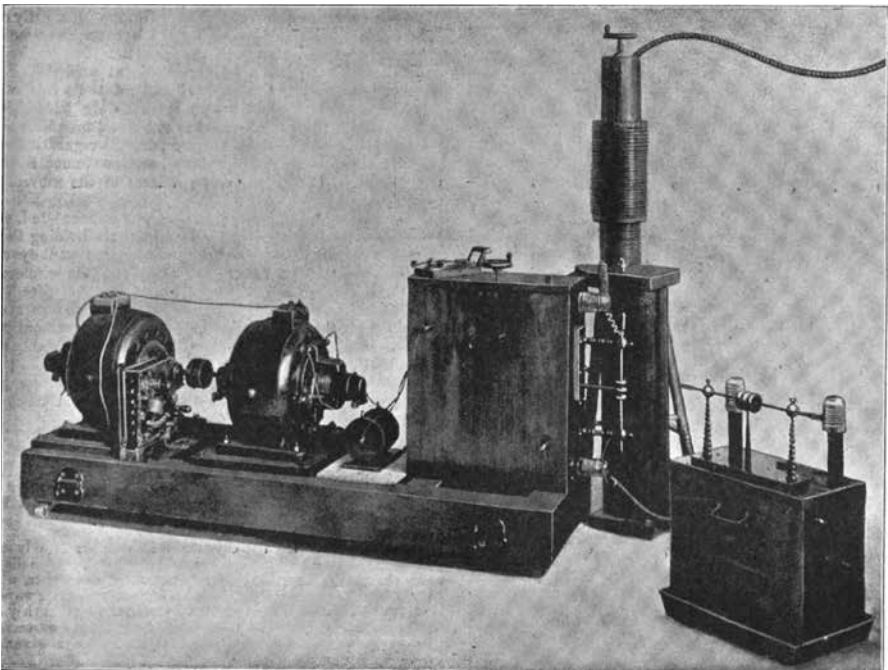


Fig. 8. This De Forest transmitter first appearing circa June 1902 consisted of a motor-generator set delivering 500 volts at 60 Hz, which was interrupted by a Morse key and then stepped up to 25,000 volts by a special transformer, the output of which was applied to a double spark gap shunted by 6 or 8 quart Leyden jars in parallel. (*Electrician*, Oct. 3, 1902, p. 943)

The Rise and Fall of the De Forest Companies

The Army was indeed impressed with new transmitter De Forest had developed, a fact that is evident from the following quote taken from the *Annual Report of the Chief Signal Officer* published in 1902: "The De Forest system gave very good results, and it is believed this system of transmission, utilizing an alternating current with a step-up transformer in oil insulation, is *theoretically* the best as well as the one giving the most promising practical results."³⁷ Beginning in 1903, both De Forest company ads crafted by White began to misquote this statement by omitting the words appearing in italics, thereby making it sound like the De Forest "system" was "the best"—as opposed to the "system of transmission" being "theoretically the best."³⁸ The De Forest companies also ascribed the quotation directly to Brig. Gen.

A. W. Greely, Chief Signal Officer of the Army, as if he stated it, when in fact the statement was written by his staff in the *Annual Report of the Chief Signal Officer for the Fiscal Year Ending June 30, 1902*. When asked about this testimonial, Gen. Greely wrote a tongue-in-cheek response to the query, which appeared in the March 17, 1903 issue of the *Washington Post* (Fig. 10). In this letter, he

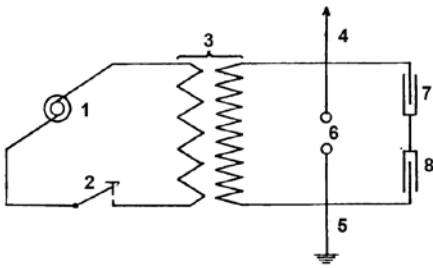


Fig. 9. The following components appear in this simplified schematic diagram of De Forest's new transmitter: an alternating current generator (1), a telegraph key (2), a high-voltage oil transformer (3), a spark gap (6) with one side connected to a radiating antenna (4) and the other side connected to ground (5), and a bank of Leyden jar capacitors (7 & 8) placed across the spark gap. (R. G. Blaine, *Engineering Magazine*, Aug. 5, 1904, p. 201)

HELPLESS TO REMEDY EVIL

Gen. Greely Indignant at Use of His Name by Wireless Company.

"That is what I call an outrage," remarked Gen. Greely of the Signal Corps, the other day. "Here is a letter from a man asking me what I know about a certain system of wireless telegraphy, and he encloses a circular of the company, in which it is stated that I endorse this system. As a matter of fact I never endorsed any system of wireless telegraphy. I would be glad to do so, and put it in operation for the government as soon as a satisfactory kind is presented to me. I don't even know much about this particular system which I am said to have endorsed. Now, what is a man to do in a case of that kind? That circular has been sent everywhere, and there is no way for me to reach the men who might be deceived by it. Probably some men are wondering how much stock I have in the concern. All this is what makes it annoying."

Fig. 10. This article placed in the *Washington Post* by General Greely, U. S. Signal Corps, was provoked by distortions in ads placed by Abraham White in early 1903, which ended with the quip: "Probably some men are wondering how much stock I have in the concern." (*Washington Post*, March 17, 1903, p. E7)

denied any personal knowledge of the system and the endorsement, closing his letter with this classic quip: “Probably some men are wondering how much stock I have in the concern.”³⁹

De Forest Improves the Goo Responder

De Forest, who was well aware from the outset that his original goo responder was unreliable and not very sensitive, set out to improve his responder in early 1902. An article appearing in the August 16, 1902 issue of *Scientific American* chronicled his wireless system with an emphasis on the receiver with an improved responder he had supposedly just developed.⁴⁰ The article stated: “During the past year De Forest has greatly increased the sensitiveness of the responder, while maintaining its simplicity.” The article goes on to say, “the receiver will respond with absolute certainty and regularity to a spark of one sixty-fourth of an inch length from a spark coil forty feet distant driven by one cell of a storage battery . . .”

Ominously, De Forest never quantified how the sensitivity of the old responder compared with the improved responder. A photograph of the receiver with his improved goo responder appeared in the article (Fig. 11), but there was no image of the detector itself. Consequently, there is no way to know how, or even if, the responder was actually improved.



Fig. 11. This version of De Forest’s receiver with an improved “goo” responder appearing in August 1902 was said to have “greatly improved sensitiveness of the responder,” which “will respond with absolute certainty and regularity . . .” (*Scientific American*, Aug. 16, 1902, p. 103)

De Forest Wireless Telegraph Co. Erects its First Three Commercial Stations (1902)

The De Forest company erected three stations in 1902 that were known to be operational by the end of 1902—all located in and around New York City. The three stations were located at: the Cheesebrough Building at 17 State Street in NYC, the Hotel Castleton in Staten Island, and Steeplechase Park at Coney Island. An article in the July 19, 1902 *Western Electrician* described the Coney Island station, which was opened on June 14, 1902, as the premier station: “The most important land

The Rise and Fall of the De Forest Companies

station yet established by the De Forest company is that at Steeplechase Park, Coney Island (Fig. 12). This enjoys the distinction of having the tallest mast in America, a fine stick of four pieces [of wood], standing 210 feet high.”⁴¹

The three stations were used primarily for test and evaluation of new designs and for demonstrations staged for potential customers. The locations were chosen because they were in close proximity to each other, to company

offices, and to company laboratories. They were also conveniently located for demonstrations to potential customers. There were allusions in the press to the erection of other commercial stations during the last half of 1902, but a check of the literature clearly indicates that only the three stations mentioned above were actually operational by the end of 1902. It is notable that the maximum distance between any of these stations was approximately six miles.

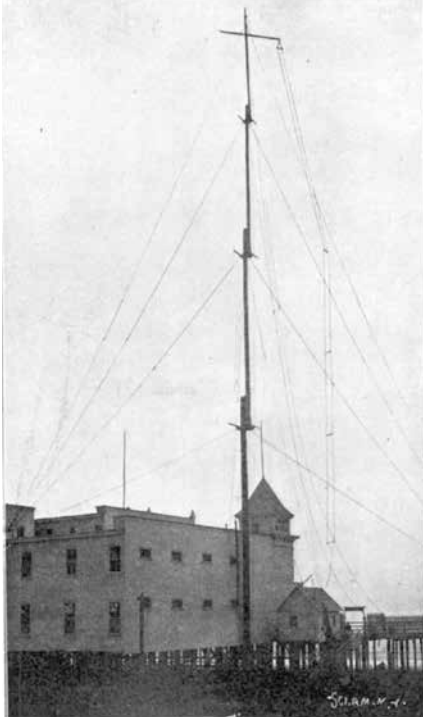


Fig. 12. The De Forest Company considered its wireless station at Steeplechase Park, Coney Island to be the most important land station when it was opened on June 14, 1902, if for no other reason, because it enjoyed the distinction of having the tallest mast in America described as “a fine stick of four pieces of wood” standing 210 feet high.

De Forest Wireless Co. is Awarded Its First Two Contracts from the Government

The De Forest Wireless Telegraph Co. was awarded two government contracts in 1902, the first from the U.S. Signal Corps and the second from the U.S. Navy.⁴² The first contract from the Signal Corps was awarded in August 1902 to supply two systems for test and evaluation during the course of the Joint War Maneuvers with the Navy.⁴³ The original contract called for one system to be installed at Fort Wadsworth, New Jersey, and the other at Fort Hancock, New Jersey, located 10 miles away. According to a later article, the contract was modified such that the set planned for Fort Wadsworth was actually installed in the scout-boat “Unique” (Fig. 13).⁴⁴ Wireless systems from two additional manufacturers were also tested during the maneuvers, namely those from Marconi and Fessenden. According to an article appearing in the *Western Electrician*, the Signal Corps was impressed with the De Forest System.⁴⁵

According to De Forest press releases, the Navy was sufficiently im-

pressed with the operation of the De Forest System during the Joint War Maneuvers in August that they purchased two systems for tests and evaluation in late 1902 and early 1903, installing one at the Annapolis Academy, Maryland, and the other at the Washington Navy Yard in Washington, D.C., 36 miles distant from the station at Annapolis.⁴⁶ While the De Forest press release may have been true, in reality the Navy purchased wireless systems from five different companies for test and evaluation and to compare capabilities. Wireless systems were also purchased from Messrs. Ducretet and Rochefort of Paris, Braun-Siemens-Halske and Slaby-Arco of Berlin, and Lodge-Muirhead of London. Initial tests were also carried out with the Marconi system, but that company refused to sell its system outright to the Navy for additional testing, so the Marconi system was dropped from further consideration.

The Navy made no statements about the results of these tests pending completion of the ship-to-ship and ship-to-shore transmissions planned for 1903. Nevertheless, the De Forest Wireless company took a very aggressive stance by sending a press release to the newspapers the day after the tests between the two land stations had been completed on January 14, 1903, which stated in part: "Washington, January 14, 1903—The Navy Department has practically accepted the De Forest wireless telegraph system, after final tests between the Navy Yard here and the Naval Academy at Annapolis to-day."⁴⁷ This statement was used in

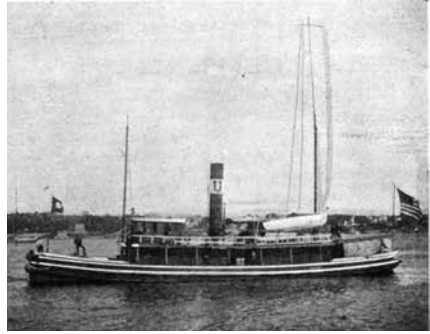


Fig. 13. The De Forest Wireless company provided two stations to the Army for joint Army Navy maneuvers in the fall of 1902, one of which was situated on the scout boat *Unique*.

many display ads appearing in 1903 to bolster sales of De Forest company stock. However, according to the Navy Report for 1903, the De Forest System was not chosen by the Navy: "The report of the [Navy] board was received by the Bureau September 23, 1903; it finds that, under the varying conditions of the tests above outlined, the Slaby-Arco apparatus is superior to the other systems. On March 27, 1903 after consultation with the president of the wireless board, the Bureau ordered 20 sets of wireless telegraph apparatus of the Slaby-Arco pattern, the Department being desirous of testing this system of transmitting signals during the summer maneuvers."⁴⁸

De Forest Replaces the Goo Responder with the Steel Needle Responder (1902–03)

Despite reports in the press about how well the goo responder worked, De Forest employees would later testify in the NESCO vs. De Forest litigation that

none of the goo responders worked well, and that they often clogged during demonstrations to potential customers. De Forest, clearly aware that the original responder did not work well, had already been thinking about developing an entirely different oscillation detector as early as May of 1902. A sketch from his notebook dated May 19, 1902 reveals a detector formed by a carbon pencil lying across two steel wires (Fig. 14). Apparently he thought this configuration was a coherer requiring restoration to sensitivity with a mechanical shock because there is a solenoid in this figure that is intended to jar the contacts.⁴⁹

The configuration in De Forest's notebook is strikingly similar to the design used by David Hughes in his wireless experiments performed in 1879, which was first published in 1899 (Fig. 15).⁵⁰ The Hughes figure was accompanied with the following description: "A microphone which is both sensitive and self-restoring, that is to say, does not cohere, is made with a carbon contact resting lightly on bright *steel*. Such a receiver is shown in fig. 3, where C is a *carbon pencil* touching a *needle*, N, and S an adjustable spring of brass by which the pressure of the contact can be regulated by the disc, D." Note that De Forest annotated his drawing with "carbon pencil," the same unusual words that Hughes used to describe his detector (see italicized words in the above paragraph). Also note that De Forest would refer to his detector as a "needle" detector, the same word Hughes used above for his bright steel contact."

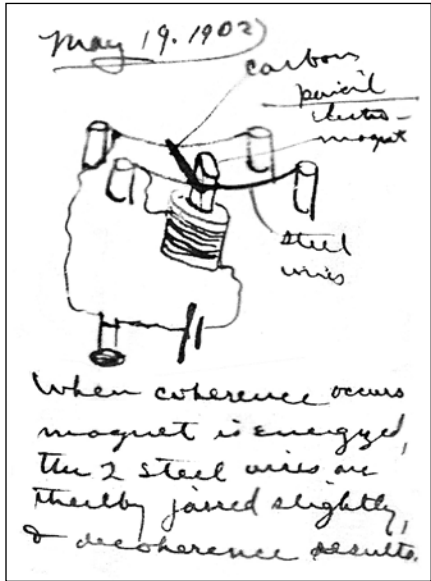


Fig. 14. A sketch from De Forest's notebook dated May 19, 1902 reveals he was contemplating a detector formed by a carbon pencil lying across two steel wires, with a solenoid intended to jar the contacts. (Perham de Forest Papers at History San Jose)

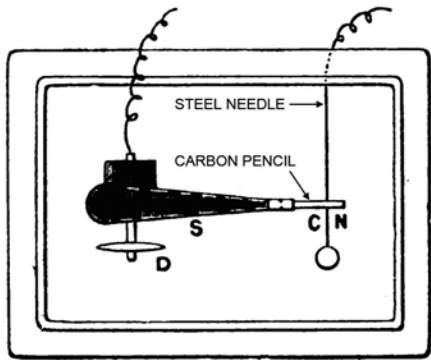


Fig. 3.

Fig. 15. This detector configuration used by David Hughes in his ether telegraphy experiments conducted in 1878, which was published in 1899, is strikingly similar to the configuration appearing in De Forest's notebook dated May 19, 1902. (*Electrical Review*, June 2, 1889, p. 884)

The main difference between the two sketches is that De Forest placed an electromagnet against the contacts to provide a mechanical shock to restore sensitivity, whereas Hughes states quite plainly that his microphonic contact is self-restoring. However, when De Forest went to the laboratory, he too found the contacts to be self-restoring. His discovery is plainly stated in the preamble to patent No. 770,228 he filed on or about Dec. 4, 1902 for a very similar configuration: "I have found that if two or more members consisting alternately of material which are unlike—such as, for instance, as steel and aluminum—be placed in series in the aerial circuit a strong autocoherer effect is produced."⁵¹ This patent shows a drawing of slightly different version consisting of two aluminum needles ("C") lying across two steel rods or pins ("D") held in place by spring ("F") with its tension adjusted by the knob ("G")—but without a solenoid (Fig. 16). While the drawing shows steel and aluminum contacts, the claims do not restrict the materials to these elements. In fact, documentation is cited next showing that De Forest actually made and used three different versions of this configuration—steel and aluminum, steel and copper, and steel and a carbon lamp filament.

All three versions of this self-restoring "needle" detector were used in the tests between Fort Schuyler and Fort Wright sponsored by the U.S. Signal Corps at the end of 1902 and the beginning of 1903. Captain Wildman, U.S. Signal Corps, testified in the NESCO vs. De Forest company litigation that

he was present during tests of the De Forest System between Fort Schuyler and Fort Wright on Long Island in the fall of 1903 where three different forms of the needle responder were used. He asserted that one version (designated responder No. 1) was an imperfect contact consisting of a steel needle held against two terminals by a spring, another version (designated responder No. 2) was an imperfect contact consisting of steel and copper, and a third version (designated responder No. 3) was an imperfect contact consisting of carbon filaments resting on steel edges.⁵²

De Forest's General Manager C. G. Tompkins, employed by the De Forest

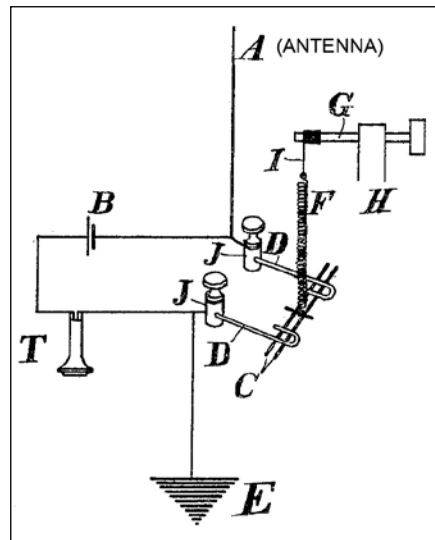


Fig. 16. This slightly modified drawing from De Forest's patent No. 770,228 filed circa Dec. 4, 1902 illustrates a version of his self-restoring needle detector consisting of two aluminum needles ("C") lying across two steel rods or pins ("D") held in place by spring ("F") with its tension adjusted by the knob ("G").

company from July 1902 to April 1903, testified in the NESCO vs. De Forest litigation that responder No. 3 had replaced the goo responders in all De Forest ship and land stations in the U.S. by December 1902, and that it remained in use until early 1904 when it was replaced by the liquid barretter electrolytic responder, which will be addressed later.

