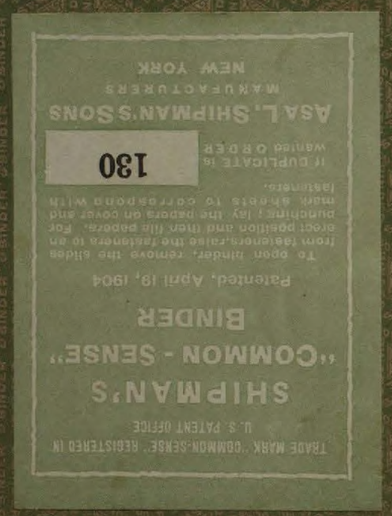

Abridged copy of de Forest Diaries

No. 1 and No. 2

No. 1 My Early Life. (p.p. 1 – 49)

No. 2 The Era of Radio/ (p.p. 1 – 297)

Book No. 1 was copied and abridged by G. H. Clark.

Book No. 2 was copied and abridged by G. F. J. Tyne. Since Mr. Tyne omitted some personal matters regarding Dr. de Forest's love-life, which matters Mr. Clrk considered to be of use in a later writing of The Life of Dr. de Forest, these omissions were inserted by Mr. Clark in the Tyne copy. These added pages are in red, typical!

This book is filed under Class 4, Biography.

A copy of De Forest diary No. 1, made by Mr. Tyne, and somewhat the same as part I of the present book, is filed under Class 5, History of Wireless Companies.

Abridgement and binding done
October, 1946

G. H. Clark

SRM 4 Book 25

The Life of Dr. Lee de Forest.
(Copied from autobiography; loaned to G.H.Clark by Dr. de Forest,1945)

AUTOBIOGRAPHICAL NOTES BY DR. DE FOREST. (1939) Abridged by GHC in places.
(Pages 1 – 49, incl.)

On my father's side I am descended from a family of French Hugenots who, early in the 17th. century, left Holland to settle in the New World. My father often told me that we were the 8th. generation from France,or more directly from the Netherlands.

The pioneer ~~of~~ immigree of the family was Jesse, who thruhis descendants formed the de Forest family. Jesse de Forest,who about ~~1912~~ 1612 had removed from Avesnes, France, to Leyden,Holland, conducted in ~~19~~ 1623 an expedition in three vessels to the Northern coast of South America, where after a few years of privation and suffering he died.

In the latter half of 1636 Jesse's oldest son, Henry de Forest, 30 years old, and his brother Isaac, 10~~x~~ years younger, decided to settle in New Amsterdam as tobacco planters. They left Amsterdam Oct. 1 1636 in a small vessel.

The upper part of Manhattan Island was then a wilderness of virgin forest and natural clearings. The de Forests fixed upon a broad,fertile flat called Mascoytah and became the unprosperous founders of Harlem.

From ~~D~~irector Van Twiller of the Dutch Colony Isaacobtained a strip of 100 acres running from his brother's tract down to the sluggish Harlem at a point opposite the mouth of Bronx Kill, including not a little of the region now called Mt. Morris Park.

Isaac lived with his brother~~x~~ Henry, who had a house 42 x 18 ft., surrounded by a palisade of heavy pickets. Henry died 1 year after arrival. Half of his boat,half of a bull calf and half of two kids were inherited by Isaac. The continuance of the de Forest name in America now depended on a single unmarried youth of 22.

For several years he remained in Harlem, raising tobacco. In 1641 he married Sarah de Truit of New Amsterdam, spinster. From this union sprang the de Forest clan.

David, youngest son of Henry, moved to Statford,Conn, whence most of the de Forest clan of New England stems. His descendants remained moderate farmers until the Revolution. 16 pf his grandsons served in the War of Independenace. His 10th and ~~yo~~ youngest son was a farmer. One of his many sons was Benjamin, Jr.,n and in ~~his~~ turn his eldest son, David Curtis de Forest, became a roving seaman and privateer of checkered and adverturous career, whp, in Montevideo and Buenos Aires , where he became first U S Consul to the Argentine , established a comparatively large fortune, by fortunate merchantile ventures at sea. It was his generous bequest to Yale College which later enabled my father, his two sons and a grandson to graduate from Yale.

Returning to David of Stratford. His second son, Samuel, was the father of Joseph, likewise resident of Stratford. One might judge of Joseph's religions character by the names of his sons, Samuel, Abel, Mills, Gideon, and Elihu. (Mills was named in honor of his mother, Susan Mills).

The 4th. son, Gideon, born 1765, enlisted in the cavalry troop of General Henry Lee, "Light Horse Harry", during the early days of the Revolution, and at the age of 13 or 14 years. Following the revolution, about 1794, Giden married Hannah Birdseye a and settled in 1795 in what was later Edmonton, Otsego County, NY. Three ofh his brothers, Samuel, Abel and Mills, were soldiers in the Revolution, and were part of the guard, and all present at the execution, of Major Andry, the British spy.

Gideon's family is typical of what was considered the best American citizenship during those early days. His children, Abel, Lee, Sally, Cyrus Hawley, Maria, Charles Augustus, Tract Robinson, and Harriett, were born 1795-1813. My grandfather, Leewas named in honor of his father's Revolutionary commander, "Light Horse Harry". My father was proud of the name and its derivation, and I have always been grateful that he chose to name me, his first-born son, by that same name Lee.

I have a group photo of~~x~~ the '80's showing these 5 sons and 3 daughters of Giden, ages ranging 68-89. All lived to be 82 or older and none died an invalid.

Gideon and wife Hannah left Stamford about 1790 and started for the town of Edmeston, Otsego County, NY. ~~The~~ All their belongings they took with them in a lumber wagon pulled by oxen, for the 200 mile journey. They finally settled on Meeker Hill, about a mile back from the East shore of the Unadilla river, choosing a hill to be more free from fever and ague. It was a mistaken choice, which a few years later he rectified by moving down to the river and occupying the farm afterwards owned by his son, Lee de Forest.

On this spot all his children were born, except his youngest, Harriet, whose advent was delayed until me moved down the river.

Giden was a tailor,and when not farming "whipped the cat", i.e.,went from house to house and clothed up the family (the father and the boys, that is) for a year.He was a powerful, positive man, and as a boy was inoculated with the Spirit of 1776. At 1 5 he joined the Continental Armyin the Connecticut quota ("was mustered into the ranks" is the correct phrase)for which service he received a pension during the latter years of his life. In this service he was joined by three brothers, Abel, Mills and Samuel. Their Spartan mother took the wool from the sheep and carded, spun and wove it and from it made the cloth they wore as Continental soldiers.

The early settlers of Otsego county had their troubles, but rarely suffered from lack of food. Fireplaces were large, fuel abundant/

From the back of the old logbook of the sloop Hawk, Commander Abel de Forest, (whose cabin boy was Isaac Hull, later renouned Commodore of the War of 1812) were copied these ietms re his father:

Apr. 17 1802. By making Harry vest. By agreement Gideon de Forest Dr. to 2 bu potatoes

May 22 1802 Gideon de Forest Dr. 1 bag flaxseed

May 24 1802 do 4½ bu. potatoes

Aug. 3 1802 Gideon de Forest took the Red Cow and came back Friday 20

May 5 1802 do Dr. to 2 bu. oats

Thus it was in this charming country in the middle fo N Y State, of fertile hills and groves of sugar maple there was erected s fine old farm house which still stands and is known as the old de Forest homestead. The property was left to m my grandfather Lee on his father's death. He had married Cynthia Stores Swift of Mansfield, Conn. They had four sons and two daughters, all born in the old farmhouse.

My father, Henry Swift de Forest, was the third son,born March 17,1833. He was the only one of the brothers who wanted a college education and decided to work his way thru Yale.He had heard of the bequest of his ancestor Davis, the income being $1000 a year,and was under the terms of the will to be divided into three equal parts, to be allotted to those of the name of de Forest who might be students at Yale College.

Henry had to do hard work on the farm and had little time to prepare himself for entry into college.But by doing odd jobs, and by rigorous economy, a trait whion distinguished him thru the balance of his life (and which his son Lee certainly did not know the rudiments of. GHC). Finally he was able to enter a private preparatory school, from which he matriculated in 1853 into the Freshman class of '57, Yale College. He stood high in his classes,excelling in mathematics, surveying, geometry, and also stood high in the classics, both Latin and Greek.

A sterling characteristic of my father, his brothers, and the whole de Forest family from earliest days was their piety and staunch christianity. As a very yiung man my father had professed religion and joined the Congregational church. Before finishing college he had decided to dedicate this life to the Christian ministry. On order to enable himself to study for the ministry after graduation from Yale he secured the position of tutor in mathematics at Beloit College, Beloit, Wisconsin. I have an ancient leather-bound book named "Loomis' Trigonometry and Logarithms", on the fly leaf of which appears in faded brown ink " H. S. de Forest, October, 1858, Beloit". Evidemces of his tutorship at Beloit can still be found in the library of that institution.

About 1860, just before the Civil War, he returned from Beloit to New Haven to study in the Yale Divinity School. In the latter part of his study here his name was delected in a draft for the U S Federal Troops and he joined the 11th. Connecticut Volunteer Regiment as Chaplain. (Note GHC. In the typed mss., a red mark is drawn somewhat at random thru the second "1" of "11th". Perhaps this figure is in error) From then till war's end his regiment wason active duty,notably in Grant's closing campaign in Virginia. He often told me of the hardships,suffering and privation of those troops during the terrific battles of the Wilderness;how his regiment was decimated by rebel fire;how across one torrid hot battlefield the chaplain gathered up all the canteens he could find,filled them with water, and carried them across the field swept by rebel gunfire to his troops, who shouted "Bully for the Chaplain". He strove to lead the men, rough, uncouth, oscene and cursing, in prayer and devotion,; some of the more devout would sing Gospel hymns on the eve before battle.