While there can be no doubt that the No. 3 needle responder replaced the goo responder in the entire De Forest System by December of 1902, there is conflicting testimony about whether the No. 3 responder consisted of aluminum rods or carbon filaments resting on steel needles. Captain Wildman testified that the No. 3 Responder consisted of carbon filaments resting on steel edges, but De Forest engineer J. P. Copland testified the No. 3 responder was the steel-aluminum version: "... defendants use the No. 3 Responder, the steel aluminum microphone of De Forest patent 770,228 . . ." ⁵³ In testimony taken in a different lawsuit in 1915, De Forest confirms that the needle responder was used in 1903 but he sheds no light on which version was No. 3.

"[Fig. 4] illustrates the receiving circuit used in 1903, in which for the first time . . . I substituted for the old form of electrolytic detector [goo responder] an auto-coherer shown at X, which was built in various forms, one of the most practical being an incandescent light filament of carbon resting lightly upon two steel edges, forming a microphonic

auto-cohering contact, which was automatically self-restoring. In shunt around this detector was connected a telephone receiver Y and the battery B." ⁵⁴

Note that De Forest uses the term "microphonic" when referring to the contact—the same term that Hughes introduced when describing the configuration he used, which was shown previously in Fig. 15. Unfortunately, the figure X cited by De Forest in the above testimony did not appear in the referenced document. Regardless of which version De Forest used in 1903, both versions actually form a relatively crude form of a crystal detector, not a self-restoring coherer as De Forest asserts. Thus, there can be no doubt that De Forest was one of the first to use a crystal detector in a wireless telegraph station—preceded only by Greenleaf W. Pickard, who documented the fact that he was using a carbon-steel form of a crystal detector on May 22, 1902 at the Cape May Station of the American Wireless Telephone & Telegraph Co. ⁵⁵

H. E. Athearn, engineer and De Forest company operator at the Coney Island station in 1903, testified that he observed both the land station and the steam-ship *Erin* outfitted with the steel and aluminum version of the needle responder in 1903. ⁵⁶ One of the better photographs appeared in *Electrical World and Engineer* on July 4, 1903 (Fig. 17), although the article is silent as to the type of responder. ⁵⁷

The only reference to the needle coherer found in the literature

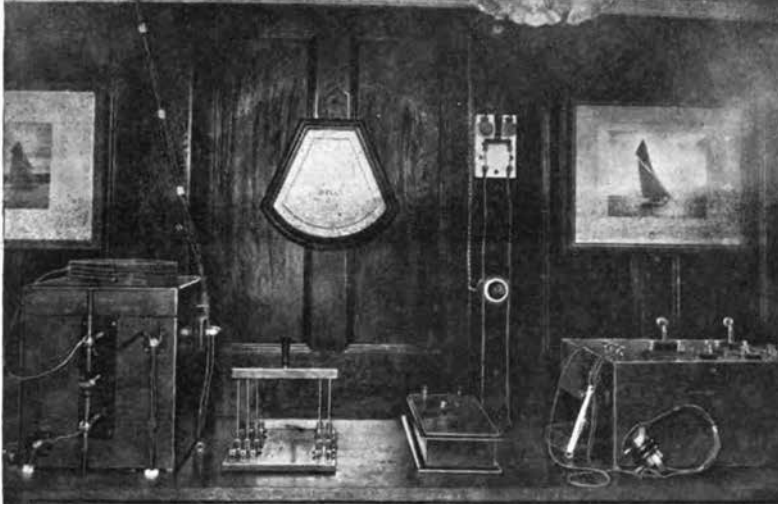


Fig. 17. One of the best photographs of the wireless equipment aboard the *Erin* was published in the *Electrical World and Engineer*; the needle responder appears at the far right. (July 4, 1903, p. 34)

appears in *Maver's Wireless Telegraphy* published in 1904.⁵⁸ Maver shows a sketch of the entire De Forest shipboard outfit using this needle coherer and states: "This figure (see Fig. 18) illustrates the arrangement of the De Forest apparatus in the cabin of the steam-yacht *Erin* [at the time of] the international races of 1903." The layout of the De Forest System in the sketch is virtually identical to the previous photograph, and can be used to identify many of the main components of the transmitter and receiver on the *Erin*. Maver also shows a drawing of the details of the receiver and responder itself, which is reproduced here as Fig. 19. It is notable that Maver informs the reader that he was given much of this information by Lee De Forest himself: "The author is under obligations to Dr. De Forest for his courtesy in supplying

many of the foregoing details of his system."⁵⁹

Actually, it is astonishing that De Forest never mentioned the needle coherer in his autobiography or other

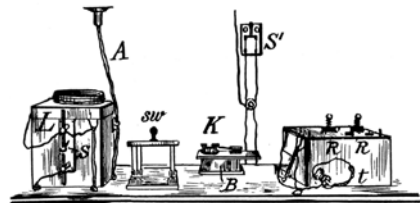


FIG. 86. SHIPBOARD OUTFIT.

Fig. 18. William Maver, Jr. identified the main components of De Forest's wireless equipment on the *Erin*. From left to right: the spark gap enclosure with Leyden jars, the antenna, the switch connecting the high-voltage transformer (not shown) to the spark gap, the key on a box enclosing circuit breakers, and the needle responder with protruding terminals holding the needle electrodes. (Maver's *Wireless Telegraphy*, 1904, p. 114)

of his known writings, and he never chronicled the fact that any form of his needle detector was used in virtually all stations in the De Forest System during all of 1903. If it were not for the testimony of De Forest employees and Capt. Wildman of the U.S. Signal Corps in the NESCO v. De Forest litigation, the extensive use of the needle coherer in the De Forest stations may never have come to light. This is all the more surprising when one considers that the needle responder was used more widely and for a much longer period of time than De Forest's goo responder, which he praised so extensively.

III. American De Forest Wireless Telegraph Co. as a Subsidiary (1903)

In late 1902, Abraham White decided to operate the De Forest Wireless Telegraph

Co. by creating a number of different subsidiaries, each of which would be assigned well-defined geographical areas in which to operate. The stated reason for creating the subsidiaries was to better compete in foreign countries, but the real reason was to capitalize each subsidiary separately, thereby creating more stock for sale. The first subsidiary he created was the American De Forest Wireless Telegraph Company, which was incorporated on Dec. 3, 1902, in the State of Maine with rights to operate the De Forest System in America and its possessions. Smith was also the driving force for creating the De Forest Wireless Telegraph Company of Canada, Ltd., which was incorporated in Canada circa March 11, 1903, as an affiliate. Rights to operate the De Forest System in Canada were granted in return for a minority stock position in the Canadian-owned company, making it an affiliate of the De Forest company rather than a subsidiary. The function of the parent De Forest Wireless company was to develop and manufacture the wireless hardware needed to operate the De Forest System and provide the hardware to each subsidiary or affiliate.

This whole subsidiary approach was something of a farce because there were no foreign subsidiaries created, and only one foreign affiliate, which was a failure almost from the outset. The incorporation of the Canadian company was announced in an article appearing in newspapers circa March 11, 1903: "The De Forest Wireless Telegraph Company of Canada (Limited) has been incorporated with a

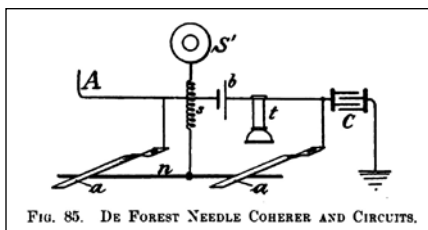


Fig. 19. William Maver, Jr. produced this sketch of the receiver including the needle responder: 1) two aluminum rods (a) of the responder are attached to terminals (R) and (R') mounted on the receiver box, 2) a steel needle (n) is held against the rods (a) by the spring (s) whose tension is adjusted by the winding screw (S'), 3) the telephone (t) used as the sensing device and the battery (b) are placed in series with the responder to complete the circuit, and 4) the terminals of the responder are connected to the antenna (A) and the ground through capacitor (C). (*Maver's Wireless Telegraphy*, 1904, p. 113)

capital of \$2,500,000. The company will acquire the present and future inventions of Lee De Forest . . . and enter into agreements with cities and municipalities to establish the new system. The head offices of the new company will be in Toronto.”⁶⁰ A second article then appeared in the March 1903 issue of the *Canadian Electrical News* stating that experiments “are now being conducted for transmitting messages between Toronto and Hamilton,”⁶¹ cities which are located 40 miles apart across Lake Erie. Five months later, a third article appeared in the *Canadian Electrical News* indicating the entire enterprise was in trouble: “The De Forest Wireless Telegraph Company is removing its instruments from the station on Point Hill. The experiments were successful, but commercially it has not been profitable.”⁶²

Little else appeared in the contemporaneous press after this announcement. However, testimony by De Forest employee J. P. Copland in the *NESCO v. De Forest* suit contradicted this statement about the experiments being successful. Copland testified that the stations never worked successfully: “At Toronto, Canada, a Mr. Thompson was trying to organize a Canadian De Forest company, and to induce Canadians to purchase stock in same; had erected through the New York office a couple of stations, one of which I think was at Hamilton. These two stations never did, within my knowledge, work successfully. These stations caused a great deal of trouble at the New York end, inasmuch as they were all the time

bothering the New York office . . . They use a No. 3 responder, and Dr. De Forest and operators from this point were in charge of the stations.”⁶³ Nothing more can be said here about the Canadian De Forest company, the only known foreign enterprise created as an affiliate of the parent De Forest Wireless Telegraph Co.⁶⁴

The distinction between the activities of the American De Forest Wireless company operating as a subsidiary and the De Forest Wireless Telegraph Company operating as a parent would become blurred. The names of the two companies were often used interchangeably and indiscriminately in announcements and ads offering stock for sale in the press. Both the parent and the subsidiary made identical claims for the same achievements, and the majority of directors for both companies were the same. The remainder of this section addresses the activities of both.

American De Forest Wireless Telegraph Co. is Incorporated

The incorporation papers for the American De Forest Wireless Telegraphy Company were recorded in the office of the Secretary of State of Maine on Dec. 3, 1902. In choosing a market capitalization for this new subsidiary, White was undoubtedly influenced by the capitalization of the competing International Wireless Telegraph Company, which was \$7,500,000 at that time. Somewhat arbitrarily, he selected a market capitalization of \$5,000,000 for the American De Forest Wireless subsidiary, thereby giving the parent

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company a market capitalization of \$8,000,000—only \$500,000 greater than that of International Wireless. Who could argue with that? With this ploy he was able to increase the capitalization of the parent De Forest Wireless Telegraph Co. from \$3,000,000 to \$8,000,000, and without appearing to dilute the exiting shareholders. White claimed other subsidiaries with operating rights in foreign countries were sure to follow. Such a scheme would allow for a seemingly endless stream of subsidiaries, each with its own stock and market capitalization.

Here is how White explained the scheme in his own words, which appeared in one of his many display ads placed in various publications beginning in 1903 for purposes of generating interest in the stock of both the parent company and the new subsidiary:

“The relation of the American De Forest Wireless Telegraph Co. to the De Forest Telegraph Co. is that of a subsidiary company. The American company was organized to operate the De Forest System in American territory. The De Forest, or parent company, is capitalized at \$3,000,000, and will eventually hold in its treasury, more than the amount of its own capital stock, [namely] the stocks of active sub companies, such as the American, English, Canadian, Mexican, etc. Stockholders, therefore, in the parent company, will derive profits from businesses of the entire

world field. The parent company also furnishes all instruments at a profit, and receives substantial royalties in addition, so that her revenues will be steady and absolute, whether the sub-companies yield large or small dividends.”⁶⁵

In this display ad, White made it clear that the role of the parent De Forest company was to develop and manufacture wireless equipment for subsidiary companies, while the role of subsidiary companies such as the American De Forest company was to operate the “De Forest System” in those geographical areas assigned to each.

White Introduces Misleading Ads and Articles

Armed with another 500,000 shares of American De Forest stock to sell at \$10 a share, Abraham White began an advertising blitz to hawk the remaining stock of the De Forest Wireless company and the newly minted stock of the American De Forest company. For the first time, many display ads were placed in magazines and newspapers specifically hawking stock of both De Forest companies. Many ads containing misleading information on the number of stations erected, and false assertions that the De Forest System had somehow been adopted by the government. Other display ads compared the De Forest System and/or the two De Forest companies to the Bell Telephone System and company, implying that the profits to be made from investing in De Forest stock were comparable profits that

had been made by investors in the Bell Telephone Company (Fig. 20). These misleading ads appeared not only in the *New York Times*, the *Wall Street Journal* and the *American Investor* magazine where one might expect to find them, but also in daily newspapers circulated in cities throughout the country.

Typically, White would pick a city where he believed he could sell stock, erect a new wireless station for purposes of attracting local investors, and create an advertizing blitz to sell stock in that geographical region. About half the ads promoted stock of the American De Forest company and the other half promoted stock of the De Forest Wireless company. A few of the ads promoted the stock of both by being intentionally vague, referring only to the “De Forest Wireless System” and the “Company” without actually referring to either company by name.

Perhaps the most interesting feature of these ads published in 1903, of which Fig. 21 is representative,⁶⁶ was that they gave credit to the American De Forest company in 1903 for the accomplishments made by the De Forest Wireless company in 1902. Worse yet, credit was also given to De Forest Wireless company in its ads for exactly the same accomplishments. Thus, while the total capitalization of the two companies had increased from \$3,000,000 to \$8,000,000, there was no commensurate increase in assets, achievements, prospects or value of the

WIRELESS TELEGRAPHY AS A BUSINESS INVESTMENT.

Another Bell Telephone as a money-maker.

For full particulars and price of stocks address

GREATER NEW YORK SECURITY CO.,
Dept. E., 100 BROADWAY, NEW YORK.

Fig. 20. Display ads placed by Abraham White, president of both the De Forest Wireless companies and the Greater New York Securities Co., often alluded to the Bell Telephone Company as a moneymaker, implying that the profits to be made from investing in De Forest stock were comparable to profits that were made by investors in the Bell Telephone Company. (*New York Times*, Feb. 4, 1903. p. 13)

combined companies. The companies not only shared the same achievements and prospects, they also shared the same address at 100 Broadway in New York City, the same President (Abraham White), and a majority of the same directors (Table 5). As a practical matter, the only real differences between the two companies were the different names on their stock certificates and separate listings on the stock exchange.

The American De Forest Wireless Telegraph Co.

Is prepared to furnish estimates for the equipment of yachts and steamers, also the establishing of PRIVATE wireless telegraph service between cities or other points.

The De Forest system has been accepted by the United States Navy after many severe competitive tests. The following is the report of the Chief Signal Officer, U. S. A. War Department Signal Office:

Washington, October 1, 1902.

SIR:—In connection with the army and navy manœuvres it was deemed advisable to test all available systems—namely, the De Forest, the Fessenden and the Marconi. The De Forest system gave very good results, and it is believed that this system of transmission, utilizing an alternating current with step-up transformers in oil insulation, is theoretically the best, as well as giving the most promising practical results.

The Secretary of War, Washington, D. C.

A. W. GREELY, Brigadier General,
Chief Signal Officer of the Army.

Stations have already been erected by the Company at 17 State Street, New York City; Coney Island, Staten Island, Fort Mansfield, Point Judith, R. I.; Block Island, R. I.; Cape Hatteras, Yonkers, N. Y.; Newburg, N. Y.; Poughkeepsie, N. Y.; S. S. "Warden" (N. Y. Harbor); Fort San Cristobal, Porto Rico.

DE FOREST WIRELESS AUTO NO. 1. (Stationed before No. 25 Broad St., New York City, from which curb market quotations are transmitted by wireless to the brokers' offices.)

The company has a capital of \$5,000,000, \$500,000 of which is 7 per cent. preferred, cumulative and participating stock, and \$4,500,000 common stock. Par value \$10 per share. For complete information regarding equipment or stock, address

**American De Forest Wireless Telegraph Company,
100 Broadway, NEW YORK.**

Fig. 21. Immediately following the incorporation of the American De Forest Wireless Telegraph Co. in 1903 as a subsidiary of the De Forest Wireless Company, Abraham White began to place ads giving credit to the American De Forest subsidiary for the all the accomplishments made by the De Forest Wireless Company in 1902—while at the same time, he also placed ads giving credit to the De Forest Wireless Telegraph Company for exactly the same accomplishments. (*Electrical Age*, April 1903, Vol. 30, p. 15)

Table 5. Directors of the Two De Forest Telegraph Companies.

Directors* as of the Dates Indicated	
American De Forest Wireless Telegraph Company (2/7/03)	De Forest Wireless Telegraph Company (5/29/03)
Abraham White	Abraham White
Lee De Forest	Lee De Forest
C. G. Galbraith	C. G. Galbraith
Henry Doscher	Henry Doscher
Clarence G. Tompkins	Clarence G. Tompkins
Ferdinand Peck	John Firth
W. N. Harte	James Stewart
M. M. MacRae	Harry E. Wise
Dr. Samuel Abel	Francis Butler

*Bold print indicates directors common to both companies

White Exaggerates Earnings Projections

White also placed ads in publications such as the *Wall Street Journal* dated February 19, 1903, in which he exaggerated the potential yearly earnings that could be expected from the operations of the two De Forest companies. White projected annual earnings of \$5,000,000, although he did not specify whether he meant “gross profit” (revenue), or “net profit” (revenue less expenses, interest, taxes and depreciation). To give White the benefit of the doubt, it is assumed that White’s predictions of \$5,000,000 referred to revenue. White broke down projected revenue into the four categories listed in Table 6 as follows: 1) telegraph messages from ships, 2) ship-to-shore messages and reverse, 3) transatlantic and transpacific messages, and 4) inter-insular messages (meaning between islands or between an island and the mainland). These four categories were generally conceded to be the ones where wireless telegraphy had the best chance of competing favorably with cable telegraphy and the fledgling telephone system, which was being assembled by the Bell Telephone Company through

acquisitions. Note that White made no revenue projections from wireless communication between cities within the U.S.

A closer look at these projections show that of the \$5M of projected revenues, \$4M or 80% was to be derived from tolls for transoceanic messages. However, the technology was simply not available at that time to support this mission. The De Forest Wireless company had demonstrated a capability for transmitting messages for a distance of only 50 to 60 miles. Further, the international laws and agreements were not in place to support the mission, and the De Forest Wireless company had no plans to make the necessary agreements with foreign countries and companies. To be fair, history would show that White’s revenue projections of \$4,000,000 for transoceanic communications was essentially correct, but it would take a quantum leap in technology and another 25 years before it happened. The Radio Corporation of America initiated commercial transoceanic communication service in June of 1920 using the Alexanderson alternator as a source for CW transmissions,

and it took another seven-and-a-half years after that before RCA revenues from transoceanic communications reached \$3.9 M in 1927, the level projected by White for the De Forest companies in 1903. By that time, RCA was using De

Table 6. Projected Yearly Earnings by the American De Forest Wireless Telegraph Co. Published in Early 1903. (Wall Street Journal, Feb. 19, 1903, p. 8)

Projected Yearly Earnings for American De Forest Wireless Telegraph Co.	Estimates
Telegraphing from ships (50 @ \$5,000 ea.)	\$250,000
Messages from ship to shore and reverse	\$250,000
Transatlantic and transpacific messages	\$4,000,000
Inter-insular communications	\$500,000
Total	\$5,000,000

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Forest's three-element vacuum tubes in its transmitters and receivers, something that was not available in 1903.

The Transoceanic Initiative Fails

White's bold projections for transoceanic revenues were undoubtedly influenced by reports of Marconi's success in communicating between England and Canada that appeared in publications such as *Electrical World* at the end of December 1902, just a few weeks earlier.⁶⁷ In making these projections, White ignored the fact that the maximum demonstrated range for stations of the De Forest Wireless company as of early 1903 was less than 50 miles—far less than that required for reliable transoceanic wireless telegraphy. White hatched a plan with Lee De Forest in January of 1903 to erect two stations hundreds of miles apart for a demonstration of the long-range capabilities of the De Forest System. De Forest himself announced the project, which was reported in a newspaper article dated January 15, 1903: "Dr. De Forest tonight said that his company had begun construction of two long-distance stations at Cape Hatteras and Block Island, three hundred miles apart."⁶⁸ The nexus between the Marconi announcement and the De Forest initiative is evident in the title of the De Forest article announcing the initiative: "Marconi Not Quite the Whole Thing."

If one examines the chronology of the Cape Hatteras initiative, it becomes obvious that the highly publicized initiative was nothing but an exercise in exaggeration and misinformation by

way of press releases to bolster the purchase of De Forest stock in the face of the Marconi achievement. Two weeks after the first announcement of this initiative, the American De Forest Wireless company placed a number of display ads hawking stock in which the Cape Hatteras station appeared in a list of commercial stations that the company claimed had already been erected.⁶⁹ The day following this ad, an announcement by the American De Forest company appeared in a local newspaper contradicting the assertion that the Cape Hatteras station had been competed: "A station is being erected at Cape Hatteras by the American De Forest Wireless Telegraph Company. G. H. Barbour, executive engineer left here this morning with a cargo of building material and the work is to be pushed to an early completion."⁷⁰ Three months later, White arranged to have an article placed in the *American Inventor* with the overt title "Spanning the Pacific by Wireless Telegraphy" that likened the De Forest initiative to the Marconi achievement: "While Marconi has made the Atlantic his chief scene of operations the American system of wireless telegraphy will be put to the practical test on the Pacific and Gulf of Mexico. The first long-distance stations of the De Forest system . . . have, however, been located at Block Island and Cape Hatteras, three hundred miles apart . . ."⁷¹

Further announcements describing the progress of the long-distance initiative all but ceased until September of 1903 when an article featuring the

steam Yacht *Erin* appeared in *Marine Engineering* with the following sentence buried on the seventh page of the article: "A large station is nearing completion at Cape Hatteras . . . to transmit messages to the Coney Island and Block Island Station, 360 and 460 miles distance respectively."⁷² Clearly, the station was still under construction nine months after the project was first announced. According to yet another article appearing on November 5, 1903, the Hatteras station was still under construction: "Stations are being constructed by the De Forest company at Cape Hatteras and Block Island, 300 miles apart."⁷³

The final article in the press dealing with the Cape Hatteras station appeared on March 29, 1904 informing the public that the Cape Hatteras station was finally completed, but that the American De Forest company was out of money and the Cape Hatteras station had been attached by creditors and was up for sale: "The American De Forest Wireless Telegraph Company, which has recently completed a station at Hatteras, this company seems to have experienced a shortage of funds for the transaction of its business. The plant at Hatteras has been attached and an execution has been issued in accordance with the judgments, and the property will be sold. Whether the project is a failure or not is not known, but it is known that money is becoming scarce."⁷⁴ The article concluded by stating that the judge refused a request for a stay of execution on the sale of the property.

Other De Forest Wireless System Failures of 1903

The long-distance wireless initiative involving Cape Hatteras was not the only blatant failure of the De Forest System in 1903. Key De Forest employees testified in the *NESCO v. De Forest* suit that most of the De Forest company initiatives during the year were a failure. The testimony of crack De Forest company telegraph operators H. E. Athearn, Harry Brown, and Mac Horton showed what small measure of success was attained by the De Forest needle responder No. 3 used in most if not all De Forest stations in 1903—just prior to the introduction of copies of Fessenden's electrolytic detectors in early 1904. All of the blatant failures occurred at stations operating at ranges of less than 50–60 miles, three of which are described next.

The first example of a failed project occurred in early 1903 when White arranged to have a wireless telegraph system placed in several automobiles to transmit stock quotes to business offices in the financial district from a curb location on Broad Street selected by brokers who sold stock there (Fig. 22).⁷⁵ The automobile station was a publicity stunt that was a total failure because the operator could not actually send messages. According to J. P. Copland, De Forest company engineer who testified at the *NESCO v. De Forest* trial, the operator was sitting there pretending to send messages:

"While I was in the employ of the company, I was given charge



Fig. 22. This wireless automobile was one of two that were assembled by the De Forest Company as a publicity stunt to send stock reports from the curb to offices in the Wall Street area of New York, but in fact there was only the pretense of sending messages because the system did not work. (*Electrical Age*, Mar. 1903, p. 178)

of their automobiles which contained wireless sending sets, and which were supposed to be operative to receive the curb market reports, and send them into various brokers offices. It was a failure. They used entirely the No. 3 responder. . . . I had orders, while I was in charge of the automobile, to have an operator every morning in the week, except Sundays, by nine o'clock in front of the Empire Building, on Broadway, and an operator inside sending messages, or just making and breaking the spark as though he were actually sending messages, to just advertise the De Forest stock. There was, however, no receiving done while the automobile stayed there sending the fake messages."⁷⁶

When asked what became of the attempt to send market quotations by automobile, he testified, "They were entirely discontinued, one automobile having been sent to Chicago, I believe, and the one which I had been using was placed by me on a steamer, and to the best of my recollection, think it was going to Providence, R. I."⁷⁷ Indeed, the automobile sent to Chicago would be put on display at the De Forest pavilion at the St. Louis World's Fair in 1904 where it was touted as being highly successful. An old adage comes to mind: "The more the lie is repeated, the more it will be believed."

The second example of a failed project, which has already been mentioned

briefly, was Abraham White's attempt to have Canadians organize a new company for the purpose of introducing the De Forest System into Canada. Shortly after the De Forest Wireless Telegraph Co. of Canada, Ltd. was organized in early March 1903,⁷⁸ the De Forest Wireless company planned to sponsor a series of tests to demonstrate the feasibility of transmitting messages between Hamilton and Toronto, a distance of only 19 miles across Lake Erie.⁷⁹ An article appearing in the August 1903 issue of *Canadian Electric News* reported, "The De Forest Wireless Telegraph Co. is removing its instruments from the station on Point Hill, Hamilton. The experiments were successful, but commercially it has not been profitable."⁸⁰ The problems that Lee De Forest had with the equipment used in this test is almost certainly the main reason the experiment was discontinued, and also the main reason that the fledgling De Forest Wireless Telegraph Co. of Canada, Ltd. soon disappeared from the pages of all future publications. The fate of this company is not known, but books of the American De Forest company reported \$700,000 worth of stock of the "Canadian De Forest Wireless Telegraph Company" on its books as of January 16, 1904.⁸¹

The third example of a failed project was the attempt by the De Forest company to build a circuit between New York City and Albany through the Hudson Valley, the first link of which was to be between Newburgh and Poughkeepsie, a distance of only 35 miles. In the fall of 1902, an article

appeared in the Poughkeepsie Daily Eagle announcing a De Forest station was to be erected in Poughkeepsie for purposes of communicating between Albany and New York City.⁸² Copland testified that the company was never able to communicate between the two stations.⁸³ C. G. Tompkins testified that the two stations were never completed, and indeed, little or nothing was heard about this project in the press again.⁸⁴ Nevertheless, De Forest company display ads hawking stock continued to list stations in Poughkeepsie and Newburgh as completed, and while they may indeed have been completed, they were not operational. It should be noted that both De Forest employees testified that the needle responder No. 3 was used during the attempts to establish communications between these two stations.

De Forest Detectors Were Insensitive

In the “Statement of Facts” prepared by the plaintiff’s attorney in the NESCO vs. De Forest suit, it was stated the De Forest detectors “were never able to work at a distance of 250 miles and there is no testimony that they ever actually covered one fourth that distance.”⁸⁵ This statement is borne out by the evidence presented in the literature. De Forest alluded to the existence of nineteen De Forest Wireless company stations at the end of 1903 in his testimony, and indeed, seventeen land stations and three stations on vessels have been identified from the literature, which are listed in Table 7. The land stations are paired with the corresponding distances between them listed in the right-hand column. Three shipboard stations are paired with the lands stations they used. The

Table 7. Distances Between De Forest Company Station Pairs Through 1903.

De Forest Station Pairs Through 1903		Distance (miles)
17 State Street, NYC	Hotel Castleton, Staten Isl.	6
Ft. Wadsworth, Staten Isl.	Ft. Hancock, Sandy Hook	10
Point Judith, R. I.	Block Island, R. I.	10
Poughkeepsie	Newburgh	14 ¹
Yonkers	Newburgh	35 ¹
Navy Yard, Wash., D. C.	Naval Academy, Annapolis	36
Toronto, Canada	Hamilton, Canada	40
Cape Hatteras	Block Island, R.I	300 ²
<i>Unique</i> (tug boat)	Fort Mansfield	30 ³
<i>Erin</i> (steam yacht)	Coney Island	50 ³
<i>Coamo</i> (passenger ship)	Coney Island	63 ⁴

¹Never completed due to lack of connectivity.

²Cape Hatteras station abandoned in 1904 before opening.

³Testimony by operator H. E. Athearn during NESCO vs. De Forest trial, p. 289.

⁴Communication obtained only by dropping word rate to a few words per minute.

maximum distance between land station pairs listed in the table is 40 miles—with the exception of the Cape Hatteras to Block Island link, which never completed despite assertions to the contrary in ads placed by White.

An examination of the actual distances between the ship and shore stations was made during the trial in the NESCO vs. De Forest Wireless Telegraph Company litigation. There were no data provided from the ship or stations logs as to the times of the communications. It became clear that the defendants carefully refrained from measuring the distances they alleged to have achieved between ship and shore stations. In essence, the distances provided by the defendants were all guesses.⁸⁶ Data introduced in the trial showed the maximum distance achieved for communications between ship and shore was 50 miles with normal word speeds, and in the case of the *Coamo* passenger ship, 63 miles for slow word speeds due to low signal levels—not withstanding unsubstantiated claims by the De Forest company that messages were received at distances of up to 120 miles or more. This exaggeration was a relatively safe distortion of the facts because there was no way for the public, press, or even individual wireless operators to determine the actual distances between ship and shore stations at the exact time communications took place. It should also be noted that the De Forest needle responder No. 3 was used for all communications in the ship stations in 1903, and that the distance achieved in 1903 were no

greater than those achieved in 1902 using the goo responders.

Stock salesman Melvin G. Lathrop testified about flagging stock sales that resulted in financial troubles.⁸⁷ Indeed, the De Forest companies were in deep financial trouble by the end of 1903. Investors had lost interest in purchasing stock—the main source of its revenues—because the companies were unable to demonstrate increased performance or point to any substantive contracts awarded during the year. The revenues of the two companies from message tolls were insufficient to cover cost of operations—much less the overhead—and stock sales were insufficient to cover the deficit. The De Forest Wireless Telegraph Co. and its subsidiary, the American De Forest Wireless Telegraph Co., were almost out of working capital by the end of 1903.

Both companies would have been out of business by early 1904 for a lack of capital had it not been for two unrelated events that occurred at the end of 1903. The first event was the merging of the International Wireless Telegraph Co. and the De Forest Wireless Telegraph Co. into the American De Forest Wireless Telegraph Co.—thereby making American De Forest Wireless Telegraph Company the new parent company. As a result, the American De Forest Wireless Telegraph Co. and the American Marconi company were the only two substantive wireless companies operating in America. The second event was the introduction of Fessenden's Wollaston wire electrolytic detector into the De Forest System,⁸⁸ which

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occurred in early 1904 immediately following a very successful demonstration at Holyhead in England during December of 1903. Both of these events soon rekindled the fire under the sale of stock, a story that is addressed in the next section covering the three-year period in which the American De Forest Wireless Telegraph Company operated as the parent.

IV. American De Forest Wireless Telegraph Co. as the Parent (1904–6)

On paper, the American De Forest Wireless Telegraph Co. had been operating as a subsidiary of the parent De Forest Wireless Telegraphy Co. since Dec. 3, 1902, but in reality, the two companies had been operating as if they were one. White had originally created the subsidiary concept to extend the De Forest System into foreign countries, but according to testimony by Lee De Forest, since no foreign subsidiaries had materialized in 1903 and no prospects were on the horizon, White decided to dispense with the subsidiary concept and merge the two De Forest companies. The timing of this decision was undoubtedly influenced by White's acquisition of the International Wireless Telegraph Co. in early 1904. Logic would dictate that the American De Forest and International Wireless companies would be merged into the then existing parent, the De Forest Wireless Telegraph Company. However, White elected to make American De Forest the parent by merging both the International and De Forest Wireless companies

into the American De Forest Wireless Telegraph Company.

The second event that propelled the American De Forest company into the forefront of wireless telegraphy in the U.S. was the introduction of Fessenden's liquid barretter into the De Forest System. This single event dramatically increased the range of the De Forest wireless system and renewed interest of government and commercial customers in the American De Forest company, not to mention renewed investor interest in the company's stock. However, the introduction of the liquid barretter would ultimately be the downfall of Lee De Forest as result of the NESCO lawsuit against the Lee De Forest and the American De Forest company alleging infringement of Fessenden's liquid barretter electrode patent. White would fire De Forest for introducing this device into the De Forest System that would be found by the courts to infringe Fessenden's patent and caused no end of legal problems for White and the American De Forest company.

White Acquires International Wireless & Merges the De Forest Company

While no specific date has been found for the merger of the International Wireless and De Forest Wireless companies into the American De Forest company, an announcement appeared in the January 16, 1904, issue of *The Chronicle* stating that "negotiations have been completed" whereby control of these two entities will be acquired by the American De Forest Wireless Telegraph Company.⁸⁹ The International

company was made up of the amalgamation of five companies—the Consolidated, American, New England, Atlantic, and Northwestern Wireless Telephone & Telegraph companies. Exactly how White convinced the directors of the International company to merge with the American De Forest company has never been chronicled, but it was reported that the directors voted unanimously to do so on January 6, 1904. The International company had no real alternative because there were only a few paying customers, and with no more authorized stock available for sale, their operating capital evaporated.

The consolidation of both the International and De Forest Wireless companies was effected by issuing shares of the American De Forest Wireless Telegraph Company for shares of both merged companies on a one-for-one basis. According to documents from the State of Maine, the necessary papers required to issue the stock to effect the merger were not recorded with the State of Maine until March 14, 1904. For want of a better date, March 14, 1904, will be used in this document as the effective date of the consolidation.

The market capital for the International and De Forest Wireless companies at the time of the merger was \$7,500,000 and \$3,000,000 respectively, so to effect the merger, American De Forest increased its common stock from \$7,000,000 to \$11,500,000 and its preferred stock from \$500,000 to \$3,500,000. The par value of all stock was \$10 per share. *The Chronicle*

pointed out that there was an unresolved discrepancy between the authorized capitalization of \$11,500,000 and the amount required to effect the merger, which the publication asserted was \$15,000,000.

As for the disposition of the De Forest Wireless Telegraph Company, according to papers filed with the State of Maine, the last shareholder meeting for the parent company was held on June 25, 1904, six months after the merger. Parenthetically, White apparently did not file dissolution papers for the De Forest Wireless Telegraph Company after the merger because the *Marvyn Scudder Manual of Extinct Obsolete Companies* reported that the State of Maine revoked its charter in 1907 for failure to pay taxes for several previous years.⁹⁰ Indeed, the annual report of the Board of State Assessors for Maine, which contains entries for the taxes owed by all companies registered in Maine, has entries for the De Forest company from inception in 1902 through 1907, but no entries in 1908 or thereafter.⁹¹ Of course, White had transferred the assets of the De Forest Wireless Telegraph Company to the American De Forest Wireless Telegraph Company and left its debts to creditors of the De Forest Wireless Telegraph Co., which had no assets.

De Forest Introduces the Liquid Barretter Responder

Reginald Fessenden filed a patent on his liquid barretter electrolytic detector on May 5, 1903, which was as reissued as No. 12,115. It was given a priority date

of the original patent No. 727,331 that Fessenden had filed on April 9, 1903. De Forest reported in his autobiography that he visited Fessenden's laboratory in March 1903 and met with Fessenden assistant, Frederick K. Vreeland, who first introduced him to the hot liquid barretter detector that he and Fessenden were developing. Vreeland told De Forest at that time that it was he and not Fessenden who had invented the liquid barretter.

Subsequent to this meeting, De Forest discovered that M. I. Pupin had published articles on electrolytic detectors in several journals in 1899–1900 that showed a sketch of an electrolytic detector and described how alternating current is rectified.⁹² Pupin ended his description of the rectification process with the following sentence: *"The author [Pupin] succeeded in rectifying electric oscillations of Hertzian frequency and producing electrolytic effects in them; the wire for this purpose was .025 mm in diameter."* De Forest reasoned that the electrolytic detector was in the public domain and that Fessenden's patent would not survive a challenge in court. Consequently, he decided to use Fessenden's electrolytic detector in the De Forest System.

De Forest employed Vreeland later in 1903 after he had been discharged by Fessenden. Vreeland testified that he brought a copy of the Fessenden's liquid barretter detector with him to the De Forest company in the fall of 1903. According to testimony by De Forest employees, Lee De Forest directed company engineer Dr. J. E. Ives to

manufacture several "Chinese copies" of the detector Vreeland had supplied in late 1903,⁹³ which were then used by the American De Forest company for demonstrations that took place simultaneously in late 1903 and early 1904. This testimony is in direct conflict with De Forest's account in his autobiography where he claims that he assigned his able assistant, Clifford Babcock, the problem of designing a practical form of the electrolytic rectifier, and that after several weeks he produced the spade form of the detector.⁹⁴ Documents will be presented to prove that the spade detector was not designed until late 1905—two years later than De Forest implies in his autobiography.

The two De Forest company demonstrations in which exact copies of Fessenden's rectifying electrolytic detector were used are described next. The first demonstration was between Ft. Wright and Ft. Schuyler in New York State in late fall of 1903 that took place under the auspices of the U.S. Signal Corps, and second between Holyhead and Howth, Ireland, that took place in December 1903 under the auspices of the British General Post Office (GPO).

i. Ft. Wright to Ft. Schuyler Demonstrations: One of the earliest but lesser known demonstrations of the De Forest System using the liquid barretter responder occurred at the end of a series of tests sponsored by the U.S. Signal Corps beginning in the fall of 1903, which took place between stations at Ft. Wright, New London, and Ft. Schuyler, NY, separated by a distance

of 105 miles over water.⁹⁵ These tests were performed at the direction of General Greely, Chief Signal Officer of the Signal Corps, to determine which, if any, wireless systems might be capable of communicating at a distance of 100 miles over Norton Sound between installations at St. Michael and Safe Harbor near Nome, Alaska.⁹⁶ American De Forest and Slaby-Arco were two of several companies requested to participate in the tests.