After the war, and the memorable three day parade thru the streets of Washington he was mustered out of military service.

He then travelled in the interests of the Congregational churches of the North and West. During these peri rinations (Lee de Forest uses the word, not I. GHC) he visited Grinnell, Iowa, where he first saw Anna Robbins playing the college organ. Later, when in Muscadine, he met her father, Rev.Aldenm B. Robbins, D.D. His eldest daughter,Margaret, was a beautiful girl,of 20 year.s. Dad fell in love with her at ~~fi~~ xxx first sight, but she was 14 years his junior and did not reciprocate;she said she wished that he would desist from his attentions. But he pursued this courrtship and one year later, when he was filling his first pastorate at DesMoines, Iowa, they were married by her father in the Muscatine church, on Aug. 25, 1869. He soon gave up the church pastorate to further his theological studies at the Andover (Mass.) Theological Seminary where they lived for 2 years, till he obtained his degree of Doctor of Divinity.

There their first child, Mary Robbins, was born, July 22,1871. In the fall of that year Dad was made pastor of the First Congregational Church of Council Bluffs, Iowa, and thefamily removed to that then far western frontier town. I was born in the little parsonage there on Aug. 26, 1873. In 1876 the family mowed to Waterloo, Iowa. From there and then date my own earliest recollections.

When I was four or five years old, my father took me to a little shop which displayed a strange contraption which had been exhibited and demonstrated at the Centennial Exposition, where he first heard it-the Edison tinfoil phonograph. What an indelible imprint that firw t demonstration of a scientific marvel made upon my infantile mind!

Tho my father was pastor at Waterloo, still he and my mother were sufficiently broadminded to take sister Mary and me to the circus. The strange,monstrous animals and the beautiful ladies in pink tights on the trapezes high in the mighty top made an indelible impression on my brain.We children turned ~~the~~ an upper bedroom into a circus to the complete disarray of the family bed, where we did somersaults and stood on our heads.

From Waterloo we moved to Muscatine,where we lived across the street from my grandfather Robbins'home. My grandmother Robbins always used to catch me when I would steal over to the china closet where the lump sugar was concealed, and so I was aftaid of her. I liked my grandfather, however. I spend hours studying the intricate details of his student lamp, trying to understand how it was that the oil in the tank did not overflow while it was atill able to supply the wick with oil.

I first went to school at Muscatine, but not for long, as Father took the presidency of Talladega College, Talladega,Alabama, for the general scholling and higher education of the Freedmen, as the negores were then called. This move was a heroic sacrifice to my parents, especially my mother, but my father regarded it as his duty. My mother and her three children were to be sacrificed on the altar of home missionary zeal, but we youngsters knew nothing of this; did not realize how the decision of our parents would influence all our future lives. So in the early Fall of 1879 Henry Swift de Forest, D.C., his lovely young wife, and their three children disembarked from a sooty day coach of the East Tennesee,Virginia and Georgia R R on the dusty, hot platform of a dingy, red painted frame depot, to be loaded into a two-seated buckboard buggy and driven up unpaved dusty streets from the village square to the hill on which stood the College.

To make available to the southern negroes the equivalent of a Northern college course was the great and consuming aim of my father. Coupled with this was his hatred for sin of all sorts, and his zeal for bringing into the Christian life all those who came under his influence. In the college were primary and grammar grades, a preparatory school, and then the sparsely attended courses for higher education, which actually invluded the study of Latin thru Virgil's Aeneid, Greek thru the histories of Xenophon, and courses in moral philosophy and logic. All these were crowded into the rooms of one building, Swain Hall, including the college libraty and my father's office.

For 2 years we lived crowded into 2 rooms on the second floor of the girls' dormitory,eating our meals in the common dining room below. These students were the first blacks I had ever seen, and I was for a time greatly puzzled over their dark skins. I wondered why the girls' hands were lighter than the rest of their bodies, to the gr at amusement of the girls, and I decided that it was because they washed

their hands oftener than the other parts of their bodies.

Later, due to the generosity of friends, a fine brick building was erected for the direct use of the Presi ent's family.

The summers in this Northern Alabama section were exceedinly hot, very trying to Northerns not inured to the climate. Most of the teachers were white, from the North. These dwelt with us, amid the colored girls in Foster Hall, all dining together at the teachers' table in the main dining room. We de Forest children wore no shoes from school's closing in mid-june to September, and stubbed toes, blistered soles and swollen feet were vacation memories.

With my sister Mary and two or three children of the faculty I jammed the dusky classes, studying arithmetic, English grammar, penmanship and history. I had no idea of any "color line", altho our teachers were all white. I enjoyed studying and kept ahead of the majority of my classmates.

Soon a carpenter shop was added to the college. I at once took opportunity to work in it, and dabbled for the first time in things mechanical. I was about ten years old at the time, and we had just moved into pur new home.

Throughout the South in those days, so nearly after the Carpet-Baggers' regime following the War, remained bitter hate and rankled angry prejudices and distrusts. Particularly distasteful to the white gentry were the efforts of Norther missionaries to educate the blacks. My parents, their children, and also all of the faculty, educated, refined men and women from the best schools and influences of the North, were totally ostracized by the white citizens of Talladega. In later years this attitude softened.

My father was taking a walk one summer afternoon with his family, and we passed a typical Southern gentleman named Colonel Hardy, to whom my father spoke a word of salutation; whereupon the Colonel moved hastily to the other side of the road and snarled " I don't wish to be spoken to, Suh, by a damned Yankee".

About this time a company of Northern engineers began the erection of a large blast furnace for the smelting of iron ore, about a mile from our home. On every possibl occasion I would hurry over to watch the overalled mechanics rivet together the heavy plates for the tanks, or assemble the giant air compressors. Above all I was fascinated by the little narrow-guage railroad which they had built, running 'cross country to the low hills where iron ore was being excavated.

After a year or so of operation, the blast furnace proved unprofitable and everything was dismantled and hauled away except the tiny, narrow guage track and some twelve ore cars. One after another these were uncoupled, and my brother and I with grunting efforts pushed each to the top of an incline to afford a wildly careening toboggan ride for us two frightened youngsters. Down the bumping sloes and around the tortuous curves we sped, until on a level stretch the speed slackened sufficiently for us to leap off the safety, leaving the car to run into an open switch, or perhaps a ditch, or perhaps come to a prosaic stop. What mattered it if w we could not push the car back to the summit for another ride! There was another car a awaiting us at the top, and one by one, each day became the source of a boyish thrill quite unknown to those who knew not the meaning of the word toboggan or had never seen a ski. Fortunately, we were never thrown off these careening gondolas to be lacerated or mangled on the rough stones of the roadbed.

The road which passed our house led, at a distance of some three miles, to a beauti ful ford across Talladega Creek. Not far above this ford was a genuine "old swimming hole". From a tall rock along its side one could jump and dive into the clear water. Above its preadthe branches of a huge tree, from one o which, by rare good fortune, hung a grapevine strong enough to hold a boy. Pendulum-like, I would grab this vine, swing far over the water, and let go. No spring board over a swimming pool since that day has afforded me half of the pleasure that I then derived. Given such facilities it was not long before my brother and I learned to swim, and thru many a hot, sweltering afternoon we walked the railroad ties of the lofty trestle crossing Talladega Creek on our way to our favorite wash hole.

I was 10 or 11 years old when I first visited the Shelby Iron Works. I had always been intensely interested in steam locomotives. From studying an article in the Mechanical Encyclopoedia in our library I had acquired a fair idea of the operation of a locomotive, but the reversing gear continued to puzzle and baffle me. On my way home from the iron works I stopped off at the railroad, and there on a side track was a beautiful full-sized locomotive, deserted. A

full sized locomotive, deserted, a giant asleep. Here was my chance to see how an engineer could reverse a locomotive.

Climbing into the cab, I tried to move the heavy reversing lever, but I could not budge it. Then I climed down and crawled under the silent monster, and lay on my back on the wooden ties peering up at the bottom of the boiler, observing the intricate scheme of the eccentric rods, pistons, and valve rods. I studied these olosely for a long time, observing the connecting rods and making my decisions as to what function each performed. In my mind I could see the locomotive in operation. The whole method of reversing the locomotove was clear at last to my mind. I can distinct ly recall my joy as I skipped along the path to home singling aloud to myself in glee "Oh, I am happy! oh, I am so happy!". (Note GHC. He's a damned liar, At that age he would not be able really to understand the intricacies of the reversing gear of a locomotive, really understant it, that is. I, whose sole love was locomotives from a very early age on, and who drew pictures of them for the engineers when I was ten years old, did not understand the real function of the reversing gear until I was many years older than Lee was, and between you and me I was as bright a lad as he was, even tho I played with French Canadian kids and not blacks)

So after returning to Talledega I constructed a locomotive in my back yard. Our large cellar had three compartments, the central one windowless and hence dark. We kids called it "The Dark Place" and for a year it was filled with scrap lumber, barrels and other trash. From this tr asure store I drew for my construction. With the aid of James Brown, a West-Indian negro, of yellow complexion and with a foreign twang to his voice, who became my father's trusted servant and the guardian of us noys, I dug up and haluled to the yard some large, square packins cases, three sugar barrels, smaller paint kegs, barrel heads (for locomotive wheels), wooden strips (for driving rods), and a tin can for a whistle, affording, with the except ion of a bell, about all the parts required for a device which might amply resemble a locomotive.