All of the participating companies initially failed, including the American De Forest company, which initially used both De Forest's needle detector and his "goo" responder.⁹⁷ However, by all accounts, the American De Forest company using its new liquid barretter detector succeeded in communicating between the two stations on Dec. 5, 1903.⁹⁸ Line drawings of the De Forest liquid barretter responder used in these tests were introduced in the NESCO vs. De Forest litigation (Fig. 23). The detector represented by these line drawings is similar, but not identical to the production model made by the De Forest company, which is shown later in this article.

The Signal Corps subsequently purchased two of the De Forest liquid barretter detectors from American De Forest, which were then used in a wireless system designed by the U.S. Signal Corps for the Alaskan link. Since the system was designed and patented by Capt. L. D. Wildman of the Signal Corps using components from several different companies,⁹⁹ all companies were proscribed by the Signal Corps

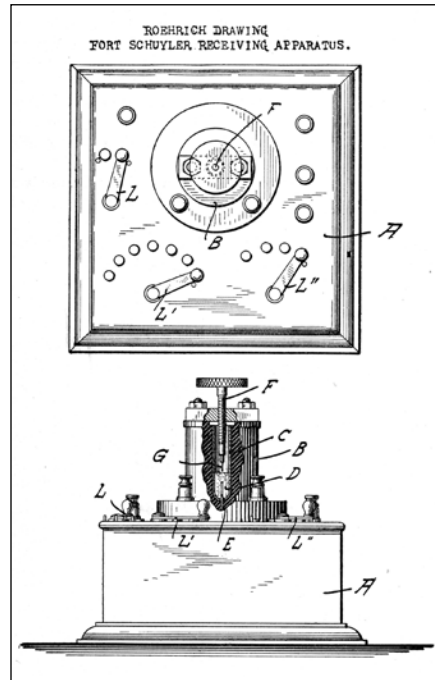


Fig. 23. These line drawings of the De Forest liquid barretter used in tests between Ft. Wright and Ft. Schuyler, which was sponsored by the U.S. Signal Corps in late 1903, are very close to the appearance of a De Forest production model that appears later in this article. (Fessenden v. De Forest litigation)

from attaching their names to the Alaskan system, although De Forest often alluded to the fact that the De Forest responder was used in Alaska. Of course, De Forest never mentioned that it was actually Fessenden's electrolytic detector.

ii. Holyhead to Howth Demonstrations:

The first public demonstration of the new electrolytic responder took place across the Irish Channel during December 1903 between Holyhead and

The Rise and Fall of the De Forest Companies

Howth (a suburb of Dublin) at a distance of 64 miles under the auspices of John Gavey, Engineer-in-Chief of the British General Post Office. De Forest was circumspect in his description of the responder used for these tests. He wrote in an article appearing in the *Electrician*: “Unfortunately the patent rights relating to the responder are not yet secure, but Dr. de Forest informs us that it works upon an electrolytic principle, the resistance becoming decreased upon the reception of Hertzian waves. Moreover, it requires no “tapping back.”¹⁰⁰ De Forest was cautious because he was well aware that he had copied the Fessenden design and did not want to openly reveal that fact. There is a photograph of the receiver and transmitter apparatus that was purportedly used during the test

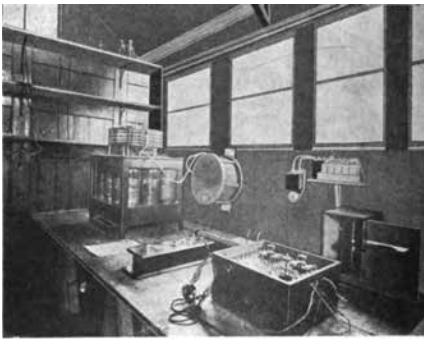


FIG. 2.—VIEW OF INTERIOR OF STATION AT HOWTH

Fig. 24. De Forest attempted to hide the fact that he used Fessenden’s liquid barretter detector in the Howth to Holyhead tests in late 1903 by publishing an article with this photograph of the detector said to be used, which appears to be a form of his needle detector, not a liquid barretter electrolytic responder that he actually used. (*Electrician*, Dec. 4, 1903, p. 241)

(Fig. 24). The receiving apparatus in the image is clearly not the De Forest electrolytic responder that was actually used in these tests. Instead, it appears to be a version of the needle responder. That De Forest actually used the electrolytic responder in these tests is revealed in the schematic diagram that also appeared in the article (Fig. 25). The symbol represented by the letter F in the schematic, which is a concave semi-circle with a short line extended downward into the concave semicircle, is identified as “responder.” The semi-circle represented a cup holding an electrolytic liquid, and the solid line represented a Wollaston wire dipping into the cup of an electrolytic liquid.

By all accounts, the Holyhead to Howth tests were highly successful, and as a result De Forest was hopeful

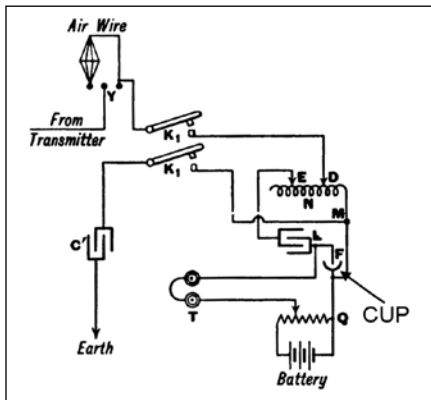


Fig. 25. That De Forest actually used a liquid barretter responder at the Howth to Holyhead tests late in 1903 can be confirmed by this schematic of the detector appearing in De Forest’s article, which clearly shows a cup holding an electrolyte (see arrow) and a liquid barretter electrode extending downward into the cup. (*Electrician*, Dec. 4, 1903, p. 240)

that the GPO would purchase De Forest company equipment. To that end, De Forest remained in England for a month trying to interest Gavey and the GPO in purchasing the De Forest System. In the end, the GPO elected to pursue wireless systems manufactured by European companies. While De Forest was unable to interest Gavey and the GPO in the De Forest System with the new liquid barretter, an event even more propitious soon presented itself as De Forest was travelling back to the U.S. from London, England, namely an invitation to De Forest to cover the impending Russo-Japanese War.

iii. Russo-Japanese War Coverage: As serendipity would have it, Captain Lionel James, a famous correspondent for *The Times* of London, was on the same mail steamer *Majestic* that De Forest took on the first leg of his trip home from London to Liverpool. Captain James was travelling from London via Liverpool to the Far East to report on a conflict that was expected to break out between Russia and Japan at any time. It turns out that James had been thinking about the potential use of wireless in reporting back to London and was aware of De Forest and his wireless system.¹⁰¹

The two met on the steamer and the upshot of this meeting was a plan whereby De Forest agreed to supply two complete wireless systems and expert wireless operators for a wireless link between a ship and a shore station to be located near a marine cable head in Wei-hai-wei, a leased territory of the

UK on the coast of China. The ship was to operate in the waters in the vicinity of Wei-hai-wei where a naval battle was expected to take place. De Forest promised a wireless range of 160 miles if James would arrange to have an antenna of 180 feet in height erected at Wei-hai-wei, and an exposed wire of 120 feet suspended on a ship's mast to be used as an antenna.

The deal was quickly sealed between De Forest and Capt. James, and a contract between the American De Forest company and the *Times* was approved and signed. Captain James arranged to have an antenna erected at Wei-hai-wei, leased the dispatch ship *Haimun*, and also arranged to have an antenna suspended vertically on the *Haimun* using its mast as a support. However, according to Capt. James, ". . . we were never able to raise more than 165 [feet] on the shore and 105 [feet] on the boat."¹⁰² Since De Forest had no time to fabricate a transmitter and receiver for the contract, he arranged to have the equipment used in the Holyhead to Howth tests shipped to the U.S. for refurbishment and then reshipped to Wei-hai-wei via Yokohama along with two De Forest telegraph operators, H. E. (Pop) Athearn and Harry Brown, both with extensive prior experience as Western Union operators. The equipment and operators arrived in Wei-hai-wei aboard the *Haimun* on Feb 17, 1904, more than a week after hostilities broke out on February 6, 1904. The first messages between *Haimun* and Wei-hai-wei were sent and received almost a month later on March 14, 1904.

The Rise and Fall of the De Forest Companies

Capt. James reported the war very effectively and accurately using the De Forest System with a maximum range of 125 “sea” miles, according to James, which corresponds to 143 statute miles—close to what De Forest had promised with longer antennas than were provided. The De Forest System operated for a period of three months before ship-to-shore link was discontinued for several good reasons. First, the Russian navy threatened to capture and confiscate the *Haimun* and treat the crew as spies. Second, the Japanese increasingly restricted movements of the *Haimun*, and third, the

Japanese released numerous sea mines in the waters where the *Haimun* operated, making navigation dangerous. Nevertheless, by all accounts, the De Forest System was a huge success. The *Times* of London scooped competing war correspondents, and the use of the De Forest System was widely lauded by the press. Wireless telegraphy as a new means of communication had finally proved its worth. However, it has never been stated that the reason the De Forest System was so successful was because De Forest used two “Chinese copies” of Fessenden’s detector in its system.

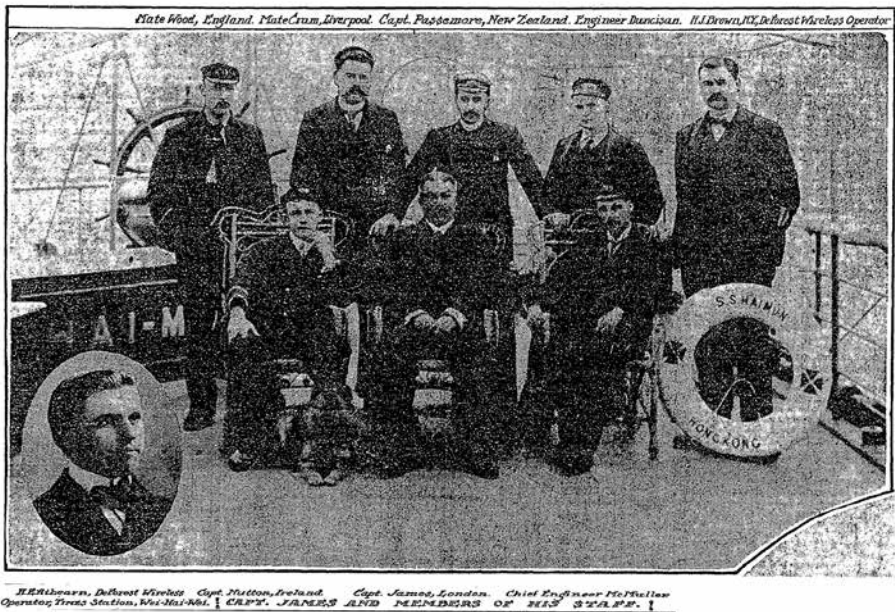


Fig. 26. A particularly interesting account of the war appeared in the Sunday edition of the *New York Times* featuring photographs taken in the theater of the Russo-Japanese war, this one of Captain Lionel James (seated, center) and his staff taken aboard his ship the S.S. *Haimun*; two notable members of his staff include H. J. Brown, De Forest wireless operator aboard the *Haimun* (standing, upper right) and H. E. Athearn (inset, lower left), who was the De Forest operator at the Wei-hai-wei land station. (*New York Times*, June 5, 1904, p. 11)

It should be noted that Capt. James was also a war correspondent for the *New York Times*, which published almost daily accounts of the Russo-Japanese war. A particularly interesting account of the war appeared in the Sunday edition of the *New York Times* on June 5, 1904,¹⁰³ with a date line “Steamship Haimun, (at sea) March 27,” which has pictures of the S.S. *Haiman*, the De Forest station at Wei-hai-wei, and a portrait of the members of Capt. James entire staff of nine including himself (Fig. 26). While

this image is not particularly good, it is exactly what the readers saw in the *New York Times* that day. Abraham White, taking advantage of the public’s fascination with the reports, placed large announcements in various newspapers lauding the success of the De Forest System with the headline “American De Forest Wireless reports the Russo-Japanese War,” the main purpose of which was to offer American De Forest stock for sale, albeit the sales pitch appeared in fine print at the bottom of the announcement (Fig. 27).¹⁰⁴

AMERICAN DE FOREST WIRELESS

REPORTS THE RUSSO-JAPANESE WAR

“Yesterday the PUBLIC LEDGER printed under date ‘At Sea with the Japanese Fleet, by De Forest’s Wireless Telegraph to Weihaiwei, March 28,’ what was unquestionably the most remarkable dispatch thus far received from the scene of action since hostilities began. It was also, perhaps, one of the most workmanlike pieces of war reporting ever sent by a correspondent.”—Editorial on The War News in Public Ledger, Philadelphia, Pa., March 22, 1904.

WIRELESS CONSOLIDATION.

The AMERICAN DE FOREST WIRELESS TELEGRAPH COMPANY now controls eight competing wireless companies, which practically gives it the entire wireless field. Over 100 patents owned, 26 stations and 12 government stations completed. Havana and Key West, Florida, are to be completed by May 1.

Popular Plan Adopted.

The enormous amount of construction work laid out for this year necessitates the expenditure of vast sums of money. In order to promptly take care of these expenditures from month to month it has been decided to offer 20,000 shares of the PREFERRED 7 PER CENT CUMULATIVE and participating stock at \$10 per share, payable in ten equal installments; \$100 worth may be purchased by paying \$10 with order and \$10 each month until the full amount is paid. This carries with it a bonus of \$100 par value of the common stock and should be taken advantage of before the price of the stock advances.

THE COMMERCIAL WORLD CANNOT DO WITHOUT WIRELESS TELEGRAPHY. THE AMERICAN DE FOREST WIRELESS TELEGRAPH HAS PROVEN ITS SUPERIORITY OVER ALL OTHERS. CAN YOU AFFORD TO MISS THE BEST OPPORTUNITY TO SECURE LARGE PROFITS EVER OFFERED?

WRITE TO-DAY FOR FULL DETAILS.
GREATER NEW YORK SECURITY CO.,
84 WALL ST., NEW YORK.

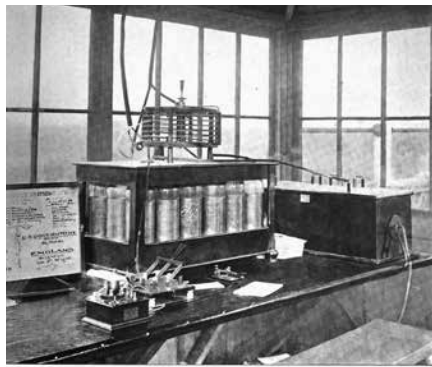
Fig. 27. To take advantage of the public’s fascination with the Russo-Japanese war reports, Abraham White placed large announcements in various newspapers lauding the success of the De Forest system with the headline “American De Forest Wireless reports the Russo-Japanese War,” the main purpose of which was to offer American De Forest stock for sale. (*United States Investor*, April 2, 1904, p. 519)

American De Forest Scores Many Successes in 1904–05

After the success of the De Forest System in the Russo-Japanese war, American De Forest Wireless quickly changed out all No. 3 needle responders for the De Forest version of the Fessenden electrolytic detector.¹⁰⁵ From that point on, the American De Forest Wireless Telegraph Company had many successes—in fact as opposed to fiction. The De Forest System scored two of its major successes using the Fessenden electrolytic responder in 1904 and 1905. The first and perhaps the most publicized success was wireless demonstrations held in the 300-foot De Forest observation tower erected at the Louisiana Purchase Exposition, more popularly known as the St. Louis World's Fair, which was held from April 30 to December 1, 1904. One of the first published photographs of the liquid barretter responder De Forest used appeared in photographs of the American De Forest apparatus taken at the De Forest tower. The image shown here in Fig. 28 is the clearest of the known photographs, which was published circa September 1904.¹⁰⁶ An enlargement of the responder itself is pictured Fig. 29. This responder is virtually identical to the one in the collection of History San Jose, which was manufactured in late 1903 or early 1904 (Fig. 30).¹⁰⁷

The story of De Forest's success at the World's Fair is so well known that it need not be repeated here. Suffice it to say that American De Forest was able to demonstrate communication between cities at much longer distances than ever before with the liquid barretter

responder and a 2 kW power source. American De Forest recorded its great successes in a brochure with the American De Forest tower pictured on the cover, a brochure that was circulated at the Fair (Fig. 31). The De Forest System set an overland record of 300 miles by communicating between the tower in



INTERIOR OF THE DE FOREST WIRELESS TELEGRAPH STATION IN THE OBSERVATION TOWER BUILT ON PAGE 105

Fig. 28. One of the first published photographs of De Forest's liquid barretter responder appeared in photographs of the De Forest apparatus taken in the De Forest tower at the St. Louis Exposition in 1904. (*Electrical Age*, Sept. 1904, p. 163)

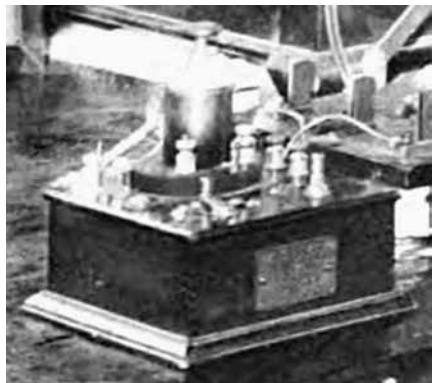


Fig. 29. The De Forest liquid barretter responder appearing in the previous figure is enlarged to show more detail.

St. Louis and a station in Chicago. The official test was held on September 14, 1904, when a host of “electrical jurors in charge of the test” located at both stations witnessed the event.¹⁰⁸

A second notable success for the American De Forest company was a Navy contract it received on June 29, 1904, to supply wireless instruments to maintain reliable communications on the following circuits in the Caribbean: Key West to Panama: 1000 miles; Puerto Rico to Key West: 1,000 miles; south Cuban coast to Panama: 720 miles; Pensacola to Key West: 450 miles; south Cuba to Puerto Rico: 600 miles.¹⁰⁹ The contract for four stations at a fixed price of \$315,000 was initially awarded to NESCO, but Fessenden insisted on contract terms that would prohibit the Navy from sending commercial messages in competition

with Fessenden stations.¹¹⁰ The Navy did not wish to purchase equipment with terms restricting its usage, so instead they awarded the contract to De Forest for \$65,666, which included not only the four 35 kW stations bid by NESCO, but also an additional 10 kW stations.¹¹¹ The American De Forest contract also called for a performance bond of \$16,416, not only to guarantee performance, but also to assure that the Navy would be protected from claims for infringement for the use of apparatus supplied under the contract. The Navy must have been aware of the



Fig. 30. An example of the De Forest liquid barretter responder in the History San Jose collection appears to be the same as the photograph of the responder taken in the De Forest tower in 1904. (Courtesy of History San Jose)

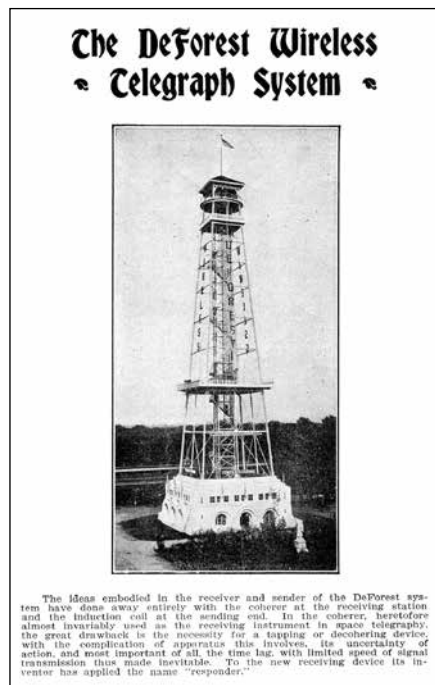


Fig. 31. De Forest recorded his great successes at the St. Louis Exposition in a 1904 brochure with the De Forest tower pictured on the cover, a brochure that was circulated at the Exposition. (Author's collection)

The Rise and Fall of the De Forest Companies

patent infringement litigation between the Fessenden and American De Forest companies over the liquid barretter responder, a topic addressed in the next section. That American De Forest used the liquid barretter responder in the Caribbean stations is evident not only from the schematic diagram of the equipment appearing in *Captain Linwood S. Howeth's* book,¹¹² but also

from a photograph of the operating room of the Cuban station at Guantanamo (Fig. 32).¹¹³

While the award of the Navy contract to American De Forest was something of a coup that provided fodder for Abraham White's ads hawking stock, it was also something of a financial disaster for the company. The contract called for completing the contract within a

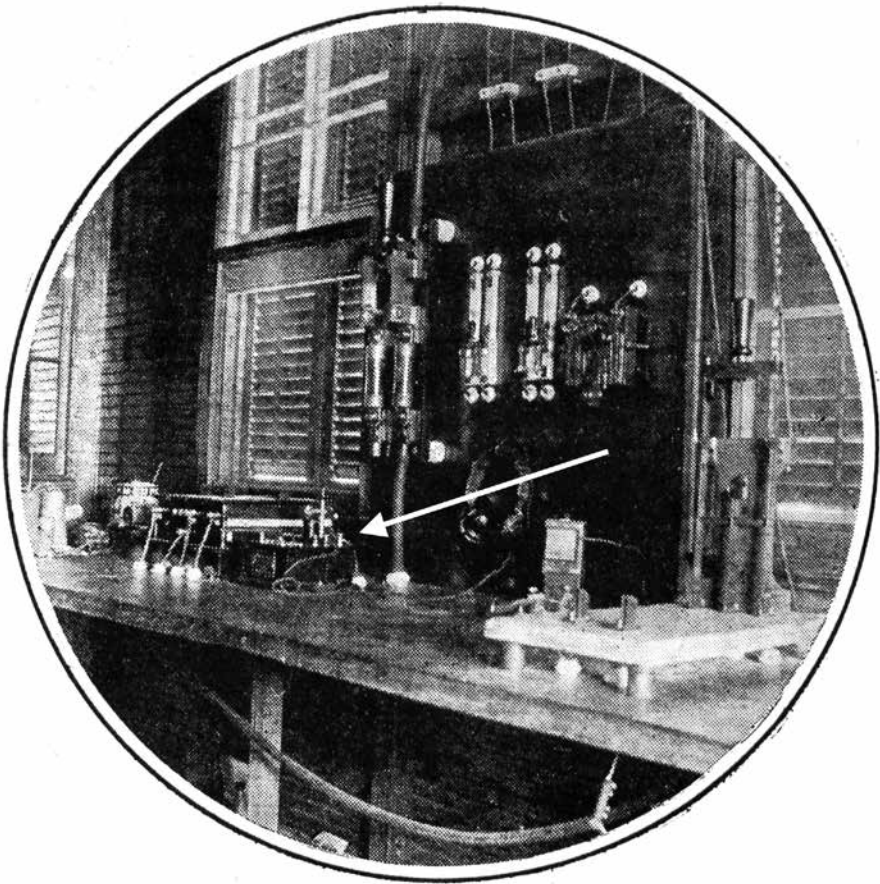


Fig. 32. That De Forest used the liquid barretter responder in the Caribbean stations is evident not only from the schematic diagram of the equipment appearing in *Captain Linwood S. Howeth's* book but also from this photograph of the operating room of the Cuban station at Guantanamo. (*Radio Broadcast*, Mar. 1925, p. 922)

year at a fixed price with payment to occur only after completing the contract and demonstrating the ability to communicate reliably between all specified circuits. The contract was successfully completed at the end of March 1906, albeit almost a year late, for which American De Forest received a total payment of \$65,000.¹¹⁴ With the American De Forest contract almost certainly underbid to begin with, and with the actual contract period more than doubled, the difference between the cost and the final payment must have been staggering. Clearly, whatever the difference in cost, it was covered by the investors who bought American De Forest stock during the two-year period of the contract. Fortunately for American De Forest, the successes of the company using the Fessenden detector coupled with the acquisition of the International Wireless Telegraph Co. had created significant new investor interest.

The American De Forest company continued to erect wireless stations throughout the United States and attempted to generate revenues from message transmissions between selected major population centers, but with little success. Lee De Forest testified that the real problem was the American De Forest company did not have messengers such as those used by cable companies to exchange messages between wireless stations and customers. The Postal Telegraph-Cable Company, for example, employed a large number of messenger boys and the Western Union Telegraph Company contracted with various

messenger services. Data published in 1909 reveal that the Postal Telegraph-Cable Co. employed 1473 messenger boys in 24 of the larger cities.¹¹⁵ For example, there were 612 messenger boys in New York City, 210 in Chicago, 62 in St. Louis, and 51 in Washington, D.C. Lee De Forest also testified that at some point he and Harry Shoemaker tried to convince Abraham White to develop stations along coastal areas to communicate with ships at sea where there was no competition from the cable companies. However, White and his stockbroker advisors were focused on placing stations to enhance stock sales and would not listen.

NESCO Sues American De Forest for Infringement

Reginald Fessenden did not stand idly by while the American De Forest company flaunted its success stories in the press with its wireless system using Fessenden's patented liquid barretter detector technology. According to Fessenden, his National Electric Signaling Company filed suit against American De Forest after he discovered the Army Signal Corps had purchased two De Forest liquid barretter detectors pursuant to the Fort Wright to Fort Schuyler tests. The NESCO suit was announced in the press on March 5, 1904,¹¹⁶ three months after the successful demonstration of the De Forest System using the liquid barretter detector on December 5, 1903. The filings contained a request for a temporary injunction to prevent American De Forest from selling any more barretter detectors prior to trial.

However, at the first hearing held on March 30, 1904, Judge Lacombe in the U.S. Circuit Court, New York City, denied the request pending a full trial.¹¹⁷ Fessenden, aware that litigation would take a very long time, felt compelled to make a public announcement in the May 1904 issues of several electrical magazines to inform readers that NESCO had filed suit against the American De Forest company for infringement of his liquid barretter patent. Clearly, he intended to discourage potential customers—in particular, the Navy—from purchasing De Forest's electrolytic responder. One such announcement that appeared in the *American Electrician* is reproduced here as Fig. 33.¹¹⁸

The litigation lasted for a considerable time, and the suit was finally decided in Fessenden's favor on October 16, 1905 when Judge Wheeler ruled that the American De Forest company, Lee De Forest, Abraham White, et al.

had infringed on the Fessenden patent and ordered an accounting for damages.¹¹⁹ On November 18, 1905, the judge issued an order restraining the defendants from using, manufacturing or selling the liquid barretter.¹²⁰ Lee De Forest, believing that he could circumvent the decree by simply tweaking the design, replaced the round Wollaston wire making contact with the electrolytic liquid with a flat spade-like electrode that he developed in short order. This form of the electrode, which was actually designed by Clifford Babcock, was named the "spade electrode." De Forest filed a patent on the new electrode on December 21, 1905, which was issued later as patent No. 894,317. The patent contains line drawings of several versions of the spade electrode (Fig. 34.)

Reginald Fessenden soon discovered that the American De Forest company was continuing to use some form of the liquid barretter detector,

THE FESSENDEN WIRELESS TELEGRAPH SYSTEM

The National Electric Signalling Company has brought suit in the United States Circuit Court, Southern Dist. of New York, U. S. A., against the DeForest Wireless Telegraph Company, the American DeForest Company, Abraham White, President of said companies, and Lee DeForest, Scientific Director, for infringement of Letters Patent of the United States of America Reissue, No. 12,115 of May 26, 1903, to Reginald A. Fessenden. This patent is for the well known Fessenden liquid barreter or receiver for wireless telegraphy, the monopoly of which is controlled by the National Electric Signalling Company, Washington, D. C., U. S. A.

Fig. 33. Fessenden, aware that the litigation with De Forest over the liquid barretter would take a very long time, felt compelled to make a public announcement in May 1904 that NESCO had filed suit against the American De Forest Company for infringement—most likely with the intent of discouraging potential customers from purchasing De Forest's electrolytic responder. (*American Electrician*, May 1904, p. 90)

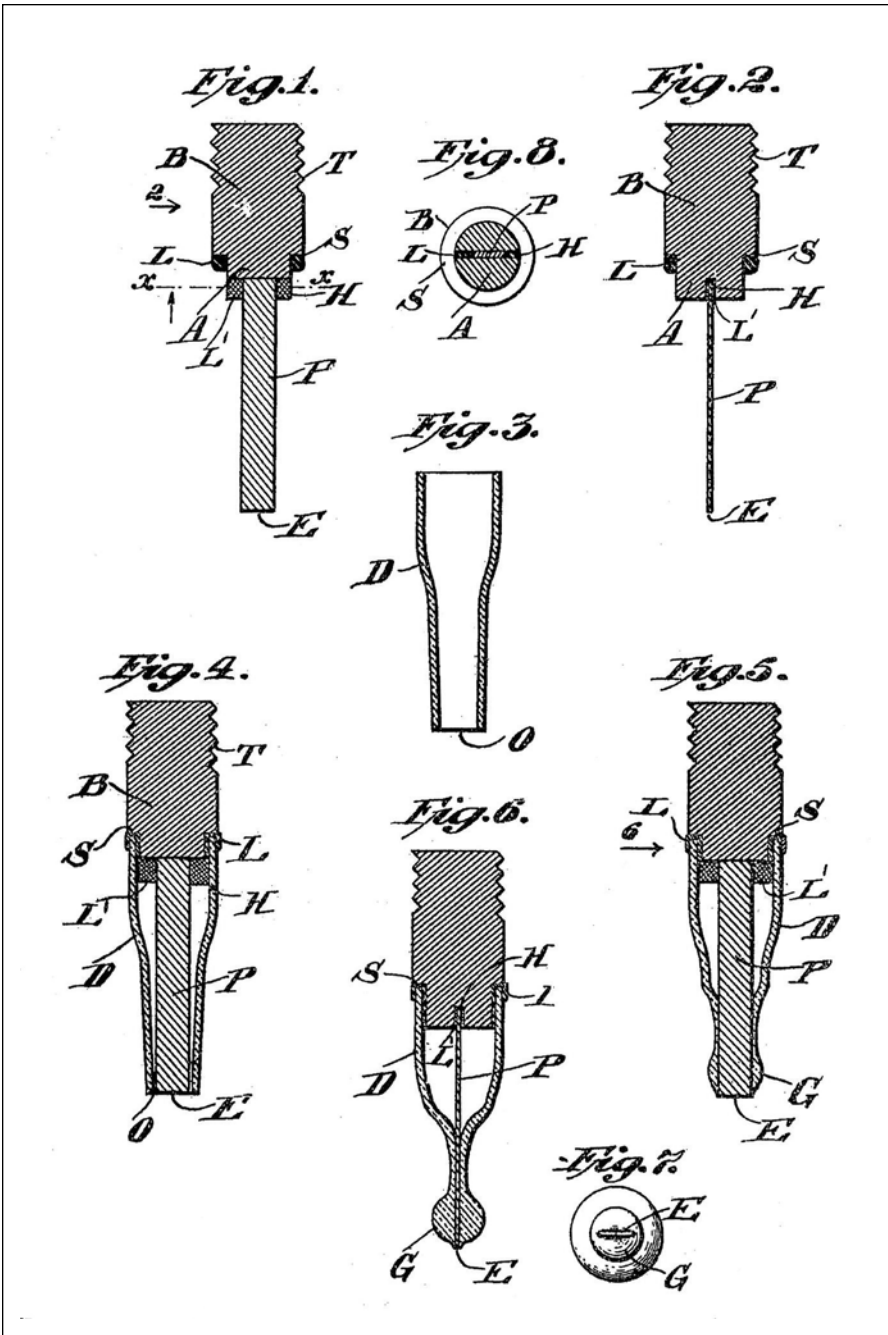


Fig. 34. Two versions of De Forest's spade detector were illustrated in his Patent No. 894,317 filed circa December 21, 1905.

and promptly filed a motion of attachment for contempt in Judge Wheeler's court. The hearing on this motion would not take place until April 7, 1906, and in the meantime Abraham White dispatched De Forest to Glengarriff Harbour, County of Cork, Ireland to perform a transatlantic communication experiment, primarily to generate grist for stock sales. De Forest was sufficiently concerned about the possibility of another unfavorable ruling by Judge Wheeler while he was away that, before he sailed, he arranged to have Babcock replace the electrolytic detectors in the entire American De Forest System with the two-element audions he had recently developed. According to an entry in his diary, Lee De Forest then sailed for England on February 17, 1906,¹²¹ arriving in Glengarriff on or about March 11, 1906.

The story of Lee De Forest's transatlantic experiment, which took place between mid-March and mid-April of 1906 is summarized later. The key point here is that while he was performing experiments in Ireland, Judge Wheeler found the defendants guilty of infringement on April 7, 1906, as well as contempt of court, and ordered an accounting of damages.¹²² This message was relayed to De Forest during the time he was performing his experiment, and according to an entry in his diary dated "mid-April 1906," he cut his experiment short and returned to America: "I returned to London with a half success; called back to America by a crisis in the patent situation not at all assuring."

While De Forest was still overseas, attorneys for the defendants petitioned Judge George W. Ray, also of the New York District Court, on April 17, 1906, for more time in which to substitute a new detector for the infringing device.¹²³ The defendants testified that they did not believe the new spade detector infringed Fessenden's patent and therefore were not willingly disobeying Judge Wheeler's order of October 16, 1905. The petition was denied by Judge Ray on May 1, 1906, and Judge Wheeler's judgment for \$15,922.04 in damages to NESCO went into effect. The judge also issued an arrest warrant for De Forest and White in lieu of a bond for \$10,00 for each. Clearly, Judge Wheeler did not think the new spade electrode was substantively different from the previous circular electrode, and decided that they were in contempt of court despite the defendant's claim that the new electrode was substantively different from the original one.

When Lee De Forest returned from England on May 6, 1906, he not only found that the injunction had been issued, but also that Judge Wheeler had found him and Abraham White guilty of contempt effective May 1, 1906, and had issued an arrest warrant and set bail at \$10,000.¹²⁴ Since White had not posted the bond on De Forest's behalf, and since De Forest did not have the money to post the bond, he decided to depart for Canada until he could arrange for a bond. According to his diary, De Forest stayed in Canada for approximately four weeks until Judge Wheeler agreed to reduce his bond to

\$5,000, at which time White posted De Forest's bond and he returned to the U.S. without fear of being incarcerated.

De Forest also learned upon his return that his directive to Babcock to replace the electrolytic detector with his two-element audions had been countermanded by a directive from American De Forest management to replace them with a new carborundum detector that General Dunwoody had recently discovered. The early form of the carborundum crystal detector first used in the De Forest System, known as the "firecracker," did not work well until Greenleaf W. Pickard, at the request of the De Forest company, redesigned the contacts by replacing wires wrapped around the crystal with a cat's whisker version.¹²⁵

It was mentioned previously that De Forest's account of how he developed the electrolytic detector with a Wollaston wire detector in his autobiography is highly inaccurate. According to De Forest, he visited Fessenden at his home in the spring of 1903, met with Vreeland who told him about the detector, found that Pupin had published an article in 1899, assumed the Fessenden's detector patent was invalid because it was already in the public domain, and set his assistant Babcock to design a practical form of the detector "using a minute insulated end . . . which had not been patented." De Forest then says: "In the meantime a patent suit was brought by Professor Fessenden against our recent deployment of the Wollaston-wire form of electrolytic detector, or rectifier. After some weeks of experimentation Babcock produced

what we call a spade electrode . . ."¹²⁶ De Forest omits the fact that Vreeland gave him a version of Fessenden's Wollaston wire detector in August 1903, and that he ordered "two Chinese copies" be made on October 1, 1903. De Forest took one to Howeth/Holyhead, Ireland in late October 1903 for a demonstration to the GPO, and sent the other one to the U.S. Signal Corps for a demonstration between Forts Schuyler and Wright across Long Island Sound. De Forest's first Wollaston wire electrodes were virtually identical to Fessenden's patented electrode.¹²⁷ De Forest says that Fessenden filed suit against De Forest while Babcock was designing the spade detector, but Fessenden filed his first suit in mid-1904 for De Forest's infringement of his circular form of the electrode, while Babcock did not begin to work on the spade form until after the suit was adjudicated in favor of Fessenden on October 6, 1905. De Forest's account makes it sound like the first and only detector he developed was the spade detector, a factual error stated by many historians.

Was De Forest's Transatlantic Experiment a Success or a Failure?

As stated previously, Abraham White sent Lee De Forest to Glengarriff, Ireland, to set up an ad hoc station (using a kite as an antenna) from late March to early April 1906 for the express purpose of demonstrating that the De Forest System could receive transatlantic signals sent from the company's 40 kW station situated at Manhattan Beach, Long Island. Abraham White

placed a large display ad in the *New York Times* appearing on April 8, 1906, with the bold announcement: "TRANS-ATLANTIC WIRELESS" followed by a portion of the message he claimed De Forest had sent him on April 6: "Messages Being Received Clearly. Transatlantic Wireless Now Assured. —De Forest (Fig. 35)."¹²⁸ If one compares the accounts in the press in 1906 with the account De Forest gave in his

autobiography in 1950,¹²⁹ one will find startling differences that cannot be reconciled, some of which are summarized below. It will become clear once again that White, who controlled all press releases for the De Forest companies, was not particularly concerned with the truth.