Finished, it was an impressive structure, with cow catcher, connecting rods, smokestack, engineer's cabin into which I could crawl, a sure enough throttle and an operative and heavy reversing lever which served to move up and down the links beneath the forward part of the boiler, and which actually functioned to slide the valve rods in and out of the steam chest above the cylinder. (Note GHC. Ex post facto stuff, if I ever heard it!)Two or three other large packing boxes formed the tender, filled with stove wood, which brother Charlie, fireman, could heave into the firebox. Our playtime for some weeks was devoted to the building of this masterpiece.

It became the talk of the neighbourhood. White and black children living near came to inspect it. Even my father took parental pride in this creation of his con. The white gentry of Talladega, who held the de Frest clan, and all our teachers8 colony, in supreme contempt, would occasionally pull in their steeds before the front lawn of our house , asking permission to let their little girls and boys look at this creation of the Yankee.

Not till the summer suns and xxxxxxx the rains of the following winter had warped and partially wrecked this cherished masterpiece was it finallydemolished and turned into firewood, and I, who was early taught by my father the cardinal virtue of work, had to do the sawing and splitting.

My father was, also, a stern disciplinarian, and I was led to the woodshed for the traditional purpose many times. My tutelage there was severe and thorough-going, and I was whaled into good behaviour and to a wholsesome reveren e for law.(Note GHC Oh yeah?)

As a boy, lackin radio, movies, and even pulp magazines, I had to resort to worthwhile literature. My father's library contained the Leatherstocking Tales, the Sea Tales of Fenimore Cooper, the novels and poems of Sir Walter Scott, the poetry of Tennyson and Longfellow. One of my sister's prized possessions was the Tanglewood Tales of Nathaniel Hawthorne, Lamb's"Tales from Shakespeare", and childrens' stories of the Grecian myths. I read the Bible from cover to cover, even thru the meaningless list in the Book of Numbers. Thisheroic task was then considered worthy of much praise and beneficial to the youthful soul of a young boy. More than this, I read every words of Milton's Paradise Lost. and his Paradise Regained. (Note GHC. Me too, Lee, but what did it get either of us???)

Once, when ill and confined to the house, my mother read to me Ivanhoe and The Lady of the Lake. I loved the Tales of a Wayside Inn and was fascinated beyond ex pression with the melodious rhythms of Hiamatha and Evangeline. I eagerly read Tales of the Kinghts of the Round Table, of medieval castles and the mystic rites of knight hood that had originated in the saced confines of some legendary domain. The romance and chivalry of the days of King Arthur kindled my youthful imagination and inspired me to brave deeds of chivalry. (Note GHC. New name for it, Lee!)

So it is not strange that I became obsessed with the necessitity of erecting a Castle. This was to stand beside the woodshed, adjoining our garden plot. My father co-operated to the extent of erecting the four corner posts of the structure.The walls were of wooden slabs, the cracks covered with smaller strips. The floor was of pounded clay.One window was cut in a wall, in the rear opposite the door. The structure was about 5' in ht., its roof slanting to shed the rain, but on top stood a mighty tower, consisting of one barrel with serrated top, carefully filled with stove wood to prevent harm from the winds.A tall flagpole topped this and carried defiantly at its top a red pennant.

Thus originated the saced confines of my Castle Luxembourg. From its portals sallied at times large retinues of knights armed with long wooden lances. It mattered not that the knights were sometimes darkies; that their lances were so long that the castle could not contain them, and they stuck out through the window. These protruding ends were rendered safe, however, by the promulgation of a Royal Edict, even by King Arthur himself, to the effect that all lances thus protruding were inviolate from theft, whether in time of peace or war.

The chief treasure hidden in this castle rested in the body of the sacred altar, a wooden box which contained an ingeniously wrought breatplate of tin, and gyves of the same marerial,for the breast and legs of King Arthur. These wree fastened in place by straps of cord. A shining tin sword with a wooden hilt and a tin crown hammered out of a large can completed the royal treasurexs.

Came one sacred vigil, when brother Charles was initiated into the Circle of the Round Table. Then a can of incense consisting of flowers of sulphur was lighted on the altar, and Sir Charles was placed on his knees in front of the altar, to remain in solitary vigil thru the long hours of the knight, the door and the single window of the castle being carefully closed while a furious attack was launched at the castle from all sides. A shower of brickbats, stove wood and blood curdling yells surged from other members of the Round Table Knights as they stormed the Castle. Fortunately for Sir Charles' continued existence one of these missles fractured the window shutter, thus preventing King Arthur's newly dubbed knight from becoming wholly asphyxiated.

On another occasion, armed with tin battle axes and sword-like sickles, Sir Charles and his dusky knights fared forth in the dense forest of cornstalks extending far behind the r ar of the castle, bravely hacked their way to the den of the Dragon, to rescue from his horrid clutches the Sleeping Princess of the Golden Hair.

In the rear of the garden my father had erected a fine two-story barn, with box-stall for the horse and a stall for the cow. James Brown milked the cow, but I curried Jennie Lind, the mare,made down her bed, fed her her ration of oats, and thru the chute to the upper loft supplied wads of baled hay. Once or twice each year when the pile had dwindled to the last remnant,several of our favored associates, each armed with a broom or club, was admitted to the upper loft, the trap door made fast, and the wild excite ment of a rat hunt indulged in, one of the most exciting episodes of our sometimes too dull existance.

My father was eager for me to become a good horseman, as he himself was. But in Talladega his salary was only $125 a month, so it was no easy matter for him to purchase a riding horse for his son. This horse, a roan mare, became our family pride. She was gentle, three- gaited, and could run very fast. My father gave me a small English saddle, I soon learned to ride well and we often rode during hot weather down the long brown road to Talladega Creek, with Bro. Charles holding on behind me.

We were very much afraid of the white bo ys of the town, knowing how they regarded us, and always felt safer when one or two of the larger negro boys of the school were with us. One day when Charles and I had dressed and were leaving the swinning hole, we were overhauled by three large-size boys, who shouted "Here's some of those

damned blue-bellied Yankees. Hold on there, boy, I want to see if your belly is blue". True to their word, they caught us , pulled up our shirts, and gleefully examined our abdomens. With a snort and a rough laugh they then released us, to our great relief, for we were thoroughly frightened by then sally, and I am not so sure that my face ~~di~~, at least, did not turnn blue.

With Charles I was the domineering elder brother. My frequently ungovernable temper would assert itself at times and we would have many battles.It seemed to me that Chas., tho the younger, lost no opportunity to tease and taunt me.

My stern and upright father, who was six feet two in his stokinged feet, was generally admired and loved by the elder students and by the deacons of the church, but not by the younger students, who often called him "Old Man Dee."

During those days I r ad Fenimore Cooper's Leatherstocking Tales.His hero, Natty Bumpo, became mine. I could think of nothin sweeter than to be like him and live in the woods and mingle with the Indians. I mdeefor myself a trusty "Kildeer" rifle, constructed of a long broomstock and a wooden stock; also two or three double barelled shot guns for myself and my comrades. Saturdays we would take long walks into the woods and climb the nearby mountains. One day we ascened Mt.Chincapin the tallest within walking distance of the town. We filled our pockets with the sweet chincapin nuts, and gathered the richly perfuemed "sweet buddies". My adoration of the mountains and love for mountain climbing dates from those early days. (Note GHC. Don't forget the story of mountain climbing in California, a few years ago, lost for many hours, and getting home all scratched up)

During the Civil War the upper floors of Swain Hall had been used as a prison for Yankee soldiers.One of these captives with a diamond ring,or perhaps with only a chip of quartz crystal, had inscribed on an upper window pane the words "Prisoners of War" Years later the faculty discovered this treasure, and the pane was taken up and hung in the library. I used to stand and admire this, with arms akimbo, and so deep an impression did it make that I found a quartz crystal, selected a safe hour, and inscribed on one of the window panes of our living room, in childish, ireegularly printed letters these same words, "Prisoners of War". I not only was punished for this act of vandalism, but got an extra dose for misspelling the word and making it "Prisners"

I would frequently climb to the College library, there to spend hours poring over the intricate drawings in the Patent Office Gazette. This developed juvenile ingenuity. I seldom found my school studies uninterestin, with the exception of Latin and still more so of Greek. In the early spring the rains prevented me from going to school, but days at home were never dreary. In the parlor downstairs, at that time unfurnished, I sequestered a large, flat pasteboard box,originally a container of dress patterns. Here were stored drawings of my favorite inventions of that time, especially of steam hammers and perpetual motion machines. The steam hammer, of which I knew only thru the medium of the encyclopoedia, took the place of the locomotive of earlier years. I designed various sizes and types, carefully working out the details of the pistons and the steam valves. Stretchedout on the floor with a large sheet of paper before me, I would work quietly and contentedly for hours. A visiting neightbour once asked if I "knew what I was doing", and my mater said, "Oh, yes. He is always inventing and sketching". I felt very proud of this remark. But even more near to my heart was the idea of a perpetual motion machine, which I was determined to invent. I had read all about the subject in the Encyclopoedia, and had learned by heart its statements as to the fallacies of the various schemes that had been proposed. But I felt that I could solve what others had not. My knowledge of physics was nil so I could not see a priori why perpetual motion was so impossible. I drew wierd sketches of a complicated design involving permanent magnets, walking beams and a magnetic shield. When I had finished the last detail I was satisfied; I had at last solved the baffling problem of the ages.I wrote on the bottom of the sketch that ~~xxxx~~ I was actually amazed that "I, a mere youth of 13 years, by my inventive genius and concentrated thought and study had succeeded where illustrious philosophers in times past had failed, and had at last furnished to humanity a machine which, without cost, would supply forever any and all demands of the human race for power". In the isolation of that Talladega parlor I felt in my heart that I was, not was to be, an inventor.

A few years later, studying physics, I realized that my boyish device was inoperative. But I did not destroy my drawing. Unfortuantely, however, my Mother did, when

she moved North, abandoning all this precious early memorabilia of her son in Talladega.

But I was yet to learn that invention is itself a process of constant disillusionment, of tearing down and building anew, and that many an invention has been destroyed in a single blast by the sudden emergence of new facts into the world laboratory of science. I could always fix definotely the age of 13 years as the epoch when I knew definitely that I was to be an inventor, determined then to devote my life to that pursuit.

There was little known about electricity in the backwoods jungles of civilizatio where I lived, in fact, the small town did not even possess a lighting plant, and so mechanical rather than electrical problems dominated my interest.

My Father was not easily convinced nor in any way erecomciled to my then expressed ambition. Ever since my birth he had cherished the keen desire that both his sons should go to Yale, and be either ministers or teachers. (Note GHC. Dr. de Forest would have made a wonderful minister. He might have leaned toward the evangelist type, rivalling or replacing Billy Sunday.)

When I was born my father wrote to a classmate of his that my first spoken words were "Yale,Yale", to which the classmate responded " Are you sure, Henry, that it was not "yell, yell"?

So we were brought up in a Yale atmosphere. Pictures of the Yale Fence and the old Yale buildings---South College, South Middle College (now Connecticut Hall), Atheneum, North Middle, the old College Chapel, framed in one long photographic panel, adorned the family library, together with portraits of President Porter and Woolsey of Yale College. Both of his sons agrred that Yale was the place for us, but while my father urged an academic career there, I scanned the catalogue of the Sheffield Scientific School at Yale, and began to plan the necessary preparatory courses for entry thereto.

My father pled, argued with me to change my fixed purpose,but to no avail, so in the end he sorrowfully concurred. Had he not, I would have, if necessary, forgone entirely my Yale education rather than follow the classical course, for I was determined to become either a mechanical or electrical engineer. The decision made, I studied with even greater interest the "Encyclopoedia of Mechanics" in the office of our new College principal, Prof. Marsh.

When I was 14 my mother's younger brother shipped to me a little foot-driven scroll saw which I had in previous years admired and coveted but which I had not been permitted to touch. I toured all the shops in town for empty cigar boxes, and saved every penny from my monthly allowance from my father--ten cents-- to add from a dollar or two, the generous gift of my mother, to buy a few thin slabs of white holly wood, and even a small one of black ebony, also extra saw blades.

Every afternoon thereafter was spent until chore time or supper in jigsawing intricate patters for brackets, small book shelves, ornamental picture frames, and the like. I even tried inlaying and marquetry, but with not much success.

Thru the early 80's, adventure, chivalry, and boyhood sports kept me occupied outside of school and daily chores. Be ides the battles and knighthood rites at Castle Luxembourg, I arranged for jousts and knightly tournaments in the clumpy orchard grass near our home. Tall stakes were driven into the ground to form a circle, and burlap bags were attached to these. Upon a royal dais, consisting of a large packing case overlooking the arena, sat my sister. Queen of Beauty, with daisies entwined in her flowing hair. In the Field of the Clith of Gold before her gallant knights--at least 3 in number, astride of prancing hobby horses, lunged and charged madly at each other. King Arthur, as customary, was protected by his tin breatplate and his shin guards, with a flowing white plume--a discarded ostrich feather--sewed to the skull cap which protected his head from the tin helmet. Other kinights were less protected, and hence fared badly at these jousts,

We had a milch cow, with a large calf called Julius Caesar. I had intended to enter the jousting ring mounted on the latter, as my "noble steed", but Rather said it was notstrong enough to support me. But Caesar grew, and in time I rode him madly about the yard, imagining I was a toreador in a Spanish bull ring. Sooner or later I would be pithed off into the grass, but that was only part of the ritual. It was intended to have Caesar transformed into butcher's

meat, but because then I did not have a horse to ride my father decided to let him live on. Riding the growing animal became more difficult, so my father--who was a very good carpenter--built a little cart and ox yoke with hickory thills, to which I could hitch my "steed". But on the first trial around the yard the hind wheels and the box of the wagon came off, and I fell off in a wild pitch. The side walk was lined with dusky boys an girls laughing as if their sides would split. Father repaired the cart and after a time the long suffering beast became reconciled to his state of servitude. But this sport palled, and in tiem Caesar was led to the college slaughter house, and probably became a part of me.

During the long summer twilights flocks of "bull bats" used to fly in the fields, their flesh, strange to say, being edible. Frequently white men would come out from town to shoot them, and now and then they would give me 2 or 3, for, needless to say, I was always present at such exciting events. The family ate them with gusto.

Mother was a skilled musician, a pinaist, and had a well trained soprano voice. Father knew nothing of music but admited it in a general way. Mother wished her children to be musicians, Mary took to piano playing and became in time a really skilled mus ician. I regarded the piano as anything but a manly instrument and felt that a boy should be ashamed to be found sitting at one, but mother made me learn the scales, and, in addition to "chopsticks" I became able to pick out without too many errors Bonnie Sweet Bessie, the Maid of Dundee, Blue Bells of Scotland, etc. Had I not been so foolishly stubborn I would have gotten much genuine joy and consola tion out of music in my later years.

However, I was fond of music in general, and was willing to play a "manly" instrument, which, I felt, was well represented by the cornet. So one was purchased(second-hand) and I took lessons from the town's blind piano-tuner. I learned to run intricate scales and arpeggios, and was finally inducted into the mysteries of double or triple tonguing. When I practiced with the windows open the neighbours were driven to distraction.. Gradually I came to have a good repertoire of intricate pieces, usually with still more intricate variations. But there were no musical organization I could join-the white folks band downtown would not have me, and I certainly would not align myself with Barclay's Band, an organization of negro noise makers in brass. I continued to practice until I left home in 1891 to go to school in the North.See p.9-A

By the time I had learned to read my parents had subscribed to the Youth's Companion, and on its pages I would concentrate for hours.It offered a luring premium list and Charles and I chose from this, as our great desire, a silver-plating outfit. I foresaw limitless opportunities for earning limitless amounts of money by replating the neighbours' silverware. Si I set out diligently to convass for subscriptions, but among the familes that I was permitted to know, and hence to canvass, most were poor black folks who could ill afford the luxury of a subscription. Most of the faculty familes subscribed, chiefly from sheer pity, "to aid Lee" in getting the premiums. One or two premiums were finally obtained; the balance had to be purchased by cash.

The first premium obtained was the plating set, including the parts of a wet battery "for power". I earned perhaps $5 by my electro-plating industry, which I at once invested in tools and supplies for my fret-saw operations. I also made some money during the summer by gathering wild plums, rich, red, luscious, and also wild raspberries. But in this we faced real competition from the darkies, and our most reliable customer was Mother.

My father, of course offered grace before every meal, and each morning after breakfast out little family knelt, each by his own chair, while Father or Mother led us in a brief prayer. None of the family went to bed with saying prayers, or to Sunday School each Sunday before church. And each Sunday afternoon before we went for a walk the family assembled in the sitting room, with the servants, to study the Sunday School lesson for the ensuing Sunday and to sing a few Gospel hymns, my mother at the piano. Naturally I was not over-pleased by this super-abundance of religious activity. Once I expressed this quite openly, who obliquely, when during vacation we were visiting my grandparents and witnessed a display of fireworks at the fairgrounds In my childish treble I cried out "Oh Papa, aren't you glad you are not at prayer meeting tonight?" The laughter which followed probably saved me from chastisement later.

I began the study of Latin when about 15. I made rapid progress thru Caesar's "Commentaries", and Papa taught me, as a class of 1, the lovely Bucolics of Virgil.

Insert as marked on page 9

There was no dearth of music in our Talladega lives. Several of the faculty possessed good voices, and mother, with her sweet ~~mi~~ soprano voice , and the college music teacher delighted to arrange recitals and community singing.

The southern negro is, of course, deeply musical by nature. There was a college glee club and choir, and we all fervently loved the old negro spirituals of slavery days. The Boys' choir was taught to sing Yale's old college glees, greatly to my father's delight.

Besides a love or music, father had a keen sense of humor, and had a hearty, explosive ringing laugh, in his merry moments. These were sufficiently rare to make his laughter noteworthy and infectious. I think I must owe my own keen sense of humor chiefly to inheritance from his side of the family, altho my mother was almost invariably of a sunny, cheerful disposition.

From him, too, there was instilled in me a deep regar for that kind of literature. I recall vaguely that I tried to translate Caesar's "Commentaries" into English verse, or worse.

As a thorough knowledge of Latin was essential for entering Yale Scientific School, I applied myself to that task with considerable cheerfulness. Not so, however, with Greek, which was not required for Sheff. However, I did appreciate t the beauty of the Greek alphabet, but only because I had already seen that this was indispensible as the symbols used in mathematics. Beyond that, Greek to me was anathema.