First, White had stated that De Forest confirmed to him that messages were sent on or before April 6,

TRANSATLANTIC WIRELESS

American De Forest Wireless Telegraph Company

ANNOUNCEMENT.

Cork, Ireland, April 6, 1906.

Abraham White, President
American De Forest Wireless Telegraph Co.
42 Broadway, New York.

MESSAGES BEING RECEIVED CLEARLY.
TRANSATLANTIC WIRELESS NOW ASSURED.
DE FOREST.

On behalf of the American De Forest Wireless Telegraph Company I wish to announce the successful transmission of aerographic communication across the Atlantic Ocean direct, without a single relay, from the Manhattan Beach wireless station, employing 40 kilowatts (30,000 volts of electricity) at the rate of 20 words per minute, to a point on the other side of the Atlantic in Glengarriff Harbour, County of Cork, Ireland, where Dr. Lee De Forest, the young American inventor of wireless telegraphy, received accurately and clearly the messages recently aerographed to him. The following confirmation was received by me on April 6 from Dr. Lee De Forest:—"MESSAGES BEING READ CLEARLY. TRANSATLANTIC WIRELESS NOW ASSURED."

Dr. Alexander Graham Bell, the distinguished inventor of the telephone, has co-operated with us in this great work, having sent a representative to England with

Dr. Lee De Forest for the purpose of conducting experiments with his tetrahedral kites in connection with the De Forest Wireless Telegraphy system, the kites being elevated and used instead of the ordinary masts. The kites were originally intended for practically exclusive use in connection with aerial navigation, but have been found to be exceedingly useful and valuable for wireless work, as was recently demonstrated also at Dr. Bell's laboratory in Virginia when wireless messages were received from distant points. Dr. Alexander Graham Bell is now in England, and is co-operating with us in this work. The De Forest wireless system now holds the world's wireless record in both overland and marine transmission. Its work for the United States Government; President Roosevelt, during his memorable trip from New Orleans to Washington on the United States battleship West Virginia; the Standard Oil Company, whose oil-carrying steamers employ the De Forest system exclusively, and the many steamship lines using this system is a matter of history. Our system now covers the Atlantic, Gulf and Pacific seaboard, as well as a great chain of overland wireless stations from Maine to California and from the Great Lakes to New Orleans.

I NOW PREDICT THE SUCCESSFUL TRANSMISSION OF TRANS-PACIFIC WIRELESS BY THE SYSTEM OWNED BY THE AMERICAN DE FOREST WIRELESS TELEGRAPH COMPANY.

ABRAHAM WHITE, President.

Fig. 35. Abraham White placed a large display ad in the *New York Times* appearing on April 8, 1906 with the bold announcement: "TRANSATLANTIC WIRELESS" followed by the message he claimed De Forest had sent him on April 6: "Messages Being Received Clearly. Transatlantic Wireless Now Assured. —De Forest."

whereas De Forest writes that his very first contact with the New York station occurred on April 11, not on or before April 6 as White reported. Second, De Forest states that he had no luck in receiving any signals at Glengarriff, and moved his ad-hoc station some 30 miles west to Cahmore, where he claims to have made contact—not at Glengarriff as White stated. Third, De Forest wrote that he sent Mac Horton, his crack telegraph operator, back to London when he departed Glengarriff on April 1, and there was no longer anyone with him who could receive messages after April 1. De Forest admitted that he could not read the code, which he estimated to be between 20 and 25 words per minute (wpm). He stated he heard messages but could not copy them, while White claims De Forest received an 800-word message.

De Forest claimed that instead of receiving a message, he recognized the sign-off signal “DF” used by the Manhattan Beach station. De Forest also wrote, “The speed of ‘DF’s’ sending was far too fast for my fist to follow.”¹³⁰ The letters DF (--- ---) have 18 dot-equivalent spaces, which constitute approximately one-third of a word (a standard Morse word has 60 dot equivalents including spaces). At 20 to 25 wpm, the seven characters of Morse code plus spaces constituting the letters DF would have been transmitted in approximately one second. It would be something of a stretch for the untrained ear to pick out the station call letters DF at 20–25 words per minute, particularly if the DF was sent in a

train of pulses interspersed somewhat arbitrarily with the letter “D,” as Frank Butler claims he did.

De Forest’s own words in his autobiography speak volumes about his ability to understand the letters DF when he writes: “But I, not foreseeing the long wind delays and Horton’s too early departure, erred in the other direction [by sending whole messages] . . . with no simple succession of dots at all.”¹³¹ De Forest is saying here that he wished he had planned to have a simple pattern transmitted that could be easily recognized by anyone (e.g., the triple dots transmitted by Marconi). De Forest concluded that his test was “equally as convincing as was the succession of triple dots which Marconi pulled in from a kite string four years ago.”¹³² That sounds about right. Neither Marconi nor De Forest had neutral observers or any documentation to prove they heard the signals, nor did either attempt to repeat their respective experiment.

Regardless of what De Forest may have said or heard, it is obvious that White’s account was a total fabrication. White says that De Forest received a complete message of 800 words on April 6, while De Forest writes: “Had Horton been able to remain one week longer, he would undoubtedly been able to copy that night (April 11) the first wireless messages ever transmitted across the Atlantic; certainly the first from West to East.”¹³³ De Forest has his own credibility problem with regard to receiving messages. While he clearly stated in his autobiography that neither he nor Horton, his crack

The Rise and Fall of the De Forest Companies

telegrapher, ever received any messages, he claims that he did receive messages flashed across the ocean in an interview with an *Electrical World* correspondent upon his return:

“ATLANTIC WIRELESS.—Dr. Lee De Forest, on his return from the other side, asserts that actual transmission of signals with the system has occurred across the Atlantic. ‘My Irish experiments,’ he says, ‘were very satisfactory. They were conducted with the Bell kites and elevated conductors, and I am able to vouch absolutely for the truth of the story that messages were flashed across the ocean from Manhattan Beach to Bantry Bay, Ireland, where the receiving station was located. The distance over which the message traveled was a little more than 3,000 miles.’”¹³⁴

The highly controversial results of this De Forest’s transatlantic experiment are best summed up by an article appearing in the *Washington Times* on the one-year anniversary of the heavily advertised event:

“White did not intend to be beaten by the Marconi people. So he sent De Forest to Glengarriff Harbor, County Cork, Ireland, to receive a transatlantic message from the De Forest Manhattan Beach station. It would be unkind to suggest that the 800-word history of wireless telegraphy, which White

says he sent through the ether to Glengarriff Harbor, was in De Forest’s pocket before he set sail for Ireland. This great achievement in aerography was recorded more than a year ago. Since then nothing has been heard of the art in connection with the De Forest companies, and it may be that transatlantic aerography is one of the lost arts. It certainly does seem strange to a layman that, after sending an 800-word message across the Atlantic, nothing more was heard of transatlantic messages. The cable companies still continue to do business, and the owners of the cable securities do not seem to be lying awake nights worrying over aerograms.”¹³⁵

Lee De Forest is Terminated

After De Forest returned to the U.S. from his failed transatlantic experiment and his four-week stay in Canada to avoid incarceration, he sensed a great deal of antagonism coming from Abraham White and C. C. Wilson, then the Vice President of the American De Forest company and a close associate of White. They were both upset with De Forest, blaming him not only for the litigation with Fessenden, but also the many lawsuits involving De Forest companies that had taken place over the past four years—not to mention the arrest warrant issued for White and the contempt finding against White and the company. Further, Dunwoody had discovered the carborundum crystal detector that had

finally provided the company with a non-infringing, inexpensive, reliable and sensitive detector—something that had eluded Lee De Forest since the inception of the De Forest companies. The cold-shoulder treatment that White gave De Forest in the summer and fall of 1906 soured him on his onetime mentor and close confidant. De Forest's four-page entry in his diary dated September 30, 1906 reads like a soliloquy from a Shakespearian play in which he relates the slings and arrows of outrageous fortune that have beset him. The following three sentences from his diary give a sense of his thoughts that presaged the outcome: "I am daily more disgusted with the man [Abraham White] and this newly-revealed side of his character. I will never be intimately connected with the metamorphosed 'Schwartz' again. . . . I am done with White. While the Co. floats I will work for it, but I will search for another man of vision and honest common sense, who can sanely finance my further institutions; that I be not always the mendicant, the 'Tramp of Fortune,' which White has delighted to make of me."¹³⁶

By November, the die had been cast, and De Forest wrote his often-chronicled letter of resignation to Abraham White dated November 28, 1906.¹³⁷ De Forest claims in his autobiography that he decided to resign when he heard White had created the United Wireless Telegraph Company for the purpose of consolidating the American Marconi company with the American De Forest company:

"When I learned of this situation, I indignantly resigned and offered to turn back into the stock-empty treasury of the American De Forest company all of my stock, amounting to some 20% of the entire capitalization. In exchange I demanded only the full rights to any pending audion and Aerophone patents, \$1000 in cash, and a general release and quitclaim. Saurian-eyed C. C. Wilson greedily grabbed at this quixotic offer on my outraged part . . . and Farnsworth advised the company to accept my proposition stating that the patent applications in question had no value, that my contributions had been negligible from the start of the enterprise!"¹³⁸

The first sentence of the paragraph on the next page of his diary begins with: "Even before being booted out the company . . .," which indicates that he was forced to resign. Whether or not he resigned of his own volition or was forced to resign is a matter of conjecture. A much more important issue is what De Forest received in exchange for his considerable stock. In the paragraph cited above, De Forest states that he received "full rights to any pending audion and Aerophone patents, \$1,000 and a general release and quitclaim." Indeed, virtually all historians have interpreted this statement to mean De Forest received only \$1,000 and full rights to his audion patents pending, ignoring the words "general release and quitclaim"—most likely assuming

they were merely “boiler plate” that often appears in such agreements. However, an entry in his diary dated November 29, 1906, hints at something entirely different. He offers to surrender all of his stock in exchange for a “quit-claim” for all his patent rights and inventions—not just those limited to audion or pending patents—and license rights back to other patents previously assigned to the American De Forest company:

“As for myself I have offered to surrender all of my stock for a quit-claim to my patent rights and inventions (if necessary the Am. DeF Co. to operate under the ‘loop patent’ as a license). ‘The Company,’ i.e., White claims to use nothing of my origination now . . . , so that it is more than a fair trade on my part—a pitiable reward for those years! I ask only the chance to again begin with a free hand, in a field not free but now crowded; to interest new (and honorable and genuine capital), to develop my ideas, to follow by best, to vindicate myself. The use of the alternating current, telephone receiver, the tuning arrangements, a host of necessary mechanical arrangements, the loop antenna—all these, albeit many unpatentable, are my productions, at least independently and early conceived, and many other some-day-to-be most valuable ideas, justify the faith in me.”¹³⁹

In the first two sentences, De Forest offers to exchange all his stock in the American De Forest company for ownership of his patent portfolio, with an option for the American De Forest company to lease back his patent rights. De Forest cites the “loop patent” as an example of such a lease. De Forest’s loop patent, No. 749,131, was assigned to the original Wireless Telegraph Co. of America, and subsequently leased to the De Forest Wireless Telegraph Co. for 99 years, a lease that was later transferred to the American De Forest Wireless Telegraph Co. In the last two sentences, De Forest made a case that he needed access to his patents for “alternating current, telephone receiver, the tuning arrangements, a host of necessary mechanical arrangements, the loop antenna” to continue in the wireless business.

The bold assertion here that De Forest retained an interest in all of his patents is supported by an article De Forest wrote in June 1907 explaining what he received in exchange for his stock. He begins by stating that he voluntarily returned all of his stock with a par value of \$1,250,000 (125,000 shares) back to the depleted treasury of the American De Forest company. He then writes: “In exchange I received a license to use all patents which I had assigned the American De Forest Wireless Telegraph Co., and a promise of \$1,000.”¹⁴⁰

The interpretation that he received a quitclaim for many of his patents is contrary to conventional wisdom, but it is fully supported by the contract De Forest signed in 1917 transferring rights and ownership of his entire

patent portfolio to Western Electric for \$250,000. The contract with Western Electric dated March 14, 1917 lists virtually all De Forest patents in two schedules, Schedule A and B. In Schedule A De Forest warranted that he owned all the rights to patents listed, free and clear of any encumbrances:

*“And the De Forest Company covenants with a warrant to the Western Company, its successors and assignees that it owns and controls the entire right, title and interest in, to and under each and all of the patents, applications of patents and inventions listed or intended to be listed in said schedule A, free and clear of any adverse assignment, grant, mortgage, license and every other encumbrance . . .”*¹⁴¹

Included in Schedule A were listed all of De Forest’s patents issued after October 31, 1904 with the exception of single patent 806,966 issued on Dec 12, 1905, which was on Schedule B as described in the next paragraph. These patents covered the non-obsolete technologies that De Forest would need in the future.¹⁴² It seems clear that De Forest received the equivalent of a quitclaim deed to his these patents. If not, how was De Forest able to guarantee ownership without encumbrance to Western Electric? If United Wireless had retained the rights to De Forest patents, those rights would have been transferred to American Marconi when it purchased the assets of the bankrupt United Wireless in 1912, but that did not happen.

Included on Schedule B were the De Forest patents beginning with his

first patent No. 716,000 issued on Dec. 16, 1902 up to his patent No. 802,981 issued on October 31, 1904—plus patent 806,966 issued on Dec. 12, 1905—for a total of 27 patents. According to the agreement with Western Electric, De Forest warranted that he had transferable rights or interests in these patents, but in this case the warrantee did not preclude encumbrances. Thus, the language characterizing patents in List B was consistent with De Forest receiving transferable lease rights but not unencumbered ownership. The assertion that De Forest received quitclaims and licenses for his patents is supported by a letter from De Forest to Frank Butler dated Dec 15, 1906, which states in part, “I have now got all my quitclaims, licenses, and contracts signed and hope to begin again on the ‘Telephone’ in a few days.”¹⁴³

United Wireless Co. Absorbs American De Forest Wireless Tel. Co.

By all accounts, the American De Forest Wireless Telegraph Co. was in dire financial straights by the end of 1906. The available stock for sale to potential investors was oversubscribed, and the income from operations did not come close to covering the overhead. The dire situation prompted White to invite American and foreign scientist and industrialists to his estate known as White Park to discuss potential solutions to the problem. Conferences were said to take place over a period of several months, ultimately resulting in the implementation of the grandest scheme of all—the consolidation of the

American De Forest Wireless Telegraph Company and its subsidiaries with the Marconi Wireless Telegraph companies of both America and England.¹⁴⁴ The resulting company would be a monopoly of wireless telegraph companies in all English speaking countries.

Hints of a grand scheme to merge the two Marconi Wireless Telegraph companies into the new United Wireless Telegraph Company reached the press as early as November 7, 1906, by way of ads placed by stockjobbers before any official announcements appeared in the press (Fig. 36).¹⁴⁵ Details of the proposed consolidation first appeared

in major newspapers and financial publications circa November 16, 1902.¹⁴⁶ Many publications stated that White had begun the process of consolidating the American De Forest and Marconi wireless telegraph companies by forming the United Wireless Telegraph Co., a new company with a market capitalization of \$20,000,000, and with White as president of the new company.

Many different versions of the proposed merger appeared in the press—Marconi officials had agreed to the merger, they were opposed to the merger, or they were unaware of the merger. American De Forest officials

**A Big Consolidation of
American DeForest Wireless
and Its Subsidiary Companies**

is reported to be in process of formation and it is understood that the new company will be called the **"United Wireless Company,"** which company will also control the Poulsen patents and possibly the Marconi companies. This will be a world-wide consolidation and ought to boom the **American DeForest** stock tremendously. If you wish to buy some of this stock cheap, in fact cheaper than can be profitably sold by any authorized agent in Syracuse, **See Me.** I also sell other stocks and bonds.

G. L. BENJAMIN,
537 University Block. Syracuse, N. Y.
Agents Wanted

Fig. 36. Hints of a grand scheme to merge the two Marconi Wireless Telegraph Companies into a new United Wireless company reached the press as early as Nov. 7, 1906 by way of ads placed by stockjobbers before any official announcements appeared in the press. (*Syracuse Standard*, Nov. 7, 1906, p. 14)

claimed that the new company had acquired a large or even a controlling interest in the stocks of the American Marconi company and/or the parent English Marconi company, but officials of both Marconi companies denied these reports. The two Marconi companies also claimed there was no deal between the Marconi and United Wireless companies, and they had no interest in any deal with United Wireless.¹⁴⁷

According to newspaper reports, White used the Amalgamated Wireless Securities Company, a holding company created on Dec. 8, 1904,¹⁴⁸ to effect this merger. White had originally organized Amalgamated Wireless to secure ownership of the American De Forest company and its subsidiaries with a broad charter covering the entire field of wireless telegraphy in America and all foreign countries.¹⁴⁹ The real reason for creating the company, which was incorporated in the State of Maine with a market capitalization of \$10,000,000, was to create an additional 1,000,000 shares of stock to sell. The additional dilution of the American De Forest stock was too much for even White's cronies, and they had forced him to abandon his plan to sell securities under the Amalgamated Wireless name back in 1904.¹⁵⁰

Since the Amalgamated Wireless company was already incorporated and already owned the American De Forest Wireless Telegraph Co., it was a simple matter to change the name to United Wireless Telegraph Company and recapitalize the company at \$20,000,000. According to both the incorporation papers filed with

the state of Maine and an article in the *Oakland Tribune*, the name was changed to United Wireless Telegraph Company effective November 17, 1906.¹⁵¹ According to the *Wall Street Journal*, stock quotations appeared on the "Curb" market beginning on November 24, 1906.¹⁵² The change in name clearly occurred before Lee De Forest submitted his resignation letter on November 28, 1906, so that it can be said the American De Forest Wireless Telegraph Company ceased to exist as an operating entity when Lee De Forest resigned from the company effective November 28, 1906. It was not long after that the assets of the American De Forest company and its subsidiaries were transferred to United Wireless, and the stock in those companies was exchanged for United Wireless stock.

Thus ends the story of Lee De Forest and the wireless telegraph companies with which he had been associated up to November 28, 1906. Suffice it to say that White was unable to consolidate the Marconi companies with the American De Forest company and its subsidiaries into United Wireless. Lee De Forest and the United Wireless Co. parted ways after November 28, and the history of United Wireless Co. from that point became essentially independent Lee De Forest and his future De Forest companies. The story of the American De Forest Wireless Company is concluded here by identifying the subsidiary companies and the assets of foreign affiliates of American De Forest that were consolidated into United Wireless along with American De Forest itself.