In my last year at T., I studied Physics, being the only white pupil in the class. With me were 2 or 3 negroes, one a girl. I recall my amusement at her stupidity and asinine answers. It was then that I realized the injustice of having to study the higher branches with such schoolmates, few of which could pursue the subjects as rapidly as I could, and none showing any interest comparable to my own. My father's financial inability to send me North to prepare for college at an earlier date was responsible for the fact that I did not enter preparatory school in the North until I was 19, instead of 16 as it should have been.

Isolated as my years in the Southland were, most of my companions being negroes, there were many happy experiences. Despite its severity, home life was happy, usually ideal. My parents were always fond of and unceasingly considerate of each other.They loved their three children very dearly, and sought in every way to give them fine character, strict consciences, a sense of duty to their fellow men.

One of my earliest inventions wa the "bedstick", a long, tapered piece of black w walnut, thickly padded at each end, laid with mathematical exactness in the middle of the bed. This kept each with a 50% possession of the sleeping facilities, and if either tried to move the diving rod into the forbidden position, the battle was on!

My father was a stickler for orderliness.His books and papers were always in perfect position and he sought to impress this virtue on his children.

My play and pastimes at T. were the same as any boy of that age and time. I played "bunkum" marbles, rolling the coveted glass balls into small holes carved in the dirt, with the harch knuckle penalty for losin . I played baseball with a tatterdemalion aggregation of niggers of all sizes and degrees of origin. Tennis, and an unorthodox type of soccer football were almso among my games

I was small and rather undersized in those early days. My father called me puny and was frequently worried about my condition, tho I had the best of food to eat and all I wanted of the best milk. The larger negroes at the school used to delight in pulling me hither and yon, so I was continually sayin "Lea' go of me", whereupon I acquired the nickname of "Leago", which clung to me as long as I lived in T.

I acquired not only the Souther but the Southern negro's methods of speech. Traces of that early dielect clung to me for many years thereafter.I never wholly and completely succeeded in eradicating this.

With such a beginning, contaminated by negro lack of manners, I should have been sent to a Northern preparatory school which would include a refining process. But I went instead to one where boorishness and uncouthness were largely predominant. I should have gone to Philips Academy at Andover, or Exeter, Mass., but the tuition was too high at such places. Instead, I went to Mount Hermon's Boys School at Mt. Herman, Mass.

In the latter half of my last year at T.,beginning Ja .1, 1891, I kept a daily journal. In it I wrote "fine quotations worth remembering and preserving", such as extracts from Sir Thomas Moore, Shakespeare, Milton, Sir Isaac Newton, Gray, Goldsmith, Burns, Byron, Sir Walter Scott, Dickens, Keats, Benjamin Franklin,

Longfellow, Whittier, Bret Harte and Poe. Thru my subsequent life I have deeply appreciated the early familiarity with fine literature which I attained. It was well that this occurred in my early days, for at Sheff there was very little time for such cultural study.

I have come across a letter I wrote to my father in October, ~~1891~~ 1890, written on the Fitch typewriter which he had recently acquired. It read:

> Dear Sir: Will you favor me with your ears for a few moments? I wish to state my desires and purposes. I intend to be a machinist and inventor, because I have great talents in that direction, In this I think that you will agree with me. If this be so, why not allow me to so study as to best prepare myself for and take the Sheffield Scientific course than the Yale University; besides I could prepare for it in one more year and the cost would be much less, which would be a great item with you,who have us all to educate. The time and money it would take to let me take both could not be spared, and a great deal of what I would learn in the University would be of no advantage to one of my profession. While what I would learn in the Scientific course would be of greatest use. I think that you will agree with me about this on reflection, and earnestly hope that you will act accordingly and educate me for my profession. I write this with no ill will in the least but thinking that it is time to decide and choose my studies accordingly.
>
> Your obedient son Lee de Forest

And then, as a sort of post script, "This machine beats Mr. Silsby's all ~~xxx~~ to flinders". On the rear of the letter I typed the poem "Lives of Great Men all remind us...etc., and a note to my mother below:

> Dear Mama: The only footprints I will leave will be my inventions. I had bettertake the scientific course. Don't you think so?"

(Note GHC. If this isn't sheer prophecy, I'll i=vent @ f.m.)

At T. I tried to replace hand picking of cotton by a mechanical picker, in which stiff brushes pressed against each cotton boll would draw the white fibres out of the hull. I made tests of this in the fields. It worked all right, but how to remove the cotton from the brushes was more difficult and I did not solve that.

One of the best of the Youth's Companion premiums that I got was a little Weeden upright steam engine, with an alcohol burner under the boiler. This was a wonderful thing to me. But alcohol was dear in the South; pure ethyl was all we could buy, so I cot away the skirt beneath the boiler and set the engine against the top of a lid of the kitchen stove. From the Youth's Companion I also got a fine set of good carving tools and carved many wierd images, salad spoons, etc, I recall carving a fine cameo out of a piece of red-on-white pine wood.

Jan. 1, 1891, I started a Daily Journal, and recorded my day's doings faithfully therein. Rereading these, I see how woefully immature, lamentably childish for my years, I then was. Had I grown up with white companions, in the North, whose parents would have cultural and social training comparable with my own, I would doubtless have outgrown my immaturities much earlier. A few extracts: (1891)

> Jan. 17 After dinner I smoked a cubeb cigaret...
>
> Jan.25. Be good, it will pay in this world and the next. I am resolved to do, not live and die and the world...would not know I ever lived. They shall know and be glad, and be sorry when I die, -so help me God.
>
> Jan. 29th. At 2 pm we had prayer meeting in our room till 2 45. then I came home and took a plank to the shop and ripped it up into ~~xxx~~ 1/4" strips. We worked till my muscle got like a rock and I raised a blood blister,...I had the luck to snag my thumb on the saw and ripped it up. It is bad off. After supper I composed my letter to Edison and asking for his advice. May it get a favorable answer. Now read and bed.

In the driv ways to Foster Hall and to Winstead Farm were two mechanically-operated swinging gates, designed to open and close then the front wagon wheels drove across an upright D-shaped iron bar. Another farm gate was operated to move right and left by means of a long, overhead wooden lever, pulled down by the driver. I studied these, noted their merits and deficinencies,and invented a gate on a different principle, to swing out before the approaching team, and close behind it, by an overhead lever pulled by the driver. I built a scale model in black walnot, and it worked perfectly; my first invention which actually thus performed.

I wrote some details of this to manufacturers of farm gates, seeking to have them acquire rights under my invention. Nothing ever came of this, but I stillm maintain that this idea had advantages over any other types with which I was then familiar.

I clipped items from the Youth's Companion howin how to build an electric motor an induction coil, ~~xxax~~ an electric bell, a telegraph outfit, and the like/ I tried to build every one, with indifferent success, because materials could not be had in T. I imported a spool of insulated wire from Boston, but failed in building a Lechanche cell. I could find no carbons, and tho I tried to pound and grind coke from the iron furnaces,using molasses as a binder, the final result proved unusable. I finally got the battery as part of my electro-plating premium, but I used it sparingly with these earlier toys, as it was indispensable for plating.

My first motor has as armature a wooden spool with a nail passing thru the center as an axis, the poles being six flat-head iron screws. The child of the 1930's has only to press a button and an electrical universe resounding with the whirr of toy Zeppelins and the roar of elextric trains comes into being.

Typical entry, Feb. 21:

> Rode to town. No rebs got me;rained all morning. After work we made a bowling alley in the upper barn chamber, by moving hay and lining the alley with planks. For balls we had croquet balls , and for pins, round sticks of wood chopped off small at one end. Played with it some, then typed for Papa. Went to town and had to wait a long time for oysters. Had my hair cut, came home in rain , but I had forgot to take pail and I borrowed one at oyster store. After dinner I cut kindlings and then played football. Came home, copied a piece, supper, read, studying, pasted in my scrapbook, bath and bed. Must play cornet in Sunday School tomorrow. Woe is me.

Another entry: This morning went down again to the tramroad,an had some good rides. Every time we went over the break in the tramroad Charles and I prayed to go safely over, and went over, thanked the Lord. Then I pushed three cars to the furnace and switched mine off and rode back. STrained myself very hard but it makes muscle. I stick to a thing like a seed-tick. (Memo: GHC. This should be inscribed on de Forest's Coat of Arms!)

Other entries read " Went to library and enjoyed the Patent Office reports. No novels"... "Read Peru, very interesting. No dime novels for me...."I don't believe my offsrping will have better reading matter than I have"...

I took a trip to and thru Colorado with my father in the summer of 1888. I got off the train at every local platform, never to climb abroad again until the train was well under way. There I met a Mr. Wallace, a deacon of my father's ~~xxxx~~ church at Council Bluffs, my birthplace. ~~Dixxy~~ I wrote my mother: "I have got a girl there (Concil Bluffs). She is a daisy. Here name is Nettie Wallace. She gave me her photo also". (More re Nettie later. GHC)

We went to Colorado Springs and saw the lonely grave of Helen Hunt. I wrote a poem to commemorate this:

> Stranger, pause and drop a tear
> Helen Hunt lies buried here,
> She whose pen the world inspired
> Like all mortals, has expired.
> And when you read my humble ditty
> Think, oh stranger, 'twas a pity
> Someone more inspired than I
> Did not speed her to the sky.

July 7,1891, left T. for Lake Quinsagamond. Said farewell to "rebs and nigs". Went by sea to Boston, where Lee experienced his first sea-sickness. (Note GHC

Didn't he invant some way to do away with sea-sickness?)

Went to Worcester to spend the summer in a boys' camp. Plenty of drilling, swimming, camp inspections, discipline.Also, most important, classes in electricity.Here I constructed some of the things I had been unable to make at T.

My journal entries show that there was never an insurrection, rebellion, wholesale infraction of the rules , without my being mixed in it, i not the ringleader.I was often put on uard duty as punishment. One entry reads " Colonel tol me to stay in my tent until relieved, leaving it only for meals, which I did. Am now in it sewing my pants. This is as bad a summer as I have ever spent in my life."

Sept.1, Father came for me and we went to Mt. Hermon, Mass. Sept. 2 Lee passed his entrance exams in US History, Geography and Spelling. Also Music. "Had a hard day and felt like crying. Am tired".

Next day:n"Went to YMCA meeting, as my dear father told me to go to all Prayer Meetings and take a lead. It'll take a long time to get acquainted and courage. Must pray. The meeting seemed tiresome and I was cold"

Much work had to be done in the potato fields, etc. Said he" That was the way at Mt, Hermon. Scholastic achievements were frequently rated as of less value than ability to milk cows and heave heavy rocks all day.

Sept. 30. "And now my good, pleasant and clean room-mate Allen was to move and a nut-headed yokel with leater boots and overalls, rank with the essence of the cowbars where he milked, was to take his place. Despite my prayers to God filthy Hatton moved in."

Lee had trouble being immaculate those days. "Each student was assigned one quarter hour a week for use of the bathtub, and as mu bath hour was Wednesday night I f equently found it necessary to bathe myself in sections, for I found potato digging to be very dirty work".

Again: "Studies suffer for work here. I'm sorry there are so many hayseeds, farmers, igonrant uncouth rough fellows here. On the apple gang now".

"Picked rocks and practiced football with the 93's. Shovelled dirt, real dago work. Got my razor strop, and now I begin to shave"

Some time later. Got a job in the bakery, " a pie bakery, at that!"

"One monday in Nov. the Hermon football team played Brattleboro. I borrowed 10¢ to go. Walked to Northfield, rowing myself across the Connecticut River. Took train to Brattleboro. Hermon won in a drizzle, 30/0. Walked 15 miles back to school. Spent my last 5¢ for rolls for supper. Reached school at 10:30 , went to bakery and swiped a loaf of bread, at this, and went to bed" This was my first Rugby football game.

"Went to Marquand Hall over at the Sem at noght-the 93's and 92's were invited over. I had a fine time. Met Miss Winter, who is quote pretty". She was a classmate of Lee's sister, who was at an academy at Northfield, Mass.Says Lee: "More of this charming young lady in this history!"

Dec. 1. Lee had bought ice skates the preceding summer in Boston but had never used them. Dec. 1. "OIce on the pond. Took my first lesson in skating. Had Hatton wake me at 5, went to laundry pond and skated till breakfast"

Geometry note: "I have discovered how to trisect and angle. Feel quite elated"

My first vacation at Harmon. My diary records the first telephone conversation in my life, from Prof. Cutler's house to my sister over at Northfield Sem. "I couldn't hear much but a buzzing. Drat old Edison. I was ashamed to talk, not understanding her". "Went to prayer meeting at Prof's invitation. My soul is not growing rapidly here. My studies have choked its progress and it has small interest now in prayer meetings". (Note--de Forest, in his memos from which all this is being abstracted, adds here "A hopeful sign!"...Also "My social ambitions now continue to expand....I walked over to the Sem. I only was knocked down to two girls, one a chromo. The Hermon band performed, I among it. I played very well. Three verses: Comrades, Annie Rooney and They're after me". A phonograph was one of the attractions, the first one I had heard since the old Edison tinfoil cylinder in Waterloo, Ohio."

Lee spent Christmas with his sister at West Medford, Mass., at the home of his mother's cousin. At Christmas he met his second cousin, Helen Wyatt, "of whom more thereafter". (Note GHC. He is really getting into his stride. Sfter being with so many nigger girls at T., no wonder he wants to meet a few white girls!)

"My diary shows that during this trip I went to the Boston Public Library and found there in the Youth's Companion information that a mechanical engineer can get $5000 per annum! "

Jan. 1 1892. First entry: "I have no sentimental resolves or feelings to express but keep right on trying with God's help to grow better. Celebrated the occasion by hearing the Boston Symphony Orchestra. It was grand"

"Prof gave a talk in Chapel and said that there are about 20 bad boys here, smoking, card playing, novel reading and drinking, who must leave at end of term. Assuredly I was not included. "

"In the dreaded January exams I did well in Virgil and got E in Physics and Algebra. My prof came across the room and whispered that I got E plus in Geometry"

"Now promted from bakery to waiting on tables in the big dining room. No more greasing tins! ...I sewed my pants Monday to last till next Monday".

Feb. 15."My shoddy pants gave out today. My Plymputh Rock pants have not yet come.....My days are sliding swiftly by"

The Semonary girls were to throw a grand party, a Character Party. I am going as Garibaldi, hero of the Red Shorts and an organ grinder. I had on blue military pants with red stripes, thrust into old rust boots, a flaming red undershirt, red bandana and old slouch hat. Made up a monkey and took it along. I rattledd off my son and got two cents. Julia Winter came along, and my heart stood still as she daid in dulcet tones so sweet "I can play it, too, can't I, prgan grinder?". She looked unusually pretty as a Norwegian peasant girl. Joy, oh joy; Julia was my partner in the grand march, but she would have preferred me in a more civilized garb. ✱ She took my arm rather gingerly and daintily. This hurt me a little but was only natural.. Soon, however, she nestled up sweetly and confidingly, and talked so sweetly about the pictures. She spoke twice during the evening of playing my organ. The march was not one fiftieth of what it should have been. Like a fool I did not bid her goodnight. Do not think I have the gentle passion(!) "

Second in class in Virgil, and E plus in Geometry. 'Best paper Prof. Dickey ever corrected'.

"Worked nine hours on the farm...Walked to church...Julia saw me and bowed to me. Oh, how sweet! My freckles show so"

April 13. "I swiped a pie, which of course tasted well!"

"I wrote in my diary 'I love Julia F. Winter' "

Entered the field day, for the kile walk. Price, a dozen cabinet photos. Only two other contestants. Came in first. Broke the previous "unbreakable record" by 7 3/4 seconds/ Was exhausted but happy.

Julia congratulated me next Sunday in church. "I pray constantly for her". "I wanted to ask her to play tennis next Monday but didn't take my chance. Poor Fool!"

My father wrote me: "...Do not weary in well-doing. May both my boys be stalwarts, regular Gideonites of the tribe of de Forest. No weak-kneed, faint-hearted namby pamby among my male successors; only two, but each a lion.You know , I was never fond of ornaments. If my children are not my jewels I shall never shine."

My roommate Lewis and I, as the spring term drew to a close, decided to try our hand as book agents during the summer We signedup with the Family Library Ass'n.,Spring ield, Mass., to sell a hefty volume called King(s Hanbook of the U.S. We were instructed by a "dynamic dynimiter" of the firm in the adroit technic of the book agent.

Bicycled over to Northfield and played tennis with Miss Winter. I lacked the nerve to go to her dormitory and waited till she came to the court. On a later occasion, Jewell (as I now dared to call her to myself) passed us and bowed sweetly and pleasantly, winking twice as is her wont. I barely spoke to her that pm and didn't bid her goodbye.

Pastor Cook invited me to supper and prayed at great length, to aid me in canvassing. It is unrecorded now these devotionals helped me in the sale of unwanted books to reluctant people.

My efforts to sell books thru the poor rural districts of southern

Vermont may be classed as pathetic. I approached the task with the utmost reluctance but my journal entries are not without humor:

First day. Worked seven hours, no sale.Next day got a doctor to buy one, at a discount "to help me entirely".

Everyone thinks it is a good book but are too poor or the time or desire to read.

At the end of the week I had 13 orders. Then two in one day, then one.

"I pray God for my success this summer, for deveopment of character, to graduate next year, to visit the World's Fair with all the family, to go to Sheffield Scientific School, my Jewell for a wife, a home for Pa and Ma when they are done South, that I may be a great inventor. Lend me millions and I'll repay it. May Papa llive to see college made independent by his son"

At the end of the summer I had sold 102 beeks.

The Degree of B A Sept. 26 1892.

After all adjustments I made only $40 in the summer, instead of $100 as I expected.

Sept. 5 1892. Back at Harmon. I am Editor of the Hermonite. Am again in training for the walking contest, and am taking Hood's Sarsaparilla. Field Day: Did not come in first in mile walk.

Got E in trig and chemistry.

Dwight L. Moody is founder of the Harmon school. He visited here this Fall and is a demi-god to the students.

Had to saw wood in weather 14 to 20 deg. below zero. I have wondered how with those long hours of farm work, with the curriculum overburdened with Bible study and Bible training classes, interspersed with religious services no end, I wam still able to stand well in my classes and to adequately prepare myself to enter YALE next year. Got highest marks in chass for trig. and chemistry.