The Rise and Fall of the De Forest Companies

Subsidiaries and Foreign Affiliate Assets Consolidated with United Wireless

The American De Forest Wireless Telegraph Company had three known domestic subsidiaries and two foreign affiliates that were created between March 14, 1904 (when it became the parent De Forest company) and November 17, 1906 (when it was merged into the United Wireless company). At the time of the merger, its subsidiaries were also merged into United Wireless, and the financial interests in its foreign affiliates were transferred to United Wireless. The subsidiaries and foreign affiliates identified in the course of this study are listed in Table 8 along with the approximate dates of incorporation, capital stock issued or owned, and the percentage of issued stock initially owned by the American De Forest company. A short paragraph describing each entry follows.

The **Atlantic De Forest Wireless Company** was organized as a subsidiary of American De Forest Wireless

Telegraph Co. on November 21, 1904 in the state of Maine with an authorized capital of \$500,000,¹⁵³ which was raised to \$1,000,000 in 1905.¹⁵⁴ The American De Forest Wireless Company owned 55% of the capital stock of the Atlantic company, and Abraham White and his associates owned the other 45%.¹⁵⁵ The stock of this subsidiary, which is the only De Forest entity said to make a profit from operations, was never offered to the public. The Atlantic De Forest Wireless Co. focused on ship-to-shore communications using land stations located on the Atlantic, Pacific and Gulf Coasts. It controlled the De Forest Marine Service Company located on the Atlantic Coast. There was also a British branch of the Atlantic De Forest Wireless Co.¹⁵⁶

The **De Forest Great Lakes Wireless Company** was incorporated as a subsidiary of the American De Forest Wireless Telegraph Co. in the state of Maine on Dec. 30, 1905, with an authorized capitalization of \$500,000.¹⁵⁷ By

Table 8. American De Forest Wireless Co. Domestic Subsidiaries and Foreign Holdings.

	Entity	Date of Incorp.	Initial Capitalization	Holding
Subsidiary	Atlantic De Forest WTC	11/21/1904	\$500,000 ¹	55% ²
	De Forest Great Lakes WTC	12/30/1905	\$500,000	100%
	De Forest Occidental and Oriental WTC	02/09/1906	\$2,000,000	100%
Foreign Holding	Dominion De Forest Wireless Telegraph Co., Ltd	~03/1905	\$1,200,000	50%
	De Forest Wireless Telegraph Syndicate, Ltd. of London	07/18/1905	£120,000	21%

¹Capitalization was raised to \$1M on Dec. 9, 1905. ²White and associates owned the remaining 45%.

that time American De Forest already had more than five stations on the Great Lakes, so the creation of this subsidiary in 1906 must have been either a ploy to create more stock for sale and/or to better position itself to compete with the Clark Wireless Telephone and Telegraph Co., which was expanding its wireless activities on the Great Lakes at the time.

The **De Forest Occidental and Oriental Wireless Company** was incorporated as a subsidiary of the American De Forest Wireless Telegraph Co. in the state of Maine on February 9, 1906, with an authorized capitalization of \$2,000,000.¹⁵⁸ The subsidiary was granted “all the rights on the Pacific Coast and Nevada, extending as far north as Alaska, and taking in the Pacific Ocean, Hawaii, Guam, China and Japan together with the right to manufacture on the Pacific Coast all instruments needed in the establishment of stations.”¹⁵⁹

The **Dominion De Forest Wireless Telegraph Company, Ltd.** was organized as a Canadian affiliate circa March 1905 in Ontario, Canada, with an authorized capitalization of \$1,200,000.¹⁶⁰ The Dominion Wireless company had a contract with the American De Forest company that granted it rights to all patents owned by American De Forest (or that it might have an interest in) for use in the Dominion of Canada and Newfoundland.¹⁶¹ American De Forest owned 50% of Dominion’s stock, but only three of the seven directors were American De Forest employees—Abraham White, Francis

Butler, and Lee De Forest, which means that American De Forest did not control the Dominion Wireless company. Thus, American De Forest’s interests in this company were transferred to the Untied Wireless company but there was no merger. De Forest Dominion had ambitious plans to erect approximately eighty stations in a number of provinces throughout Canada as well as a transatlantic and transpacific station on either coast. However, by the end of 1907, the Dominion Wireless company had run into serious financial problems, and by the end of 1908 it was taken over by the Northern Commercial Telegraph Company.¹⁶²

The **De Forest Wireless Telegraph Syndicate, Ltd.** was registered on July 18, 1905. It was a British affiliate with a capitalization of £120,000 at £1 per share for a total of 120,000 shares “to carry on the business of owners of wireless and other telegraph systems, patents and concessions, etc.”¹⁶³ There were initially six subscribers—most notably Lord William Armstrong, the first scientist and engineer to join the House of Lords—each with one share; no shares were initially offered to the public. According to the *Chronicle*, the American De Forest company received 25,000 shares of stock, which amounted to 21% of the authorized shares. Prior to its registration in 1905, Syndicate announced an agreement to pay the American De Forest company £125,000 for rights to use the De Forest patents in the UK.¹⁶⁴

On September 16, 1906, the De Forest Syndicate registered a new

company—the Amalgamated Radio-Telegraph Co., Ltd.—which it had created to amalgamate and operate the interests of the Poulson Wireless Telegraph Co. patents, as well as the De Forest and Maskelyne patents, and others unnamed.¹⁶⁵ Lord Armstrong was chairman of this entity with a share capital of £500,000 that was partially subscribed with private capital from British industrialists. No public money was invested in this undertaking. American De Forest's interest in this company was transferred to the United Wireless company, but again there was no merger. In July of 1907, the De Forest Wireless Telegraph Co., Ltd. voluntarily wound up its affairs, and the De Forest Syndicate ceased to exist as a separate entity.¹⁶⁶

Summary

The key takeaway from this paper is that the conventional histories of the first three De Forest companies written by most historians are incorrect or incomplete in many details, some of which are particularly relevant. For example, most historians are confused about the creation of the American De Forest Wireless Telegraph Company, most likely because De Forest's published autobiography mistakenly referred to the creation of the American De Forest Wireless Telegraph Company when it was actually referring to the creation of the De Forest Wireless Telegraph Company. De Forest had corrected the draft of the manuscript by hand but the corrections were never included in the final manuscript. As a result, most authors

state the name of the De Forest Wireless Telegraph Company was changed to the American De Forest Wireless Telegraph Company in late 1902, or in some cases state it was merged into the newly created American De Forest Wireless Telegraph Company. In fact, the American De Forest Wireless Telegraph Company was created as a subsidiary of the De Forest Wireless Telegraph Company on December 3, 1902, and operated as a subsidiary in parallel with the parent De Forest Wireless company for approximately one year until March 14, 1904, at which time the parent De Forest Wireless company was actually merged into the American De Forest subsidiary and the American De Forest Wireless Telegraph finally became the parent. Confusing? Blame it on Abraham White, who created the American De Forest company as a subsidiary primarily to create more stock to sell.

As a second example, despite the many successes reported in the press by the De Forest Wireless and American De Forest companies during 1902 and 1903, they were both actually abject failures because the De Forest System was limited to a nominal range of 50 miles due to the lack of a sensitive and reliable detector. Virtually all of the successes reported by Lee De Forest and Abraham White during 1902 and 1903 were vastly overstated or falsified. Only after Lee De Forest introduced Fessenden's electrolytic detector into the De Forest System in early 1904 did American De Forest actually begin to have substantive successes. In fact, sworn testimony by several De Forest employees reveals

that De Forest actually made “Chinese” copies of Fessenden’s detectors from one of two prototypes that Frederick Vreeland brought with him when he joined the De Forest company in late 1903 after leaving the employ of Fessenden. Many historians believe De Forest’s account that De Forest assistant Clifford Babcock developed an improved version of the electrolytic detector in late 1903, and they fail to give Fessenden sufficient credit for the successes of the De Forest System in 1904 and beyond.

An example of an omission in the historical accounts of De Forest exploits is the lack of any reference to the needle detector that Lee De Forest designed and patented in late 1902 and used throughout the entire De Forest System during all of 1903. De Forest developed this new needle detector most likely because the goo detector was so unreliable, not because it was much more sensitive. Even more astonishing is the fact there is no mention of a needle detector in his autobiography or any other of his writings. In fact, De Forest stated quite erroneously on page 162 of his autobiography that he replaced the goo detector by the his “spade” electrolytic detector (based on Fessenden’s design) circa 1904, when in fact he replaced the goo detector with his new needle detector in early 1903. The startling discovery that he developed and deployed a needle detector in the De Forest System for almost a year has never been chronicled.

The errors, omissions, and distortions found in De Forest’s book, three

of which are summarized in the above paragraphs, correlate well with those appearing in historical accounts by many historians. Clearly, authors and historians have been misled by De Forest’s accounts that aggrandized his own accomplishments and those of the early De Forest Wireless companies. Authors and historians would be well advised to quote his autobiography only after checking the veracity of the material with other sources.

The second and last installment of this story begins in 1907 with De Forest’s discovery of the three-element vacuum tube with an intervening grid, something he discovered after leaving the employ of the American De Forest company. While De Forest copied Fleming’s two-element valve when he was employed by American De Forest, it was deemed to be worthless, and it never had any impact on the performance of the American De Forest company or its successor, United Wireless. Hence, it was not addressed in this installment.

Author’s Note

In the course of researching for this paper, I was struck with the complicity of Lee De Forest in Abraham White’s many stock schemes. While White misrepresented the value of the stock and the accomplishments of the De Forest companies, it was De Forest who enabled White to do this by misrepresenting the value and capabilities of his technologies in his many writings and interviews. De Forest regularly participated in outright fraud such as

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arranging to send fake stock reports from the wireless Auto No. 1 from the curb to offices in the financial district of New York, and making false statements to the press such as his claim that he received transatlantic messages in Ireland from the Manhattan Beach Station in 1906, when in fact he admitted in his autobiography 40 years later that he did not receive any messages. In the NESCO vs. De Forest litigation, De Forest employees testified to many more misstatements and frauds of a technical nature in which De Forest was complicit. As a result, a number of his failures were actually reported in the press and in his autobiography as successes.

Perhaps the greatest fraud of all chronicled here was De Forest's claim that he developed and implemented an alternate form of Fessenden's electrolytic detector, when in fact several former De Forest employees testified under oath that Lee De Forest ordered Chinese copies of Fessenden's detector be made from copies Vreeland brought to Lee De Forest when he entered his employ in the late summer or early fall of 1903. De Forest then directed they be used in demonstrations between Holyhead and Howth, Ireland, at the demonstrations at Ft. Wright, New London, and Ft. Schuyler sponsored by the Army Signal Corps, in the reporting of the Russo-Japanese War, and at the St. Louis exposition. The real fraud was not that De Forest's detector infringed on Fessenden's patent, which it did, but that De Forest claimed he developed a form of the detector that he believed

did not infringe when, in fact, he simply made Chinese copies of detectors in Vreeland's possession—and he then advertised the detector as his own. As a result, De Forest received accolades for what he described as the De Forest System, when in fact, the most important part was a detector pirated from Fessenden.

In the end, De Forest blamed Abraham White and his lavish life style for all the ills that befell the De Forest companies. He wrote in his diary that he would search for another man of vision and honest common sense, who could sanely finance his further institutions. De Forest seemed to be blind to the fact that the financial problems of the De Forest companies were due to a business model in which stock sales were used to finance and operate the company without any plan to make a profit. To finance company operations from the sale of stock without any intent to reach breakeven is clearly a pyramid scheme, if not a Ponzi scheme. The increase in the market capitalization of the stock offered by the two De Forest companies over the five-year period from 1902 to 1906 from \$3M to \$20M (see Table 9) are way out of line with increase in revenues or market value

Table 9. Market Capitalization of De Forest Companies by Event and Date.

Event	Date	Event Market Cap.	Cumulative Market Cap.
Initial Cap. De Forest Wireless	02-19-02	\$3M	\$3M
Initial Cap. American De Forest	03-03-02	\$5M	\$8M
Acquisition of Internat'l Wireless	04-14-04	~\$7M	\$15M
Initial Cap. United Wireless	11-17-06	\$5M	\$20M

of the two companies during the same period. Clearly, even the honest financier that De Forest wished for would not have helped the De Forest companies. De Forest was upset with White only because he, De Forest, did not receive a greater portion of the largess from White's scheme to sell worthless stock.

Notes

1. E. P. Wenaas, *What's "de" Story on the Spelling of Lee De Forest?*, *AWA Journal*, Vol. 56, No. 1, Winter 2015, p. 40–47; Vol. 57, No. 2, Summer 2015, pp. 50–58. While Lee De Forest generally signed his private letters with the surname "de Forest," he and the press used the De Forest form most often in his publications. For example, the De Forest spelling was used in virtually all of the references cited here. As discussed in this reference, the single sentence and footnote appearing in his autobiography that is often cited to prove that he preferred the de Forest spelling is specious. In fact, there is no factual evidence that Lee preferred the de Forest form over any other of the three forms he used somewhat indiscriminately.
2. "Lee De Forest papers, 1884–1955," Manuscript Division of the Library of Congress (hereinafter referred to as De Forest Diaries). The diaries can be located as follows: Box 3 contains Diaries 1–15 with entries dated 1891–1902, and Box 4 contains Diaries 16–23 dated 1903–1949.
3. *NESCO vs. De Forest* will be used hereinafter as the title for the following reference: Wm. Houston Kenyon (of council for Complainant), *National Electric Signaling Company vs. DeForest Wireless Telegraph co., et al., Defendants, in Equity No. 8649*, (C. G. Burgonye, N.Y, Aug. 5, 1905).
4. Lee de Forest, *Father of Radio*, (Wilcox & Follett Co., Chicago, 1950).
5. Lee and Marie de Forest Papers, History San Jose, Box 37, Folder 2: Lee de Forest, *Father of Radio*, unpublished version of De forest's autobiography dated 1949.
6. *Ibid.* p. 130–131; There are two separate but related vignettes in which the activities of the De Forest Wireless Telegraph Co. are described, but the company is incorrectly identified in both cases as the American De Forest Wireless Telegraph Co.; consequently, the discussion makes no sense.
7. On page 125 of De Forest's autobiography, he states: "the assassination of President McKinley caused the postponement of the International Races (in 1901) for five weeks." He goes on to say that this delay enabled him to complete the apparatus and install it the day before the races. In fact, by all accounts, the assassination delayed the races by only five *days*, which means his description of the timing of events in August and September is in error. See *American Monthly Review of Reviews*, Vol. 24, Oct. 1901, p. 412 for the planned and actual dates of the International Races in 1901.
8. "New Wireless Telegraph Succeeds in Four-Mile Test in the City," *Chicago Tribune*, July 20, 1901, p. 4.
9. "Notes," *The Electrician*, Oct 5, 1900, Vol. 45, p. 878. When referring to wireless receivers, the article states: "May they not be called 'responders'? Distinctly, when we remember the entire action that goes on, we see the apparatus does more than receiver radiation—it *responds* to it."
10. "A New System of Space Telegraphy," *Western Electrician*, Vol. 29, July 27, 1901, p. 50.
11. R. A. Fessenden, "Receiver for Electromagnetic Waves, Reissue Patent No. 12,115, application filed May 5, 1903, issued May 26, 1903.
12. *Father of Radio*, p. 124.
13. *Father of Radio*, p. 124; De Forest writes: "Three weeks after I came out east, and only a month before the International Yacht Races, the actual work of construction began." Since the races began on Sept. 28 1901, one month before that would correspond to Aug. 28. He wrote that he came out east three weeks before that date, which would correspond to Aug. 7, 1901.
14. *Minute Book of "Wireless Telegraph Company of America*, History San Jose, De Forest Collection, Box 10, Folder 1, p. 25. The minutes state that Seidler was elected "Chairman," but letters from Seidler to Smythe dated Dec. 18, 1901 and Dec. 24, 1901 make it clear that he was also elected president (History San Jose, De Forest Collection, Box 2, Folder 3).
15. *Ibid.*, p. 27.
16. "Columbia V. Shamrock II. Reported by Wireless Telegraphy," Vol. 48, *Electrician*, Oct 25, 1901, p. 3; "Syntony a la Mode," *Western Electrician*, Vol. 29, Oct. 19, 1901, p. 252.

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17. "E. R. Holden and Co. Again," *Truth*, Vol. 57, May 4, 1905, p. 1139. Truth magazine characterized E. R. Holden and Co. in this way: "To those who know E. R. Holden and Co., and especially to those who were swindled by its instrumentally, the suggestion that it is connected with 'any thoroughly sound business enterprise' looks a trifle extravagant."
18. Letter from Seidler to Smythe dated Dec. 11, 1902, History San Jose, De Forest Collection, Box 2, Folder 3.
19. *Ibid.*
20. Seidler was elected Chairman at a shareholder meeting on December 14, 1901, but it is not clear from the minutes who the president was at that time.
21. De Forest Diary, Dec. 22, 1902.
22. *Minute Book*, Box 10, Folder 1, p. 53.
23. S. Lubell, *Saturday Evening Post*, Jan. 24, 1942, p. 21. De Forest confirms that he first met White in early 1902 by stating that in January of 1902, "a new figure crossed my horizon . . . —Abraham White."
24. De Forest Diary Feb. 9, 1902.
25. The capitalization value of \$3,000,000 in the company White formed provides definitive proof that the Snyder contract with a capitalization value of only \$1,000,000 was somehow set aside in favor of the new agreement with White.
26. H. M. Heath, *Laws of Maine concerning Business Corporations with the Liberal Changes of 1901*, (Heath & Andrews, Augusta, Maine, 1902) p. 4. This book was a publication that extolled the advantages of incorporating within Maine, listing thirteen specific advantages on page 4.
27. "Certificate of Organization of a Corporation under the General Law" for De Forest Wireless Telegraph Company, dated Sept. 7, 1902 (Office of the Secretary of State, Bureau of Corporations, Elections and Commissions, Augusta Maine).
28. De Forest Diary, February 18, 1902.
29. *Ibid.*
30. The significance of the Feb. 28, 1902 date here is uncertain, given that the draft agreement was apparently prepared for signature sometime in June 1902 (as indicated in the 1st and 2nd line), and the agreement was actually approved by a majority vote of directors on May 5, 1902.
31. De Forest Perham Collection, Box 2, Folder 3.
32. *Minute Book*, p. 44.
33. De Forest Perham Collection, Box 2, Folder 3: "Articles of Agreement."
34. "Order, Supreme Court of the State of New York, Henry B. Snyder v. DeForest Wireless Telegraph Co., American De Forest Wireless Telegraph Co. Abraham White, Lee De Forest, et al.," (Stillman Appellate Printing Co., New York, 1906) p. 5–6. Among Snyder's pleadings in this document was the following demand: "... (2) the cancellation of a paper purporting to have been executed in the name of the said DeForest Wireless Telegraph Company on January 4th, 1904, which purported to grant to the said American DeForest Wireless Telegraph Company the right to use the franchises and assets and profits for the period of ninety-nine years from the 1st day of January 1904, at a nominal rental of no more than \$500 a year."
35. "De Forest Wireless System," *Electrician*, Vol. 49, Oct. 3, 1902, p. 943.
36. R. G. Blaine, "Wireless Telegraphy," *Engineering Magazine*, Vol. 34, Aug. 5, 1904, p. 201.
37. *Annual Report of the Chief Signal Officer for the Fiscal Year Ending June 30, 1902*, (Gov. Printing Office, Washington, 1902) p. 48; "The Work of the Signal Corps, Part III," *Western Electrician*, Vol. 31, Nov. 29, 1902, p. 387.
38. American De Forest Wireless Telegraphy Co. Display Ad, *New York Times*, Jan. 29, 1903, p. 13.
39. "Helpless to Remedy Evil," *Washington Post*, March 17, 1903, p. E7.
40. "The De Forest System of Wireless Telegraphy," *Scientific American*, Vol. 87, Aug. 16, 1902, pp. 102–103.
41. "The De Forest-Smythe Wireless Telegraph," *Western Electrician*, Vol. 31, July 19, 1902, p. 39.
42. "Wireless Telegraph Contracts," *Electrical World and Engineer*, Vol. 40, Aug. 2, 1902, p. 193.
43. "Marconi's Rival Scores a War Department Order," *Brooklyn Daily Eagle*, Aug. 6, 1902, p. 6.
44. "De Forest Wireless System in the War Manoeuvres," *Electrical World and Engineer*, Vol. 40, Sept. 13, 1902, p. 427–8.
45. "The Work of the Signal Corps. Part III," *Western Electrician*, Vol. 31, Nov. 29, 1902, p. 387.
46. "Government Tests Successful and Plants Will Be Immediately Installed," *Wall Street Journal*, Jan. 16, 1903, p. 7.
47. The complete news release consisting of one additional sentence appeared in a number of