This making of intelligent minds go to waste on senseless farm work instead of developing hand and brain in a useful trade or allowing time and strength for other lessons --these evils are rampant at Mt. H. I haven't time to go to prayer meeting. "I am increasingly more indignant at the injustice and stupidity of the Faculty and school management which seem to delight in making it so difficult for an unusually ambitious and gifted student to make the most possible out ofhis educational opportunities. To keep up with my chemistry I am compelled to buy time off for a substitute in my farm work."

Wrote to Chicago for position as guide during the World's Fair.

I studied hard on Bible Study so as to compete with my Bible paper for a $50 prize. Was selected to give the Scientific Oration. I feel honored and pray not to be conceited. I have to speak on "Scientific Discovery"--I am full of that. This was given to me for no other reason than my scientific merit. I am not popular.Got E in astronomy, the highest mark in the class.

Rode to the Sem. But Julia loves Brooks, I fear.

World's Fair openedk today. I hope that the directors who open it Sundays will be cursed.

Have spent over 40 hours on my precious Bible prize easay. Did not take part in field day. If I win, Papa writes I can buy a $100 second hand Columbia bicycle.

Hines and I were the only ones to pass the Astronomy exam.

The '93 Class Banquet at the Northfield Hotel. I had Julia all the time, oh bliss. We went out on the piazza and xxxx she suggested xx going off by ourselves, w which we did, and then she recited beautifully her lovely Class Poem. Oh, if I only win the prize and her regard.

Class Day. I delivered with dignity and becoming modesty the oration, "Scientific Research"/ Then Graduation Day, and the prizes. But the Bible Prize was awarded--not to me, tho I waited for my name to be spoken--but to Charles Snow. My youthful trusting faith in God sustained a blow from which it never quite recovered. Got my diploma anyway and took Julia to the collation. Julia has a geat appetite. Couldn't afford the 75¢ for the banquet that night. After she departed I drank her health in two glasses of phosa water.

I had determined to take all the Yale entrance exams this June, so thru the following weeks, 10 hours a day, I studied Virgil, Geom., Algebra. At last I entrained for New Haven, to be enrolled as a freshman at Yale. 200 of us sub-

freshmen assembled in the upper corridors of Winchester Hall for the exams, all wearing straw hats with brims so wide that broad shoulders came not into contact. This was the college style of that year.

Latin prose. I feared I flunked. Caesar and Virgil were better. Algebra was hard. Trig and Grammar finished the list. Then found a $2.50 a week room in Freshman Row on Campus Street,3rd. floor back. Saw Prof. Brush , head of Sheff and learned that Father had written him, and that my tuition would be paid from the de Forest scholarship. Later learned that I passed everyone of my entrance exams.

Returning to Hermon, found a letter from the Fair--no job as guide. So had to take up the hateful work of book canvessing, this time sellin g "What can a Woman Do?" The place, Syracuse. Finally sold enough books to pay the $18.50 for a round trip to Cjicago, on long, crowded excursion train, sleeping ipright and restlessly. Put up at Aunt Hattie's home in the outskirts. Spent the first day in the Mfrs. Bldg., studying typewriters especially. Thursday do. Many chair boys have struck, maybe I'll get a job. Then in the transportaion bldg. studyin railroad matters.

Monday. Could get a chair pusher's job. Paid $8 and got my uniform.Hard work, but one can see the Fair at night.Got big tips. Boarded at Aunt Harrie's and slept at Bingo Farm for 50 ¢ a day.

Worked 11 hours second day. It was my 20th. birthday.

Aug. 28 1893. The night scenes are beautiful beyond compare .They repay the day's hard work. Tips not so good this week. Papa is here. Sometimes my clients wish to park by the lake and watch the fireworks;then I do not have to push. Last night went to Auditorium and saw "America2. Stependous. So much splendid ballet dancing and high kicking made me restless to see more. (Note GHC I get you, Lee!!!)

Sept 16. Finished my duties. I love the Fair and hated to leave. Took a last farewell look at the Peristyle It was with saness that I heard that sad dull click of the turnstile as it shut me out forever from that wonderful Exposition whi h had been my happy home for a month.

Day coach to Kuscatine.Walkedup the long hill to Grandfather Robbins' old parsonage and found them all at prayer. Brother Charles was there, and my parents. Two days later again I left them, to Syracuse and then on to New Haven.A Yale freshman at last.

Rushed over to the Commons for a job as waiter;found I was several days too late but went on the reserve list. Fixed my room up prettily, with the Harmon curtains hung around the looking glass. I eat at a 5¢ restaurant nearby; not more than 15¢ per meal.

Papa sent me $50, I spent $42.63 for books, paid my debts and bought a meal ticket, leaving less than $2. New Haven is the prettiest city I have ever seen. Lakes, walks and drives make one love Yale and its home, so soon.

At that time I became a love-lorn loon, going up to Middletown to call on Julia Winter and filling page after page with maudlin sentiments, emotions and hopes. Dismal weeks awaited letters that did not com .

I bought some connamon cigarettes to be like the boys. Got $20 from Papa and spent it for an ulster and am dead broke again.

Heard a medical professor at Dwight Hall talk on the brain, and now I almost believe in evolution. Here was planted the first seed of agnisticism in my mind. Slowly thereafter were one by one broken asunder and discarded many of the myths and beliefs which had been my spiritual pabulum through my youth. One by one I began to test this and that belief with the corrosive acid of experience, scientific reasoning, and probabilities.

Invented a game based on the Chicago Fair. I carved a miniature Midway Plaisance, down which rolledtwo shots, the big one a lady, the small one a gent. The gam w was to get them down the Midway without going into any of the shows, a penalty being charged for "admission" to each show, for each shot entering. I wrote to the Ferris Wheel Puzzle Co. regarding the invention, and on the strength of my expected royalties bought a large kerosene lamp to light and especially to heat my room.

Read in Sci. Am of $50,000 prize for the best design of an underground trolley system. In church today the idea of how to build this came to me, and I drew up the plan that evening. Vowed to give one tenth to the Lord if I won. Looked up the idea in the library;found that allexisting plans depended on drainage for in-

sulation, mine does not, and can run under a foot of mud or water.

Sam and I went to the Grand Theatre one night for 10¢ and next day I got a letter from Papa hoping I would never go there agin. I am sorry. Last night I dined with my landlady, and she offered me cider. Not wanting to offend her I took a sip, then said I didn't like it. I should have refused, but I broke my pledge. I am strong enough not to take to drinking but if in public my example might have been damning. I'll not do the like again. (Note GHC. How about the wines, cocktails, and highballs at the cobwebby bar in Washington, with me, around 1915, Doc?)

I have grown more manly this last year. My suit with Julia is, I trust, in much better condition. Still no invitation from them, alas. I yearn strongly for girl company and am apt to flirt for want of it. Farewell dear old '93.

Went skating this week and skated ith a girl, pretty and straight, but gay like myself. I like to skate, especially with girls, and there is no harm in it. It satisfies my desire to be with girls. My Midway puzzle was returned.

Cut chemistry and to skate with the girls but neither of them was there.

Flunked in German. I am out of the running for the General Excellence prize on account of German and Drawing.

I find I lack strength, common sense, manliness. Don't improve all my opportunities. Always resolve to do better but often repeat folly. Lack the individuality of character my life's work demands; am a fool.

Bad news from Talladega. Deaths among the faculty; father alone and worried. He is without money and I have one cent!

I am now earning 10¢ an hour helping sum up psychology cards. Studies seem tedious, especially German, but I will not give up.

I am now inventing the air ship, double mirror illusion, steam saver (returning exhaust steam to the boiler), atmospheric electricity generator. Thinking on my photoscope, and trying to think of a way to transform light and all energy into electricity.

Wise physicists and savants, with their formulas, may prove a thing absolutely impossible or physically impractical, but the simple inventor dries their cold water with the towel of ingenuity and the sponge of dauntless perseverance, accomplishing their impossibilities and extorting their toll for the use of his production.

I am still praying ernestly to God that I may win the underground trolley prize for Papa's and for Mama's sake.

I note that when I go to the theatre I always sit in nigger heaven unless some one is with me.

Sunday. Chapel in the morning, then read History of Evolution. I must read Darwin et al and know the facts. One after the other the cherished tenets of my faith, the religious doctrines which had become ingrained in me, were reluctantlu surrendered, challenged by the ever incteasing severity of my developing intellect which was rapidly grasping the significance of the scientific approach.

Have tried to sell my Midway puzzle to 11 firms and have now quit.

Am working on my telephote, now changing it to a duplex system. May use tourmaile. (Note L de F. Probably this was form of television, and I was working along the lines of a Kerr cell).

The Metropolitan Co. has withdrawn its offer of $50,000 for an underground trolley system. My plan returned to me.

Began waiting at Jackson's Restaurant for two meals a day. It is not hard but takes two hours a day. Sheff boys miss so much with no dormitory. I will endow the college so they will have dormitory rooms so rich and poor are mixed everywhere and equally.

Saturday before Commencement Father arrived, Was much pleased with my work. I was present at the last Commencement exercises in old Center Church. That afternoon I heard Tesla speak, Chauncey Depew at the Alumni Dinner.

Moved to small upper room of the senior Greek prof., in return for mowing lawn and watering it.

Took my first steamboat ride down the Sound to N Y City. Sailed under Brooklyn Bridge. Visited Central Park;lost in admiration of the beautiful buildings. Went to the theatre to see the "living pictures".