- newspapers the next day. See for example: "Test Wireless System," *Norwalk Daily Reflector*, Jan 15, 1903, p. 5.
48. *Annual Reports of the Navy Department for the Year 1903*, (Government Printing Office, Washington, 1903) p. 373–374. The outlined tests referred to in this statement included transmissions between Annapolis and Washington, Annapolis and a moving ship, and between two ships at sea.
 49. De Forest Perham Collection.
 50. J. Munro, "Ether Telegraphy," *Electrical Review*, Vol. 44, June 2, 1889, pp. 883–885.
 51. Lee de Forest, "Receiver for Space Signaling," U.S. Patent No. 770,228, filing date Sept 24, 1902, patented Sept. 13, 1904, p. 2, lines14–18.
 52. NESCO vs. De Forest, testimony by Captain Wildman, U.S. Signal Corps, p. 279.
 53. *Ibid.*, p. 294.
 54. *Marconi Wireless v. Atlantic Communications Co.*, *Eastern District Court of New York*, testimony by Lee De Forest, May 8, 1915, p. 689.
 55. G. W. Pickard, "In Justice to the Crystal Detector," *Popular Science*, Vol. 101, Sept. 1922, p. 31.
 56. NESCO vs. De Forest; testimony by H. E. Ahearn pp. 87, 291.
 57. "Wireless Telegraphy on the 'Erin,'" *Electrical World and Engineer*, Vol. 52, July 4, 1903, p. 34.
 58. William Maver, Jr., *"Maver's Wireless Telegraphy: Theory and Practice"*, (Maver Publishing Co., New York, 1904) p. 107–120.
 59. *Ibid.*, p. 120.
 60. "Wireless Telegraph Company Formed," *Oakland Tribune*, Mar 11, 1903.
 61. "De Forest System of Wireless Telegraphy," *The Canadian Electrical News*, Vol. 13, March 1903, p. 40.
 62. "Short-Circuits," *The Canadian Electrical News*, Vol. 13, Aug. 1903, p. 177.
 63. Copland Testimony, NESCO v. De Forest, p. 298.
 64. Other foreign De Forest companies were formed later as subsidiaries of the American De Forest Wireless Telegraph Co. after it became the parent company in March 1904.
 65. American De Forest Co. Display Ad, *Fitchburg Sentinel*, Feb. 24, 1903, p. 2.
 66. American De Forest Wireless Telegraphy Co. Display Ad, *Electrical Age*, April 1903, Vol. 30, p. 15.
 67. "Exchange of Official Wireless Telegraph Message Across the Atlantic," *Electrical World and Engr.*, Vol. 40, Dec. 27, 1902, p. 1028.
 68. "Marconi Not Quite the Whole Thing," *Saint Paul Globe*, Jan. 15, 1903, p.1.
 69. "The Government's Adoption of a Young American's System After Thorough Tests on Land and Water," *New York Times*, Jan. 29, 1903, p. 13.
 70. "Station at Hatteras," *Charlotte News*, Jan 30, 1903, p. 3.
 71. W. F. Fawcett, "Spanning the Pacific by Wireless Telegraphy," *American Inventor*, Vol. 10, Apr. 1, 1903, pp. 185–6.
 72. "De Forest Wireless Telegraph on the Steam Yacht Erin," *Marine Engineering*, Vol. 8, Sept. 1903, p. 450.
 73. "Wireless for Navy," *Roanoke News*, Nov. 5, 1903, p. 4.
 74. "Out of Money, Plant of a Wireless Concern Attached on Judgments," *Morning Post* (Raleigh, NC), Mar. 29, 1904, p. 7.
 75. "Automobile Wireless Telegraph Stations," *Electrical Age*, Vol. 30, March 1903, pp. 183–184.
 76. NESCO vs. De Forest, J.P. Copland testimony, p. 296; also see bottom of p. 299.
 77. *Ibid.*, p. 299.
 78. "New Wireless Company," *Oakland Tribune*, March 11, 1903, p. 2.
 79. "The De Forest System of Wireless Telegraph," *Canadian Electrical News*, Vol. 13, March 1903, p. 40.
 80. "Short Circuits," *Canadian Electrical News*, Vol. 13, Aug. 1903, p. 177.
 81. *Commercial & Financial Chronicle*, 1904 Vol. 78, Part 1, Jan. 16, 1904, p. 230; note that the title of the company appearing in this notice is slightly different than the one appearing in all other publications referenced.
 82. "Wireless Telegraphy," *Poughkeepsie Daily Eagle*, Sept 26, 1902, p. 5.
 83. NESCO vs. De Forest, p. 302.
 84. *Ibid.*, p. 301.
 85. *Ibid.*, p. 303.
 86. *Ibid.*, p. 288.
 87. *Ibid.*, testimony by De Forest employee Mr. Lathrop, p. 284–5.
 88. The Webster definition of a Wollaston wire is "an extremely fine wire formed by a process (Wollaston process) in which the metal, drawn as an ordinary wire, is encased in another metal and the two drawn together, after which the outer metal is stripped off or dissolved."
 89. "American De Forest Wireless Telegraph.—Consolidation," *Commercial and Financial Chronicle*, Vol. 78, Jan. 16, 1904, p. 230.

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90. Robert D. Fisher, Ed., *Marvyn Scudder Manual of Extinct or Obsolete Companies*: 1930 – Vol. III, (Marvyn Scudder, New York, 1930) p. 501; The entry for DeForest Wireless Telegraph Co. states: “. . . its charter was suspended in 1907 for non-payment of franchise taxes.”
91. *Seventeenth Annual Report of the Board of State Assessors of the State of Maine*, (Kennebec Journal Print, Augusta, 1907) p. 247. There is no entry for De Forest Wireless Telegraph Co. in the *Eighteenth Annual Report* published in 1908.
92. M. I. Pupin, *Jarbuch d. Elektrochemie*, Vol. 6, 1899, p. 35 (translation by G. W. Pierce, “The Electrolytic Detector Studied with the Aid of an Oscillograph,” *Physical Review*, Vol. 29, 1909, p. 57); M. I. Pupin, “Platinum Electrolytic Cell,” *Electrical World*, Vol. 34, Nov. 11, 1899, p. 43.
93. NESCO vs. De Forest, p. 269. The context of “Chinese copy” is clear; Ives duplicated the Fessenden electrolytic detector in every detail, both good and bad.
94. De Forest autobiography, p. 161–162.
95. *Annual Report of the Chief Officer, U.S.A., for the Fiscal Year Ending June 30, 1904*, (Government Printing Office, Washington, 1904) pp. 12–13, 38–41. This is the best and most complete description of these tests.
96. *Annual Report of the Chief Signal Officer, U.S.A., for F.Y. Ending June 30, 1903*, (Government Printing Office, Washington, 1903) pp. 19–22.
97. NESCO vs. De Forest: Testimony on pages 278–280 supports the assertion that the goo detector was not successful in the test between the two forts, but the De Forest liquid barretter, which was used at the end of these tests, was successful.
98. “Long Distance Test of the De Forest Wireless Telegraph System,” *Electrical World*, Dec. 12, 1903, p. 979; also see H. J. Gloublitz, “The United States Government and the Wireless Telegraph System,” *Electrician*, Vol. 53, July 22, 1904, p. 566.
99. L. D. Wildman, *Wireless Telegraphy*, U.S. Patent No. 764,094; *Receiver for Space Signaling System* U.S. Patent 883,437.
100. “The De Forest Wireless Telegraph System,” *Electrician*, Vol. 52, Dec. 4, 1903, pp. 240–241.
101. The account given here is taken mainly from an article written by Captain Lionel James himself: “Wireless Telegraphy and War Correspondence,” *Journal Society of Arts*, Vol. 53, Jan. 20, 1905, pp. 204–14. For a more complete account of De Forest system used during this war see: Peter Slattery, *Reporting the Russo-Japanese War, 1904-5*, (Global Oriental, Folkestone, Kent, UK, 2004).
102. Ibid., p. 206.
103. “Getting War News by Wireless: Capt. James, Correspondent to the London Times and The New York Times Tell of His Experience,” *New York Times*, June 5, 1904, p. 11.
104. See for example, Display Ad, *United States Investor*, Vol. 15, April 2, 1904, p. 519.
105. De Forest’s autobiography is quite in error on page 162 when it states: “. . . the ‘goo’ type of antiocherer Responder which we had been using up to that date was officially replaced by the ‘spade electrolytic detector.’ The electrolytic detector actually replaced the needle detector in early 1903.
106. For example, see: “Wireless Telegraphy at the St. Louis Exposition,” *Electrical Age*, Sept. 1904, Vol. 33, p. 163.
107. History San Jose.
108. “De Forest Wireless Tests a Success,” *Telephony*, Vol. 8, Oct. 4, 1904, p. 311.
109. “Wireless for the Navy,” *Boston Transcript*, July 29, 1904, p. 13. L. Howeth, *History of Communications-Electronic in the United States Navy*, (U.S. Government Printing Office, Washington, 1963), p. 95.
110. Howeth, p. 94.
111. Ibid., p. 95.
112. Ibid., p. 93.
113. Frank Butler, “How Wireless Came to Cuba,” *Radio Broadcast*, Vol. 16, Mar. 1925, p. 922.
114. “Wireless Station Sold,” *Electrical World*, Vol. 47, March 31, 1906, p. 655.
115. *Investigation of Western Union and Postal Telegraph-Cable Companies*, (Government Printing Office, Washington, Feb. 16, 1909) p. 69.
116. “Fessenden Liquid Barretter Patent,” *Electrical World*, Vol. 43, March 5, 1904, p. 503.
117. “Wireless Telegraph Litigation,” *Electrical World*, Vol. 43, April 9, 1904, p. 714.
118. “The Fessenden Wireless Telegraph System,” *American Electrician*, Vol. 16, May 1904, p. 90.
119. National Electric Signaling Co. v. De Forest Wireless Telegraph Co., et al, *Federal Reporter*, Vol. 140, pp. 449–455 (A.K.A. 140 F 149).
120. R. A. Fessenden, “Wireless Telegraphy,” *Electrical Review*, Vol. 58, May 18, 1906, pp. 788–9.

121. "Personal," *Electrical World*, Vol. 47, Feb. 24, 1906, p. 433.
122. National Electric Signaling Co. v. De Forest Wireless Telegraph Co., et al, *Federal Reporter*, Vol. 145, pp. 345–356 (A.K.A. 145 F 345).
123. National Electric Signaling Co. v. De Forest Wireless telegraph Co., et al, *Federal Reporter*, Vol. 154, pp. 81–82 (A.K.A. 154 F 81).
124. "Lee De Forest Home," *New York Times*, May 7, 1906, p. 4.
125. E. P. Wenaas, "From Coherers to Crystal Detectors," *AWA Review*, Vol. 22, 2009 pp. 200–204.
126. *Father of Radio*, p. 161–2.
127. According to the testimony in the litigation, as well as Judge Wheeler's published findings, the only version of the De Forest detector that was in use before Judge Wheeler's October 16, 1905 decision was a circular Wollaston wire with a diameter of .000038 of an inch—almost identical in diameter to the circular electrode used by Fessenden with a diameter of .00004 of an inch. Only after Judge Wheeler's decision was the spade type electrode introduced into the De Forest system. According to Judge Wheeler's findings published on April 7, 1906, De Forest replaced the circular Wollaston wire contact having a diameter of .000038" with a flat metal contact having a width of 1/32" (.03125").
128. Transatlantic Wireless Display Ad, *New York Times*, April 8, 1906, p. 13.
129. L. de Forest, *Father of Radio*, p. 201–209.
130. *Ibid.*, p. 206.
131. *Ibid.*
132. *Ibid.*
133. *Ibid.*
134. "Atlantic Wireless," *Electrical World*, Vol. 47, May 19, 1906, p. 1024.
135. "Limit of Aerograms in De Forest System," *Washington Times*, Jan. 30, 1907, p. 12.
136. De Forest Diaries, Sept 30, 1906 entry.
137. See for example M. Adams, *Lee de Forest, King of Radio Television and Film*, (Springer, New York, 2011) p. 73.
138. *Father of Radio*, pp. 218.
139. De Forest Diaries, Nov. 29, 1906 entry.
140. "Lee De Forest Explains," *El Paso Herald*, June 8, 1907, p. 4.
141. De Forest – Western Electric Agreement of March 15, 1917, p. 3.
142. One notable patent issued before Oct. 31, 1904 of great importance to De Forest was No. 730,247 issued on Jun 9, 1903, which covered the Letcher antenna system producing a marked resonance used for tuning. This patent was the only one issued before Oct. 31, 1904 that ended up on Schedule A, indicating that De Forest was allowed to pick and choose the patents for which he received a quitclaim from the American De Forest company. For the importance of the Lecher system to De Forest, see: "Dr. Lee De Forest, Inventor of the de Forest System of Wireless Telegraphy," *Pages Weekly*, Vol. 3, Dec. 1903, p. 508.
143. George H. Clark, *Radioana*, Archives Center, American History Museum, "Abstracts of the Daily Thoughts of a Great Man. Notes from letters of Dr. Lee de forest, written to his first assistant, Frank Butler, and others. Copied July 29, 1938, p. 4, item 23.
144. "Wireless War Will Soon End," *Los Angeles Herald*, Nov. 23, 1906, p. 3.
145. Display Ad, *Syracuse Standard*, Nov. 7, 1906, p. 14.
146. "In Wireless Combine," *Washington Herald*, Nov. 16, 1906, p. 2.
147. "That Wireless Merger Will Not Stay Merged," *New York Times*, Nov. 20, 1906, p. 4.
148. "Ask Receiver for Wireless Concern", *Oakland Tribune*, June 24, 1911, p. 4.
149. "Amalgamated Wireless Securities Co. Display Ad," *Wall Street Journal*, Dec. 8, 1904, p. 7.
150. F. Fayant, "The Wireless Telegraph Bubble," *Success Magazine*, Vol. 10, June 1907, p. 450.
151. *Ibid.*, *Oakland Tribune*, June 24, 1911, p. 4.
152. "The Curb Market," *The Sun* (New York), Nov. 24, 1906, p. 14.
153. "New Incorporations," *Electrical Review*, Vol. 45, Dec. 10, 1904, p. 992.
154. *Annual Report of the Board of the State Assessors of the State of Maine for 1906*, (Kennebec Journal Print, 1906) p. 218.
155. Frank Fayant, "The Wireless Telegraph Bubble," *Success Magazine*, Vol. 10, June 1907, p. 45.
156. "No Wireless to Ireland," *New York Times*, Apr. 3, 1906, p. 1.
157. "American De Forest Wireless Telegraph Co.," *The Commercial and Financial Chronicle*, Vol. 83, Pt. 1, July 28, 1906, p. 211; "New Incorporations," *National Corporation Reporter*, Vol. 31, Jan. 4, 1906, p. 722.
158. "New Incorporations," *Electrical World*, Vol. 47, Feb. 24, 1906, p. 431.
159. "American De Forest Wireless Telegraph Co.," *The Commercial and Financial Chronicle*, Vol. 83, Pt. 1, July 28, 1906, p. 211.

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160. "New Incorporations," *Canadian Engineer*, Vol. 12, April 1905, p. 126.
161. "Dominion De Forest Wireless Telegraph Co.," *United States Investor*, Vol. 17, Sept. 22, 1906, p. 1451.
162. "Telegraph and Cable Matters," *Railway and Marine World for 1908*, Oct. 1908, p. 761.
163. "New Companies Registered," *Electrical Review*, Vol. 57, Aug. 4, 1905, p. 188.
164. "More Wireless Electricity," *St. James Gazette* (London), July 14, 1904, p. 9.
165. "New Companies Registered," *Electrical Review* (London), Vol. 59, Oct. 5, 1906, p. 547; "The Poulson Wireless Telegraph Patents," *Electrical Review* (London) Vol. 59, Oct 26, 1906, p. 678; "Radio-Telegraphic Convention," *Electrical Review* (London), May 3, 1907, Vol. 60, p. 712.
166. "Dissolutions and Liquidations," *Electrical Review* (London), Vol. 61, July 19, 1907, p. 94.

About the Author

Eric P. Wenaas has had a lifelong passion for antique radios beginning with his first Radiola and crystal set given to him as a young man growing up in Chicago by family friends. He experimented with radio devices and repaired radios and televisions as a hobby while in high school, and went on to study electrical engineering at Purdue University, graduating with B.S. and M.S. degrees in Electrical Engineering. He then went to the State University of New York (SUNY) at Buffalo where he earned a Ph.D. degree in Interdisciplinary Studies in the School of Engineering. After graduating, he spent most of his career at Jaycor, a defense company in Southern California—first as an engineer and later as the President and Chief Executive Officer.

Upon his retirement in 2002, he set out to research the early days of wireless and document interesting historical vignettes based on original documents of the era. One of his areas of specialty is the early coherer and crystal detector. He has assembled an extensive collection of early coherers and detectors, and performed many experiments on both types of early wireless detection devices. He has tested most types of early coherers, including metal filing tubes, point-contact electrodes of various metals, and a mercury coherer of the type used by Marconi in his transatlantic experiment. He published three articles on the coherer and crystal detector in previous issues of the *AWA Review*, and two articles on Oliver Lodge and his involvement with wireless telegraphy in the *AWA Journal*.



Eric P. Wenaas