I spent many nights in my little room reading such great tomes as the translation of Kundt's "Philosophy". My ~~ix~~ diary entires are fullof embryonic philosophmical observations and attempts at reasoning, regarding self-consciousness, the ego, predetermination,free will, the end of the world. "But the end of the world is thousands of years off yet, and no theologian can thus scare me. Man is in his infancy and is hardly an intellectual animal yet. I comprehend the grand and sublime scheme of evolution too well, tho very blindly, not to see that it can't be near ended yet. Intellectual chapters just beginning will last until the upper strata of sciences are comprehended. Eternity is too short for our minds to penetrate all the strata, to know all the reasons why.And yet until then will no great mind be satisfied"

" Mrs. Seymour wanted me to do some odd jobs around the house to pay for my room rent, and then she wants me to take Charlie to Glen Island for a day.
So we sailed to the Island today. The trip cost~~x~~ us only 60¢ but Mrs. Seymour didn't put up an elaborate lunch or let us have any money for candy". That little boy Charles then in knee pants, is now the honored president of Yale U. I met him recently at a Yale dinner, to learn that he still remembered that early dinner.

"I read a little in metaphysics. I don't like it very well, but it's good mental discipline. It's altogether too theoretical yet without any tangible theory. Too much of the thingness of the wherefore. The truths with which it deals must be discovered thru other channels than mere logic and reasoning. They must be got at by experiment and observed facts . The ways leading~~x~~ to them are too obscure, the paths too long and devious to be followed by the mind guide alone. The way must first be blazed by facts and data secured by the scientists. Then may the pure pure philosopher know where "he is at",and his determinations and conclusions carry conviction in the minds of others. Man's mind alone is not great enough to determine Nature's causes or purposes. It goes astray at many points unawarres and yet to all logic and reason appears to be perfectly right. But the scientific experimenter has the most aggregating way of going about his business and turning up plain andsimple facts which show flaws in all this fine reasoning and proves his infallible logic to have been illogical. Without such proofs the philosopher's conclusions and results will never be more than his own opinions, nor convince others than himself."

"Conversation is the hammer and tongs with which the strong link of friendship is forged".

" I think the evidence of fact is against the immortality of the soul (however, I never doubt it for a moment). For all thought of man, all his consciousness, depends so directly and invariably on the brain and its conditions that when it is diseased or stops all consciousness ceases, as in a deep, dreamless sleep or a dead faint. The victim is no more conscious than a stone.Why, then, will he be more so in death, when the brain is stilled forever? I explain that while the brain lives the soul (evolved and generated by its output, thought)is directly dependent on it, stops when it stops, rests when it rests. But when thebrain is dead the soul is freed from it and its thenceforth free, yet changeless. It is intensely self-conscious yet cannot change its manner of thought, good or bad, i.e., eternal remorse or satisfaction over its attitude while on earth to God. Its degree of Heaven and Hell depends thus on the intellectuality of the brain it left, and on its former environment, customs, enlightenment, etc. Hence each soul is its own criterion of right and wrong, ~~depend~~ determined by its life on earth and its condition. Thus babies, savages and animals are not immortal, for until the intelligence is fully developed no eternal essence is evolved by its output, thought. I hold that the final reason or logic to which every thought must be referred whether it be correct, comprises those uncaused and unotherwiseable facts we know such as the laws of mathematics, space, time, etc. After death we think indeed and go on knowing truth. To the scientist there can be no other Heaven. Thus as we think deeper and truer our Heaven or Hell increases as eternity lengthens.
Even God cannot stop us without destrpying us, a spirit". (Note GHC. Phew!!!)

Aug. 26 1894. I am of age today. I can't realize it. I am almost a materialist to day. ...I have been seeking to reconcile with fact my life-long devout belief in miracles and the Biblical myths. It was the clear thruth that I am beginning more clearly to discern and reverandly welcome....Thru that freshman vacation at

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...house to pay for my room ... for a day. ...O& but Mrs. Seymour didn't ...ndy". That little boy Charles ... I met him recently at a ... dinner. ...ell, but it's good mental ...my tangible theory. Too ...hich it deals must be ...ing. They must be ...s to them are too obscure, ... guide alone. The way must ...s. Then may the pure ...ons and conclusions ... is not great enough ...at many points unawarres ...ght. But the scientific ...is business and turning ... reasoning and proves his ...ofs the philosopher's ...inions, nor convince others

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...y of the soul (however, I ... his consciousness, depends ...s that when it is diseased ... sleep or a dead faint. ...l he be more so in ...while the brain lives the ...ctly dependent on it, ...ain is dead the soul is ...It is intensely self- ... bad, i.e., eternal re- ...b God. Its degree of ... brain it left, and on ...nce each soul is its own ...ife on earth and ...mmortal, for until the intelligence is fully developed no eternal essence is evolved by its output, thought. I hold that the final reason or logic to which every thought must be referred whether it be correct, comprises those uncaused and unotherwiseable facts we know such as the laws of mathematics, space, time, etc. After death we think indeed and go on knowing truth. To the scientist there can be no other Heaven. Thus as we think deeper and truer our Heaven or Hell increases as eternity lengthens. Even God cannot stop us without destrpying us, a spirit". (Note GHC. Phew!!!)

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Soph year at P9 Shld try "I Do" thru dual entrance exam filled w/ involved metaphysical discussions w/ mingled w/ Senior observations about Doc to dual personality one could study relig-ious training one forbidden to develop sexual purpose) he P19 language (& work about Poem in pure Ah Poem Relig record in mud Sic Doc Lecher wine P17-18 P24 taste Poem P19 tab

Yale I became more of a philospher than I have ever been since. And thus, one by one my childhood's firm religious tenets and beliefs altered and were reluctantly discarded.

I find that my diary entries are filled with involved metaphysical discussions, mingled with sensory obervations. (Note GHC. Doc is a dual personalty, one caused by his religious bringing up, one following his rapidly developing sexual prowess)

"Evolution is indubitable, indisputable, that of mind along with body...Nowhere else can I find rest or satisfaction"

Junior year at Sheff. Moved to Freshman Row,to a 3rd, floor front, with a dear old motherly soul, Mrs. Barker, as my landlady. "When I get a few more pillows my window seat will be as fine as any. I take lots of comfort in it....Sat. night was my first hazing of Freshmen".

We caught two freshmen this evening. Made them kneel on the steps and tell us why they came to Yale. Then they marched to Otto's, yelling Rah, Rah, and 'I am the biggest man in college' and 'I am a damned fool' We paused at a lady's window while one, in accents touching and pathetic implored "Mamie, come kiss your honey boy'. At Otto's they mounted sheeless on the table, a bottle of beer was produced and one knelt while the other shapooed him. Finally a Senior rescued them.

Now in the mechanical engineering course, taking German and French, solid analytics, mechanism, drawing. I hate languages and want to study only engineering subjects. (Too bad I did not realize how a thorough working knowledge of French and German would help me later) (Note GHC. Bet you realize it even more these days, when, in your study on the 4th. floor of your beautiful L.A. home you look over the foreign magazines, on electrical, technical and medical matters, and keep up with Europe)

"Pressed my pants again, experimenting with my 'crease perpetuator', which saved me 10 ¢. (Note L de F. Put them between the mattresses and slept on them)

Being full fledged Junior, I had the right to smoke a pipe. Bought one for 25¢. Locked myself in my room with a pkg of "Hearts and Flowers", the mildest smoking tobacco I could buy, I smoked furiously one night. Got sick over it.

Wrote my story about "Catching the Flying Express", which I concieved 2½ years ago-for the Youth's Companion. Plot very novel and exciting but of course it's poorly written.

"I define a conservative as 'an Adam who mistakes his epoch for the millenium' "

Looking over the events of that Fall, my undernourishment, my excessive work, my late hours, my exposure to cold and wet during my skating excursions on Lake Whitney, I wonder not that recurrent symptoms of approaching illness appeared. I found myself a very sick boy. My landlady gave me hot flatirons to keep myself warm. An awful night with chills and fever, then the College Hypocrates drove me to the Yale Infirmary. 3 weeks convalescing. They have a spledid table and how I did eat, and how I needed it.

Recovered, I again took long walks to the restaurant for my 10¢ milk toast breakfast. Bought long underwear. "I hope never to be sick again until my death, in the ninth decade". (Note GHC. Check up on this!)

During Freshman year I went to Middletown several times to see Julia Winter.My diary was full of lovelorn mooning. She went to Chicago, to study in Moody's Bible Institute, and doesn't write.

Writing notes for the Yale Scientif Monthly. The Jan. number had only one of my three notes in it.

My life at Yale was not adapted for nringing me into close social contact and understanding with my classmates. I knew but few and these not intimately.Few class mates knew me well enough to understand me. I was given the chance to join one

secret society but my poverty compelled me to declibe. "Took great pride in watch ing my indomitable will doing self imposed tasks laid out beforehand, despite theatres and weariness."

"I'm reading about Tesla. Admire him sincerely. How I pray that I may equal and excel him,that all his belief in my genius and sdestiny are not idle visions".

A letter advises me that I am on the Editorial Staff of the Yale Scientific Monthly. At last!

My diary now records weeks of unrelenting work, continued hard study, writing, re writing and condensing my prize-seeking essay on Aerial Navigation. Every night I went to the U. library and reading room to seek material for the article.

The dead line is May 1 and I am struggling furiously.It is to be 5000 words. I finished the neatly typed essay at 9:30 the day before. "Did I congratulate myself? Did I shake hands with Lee de Forest! It has much merit and will win--if there is no other so good"

"Julia Winter finally wrote me, enclosing a tract. She can't write me again. I am glad the Balm of Time has healed my heart so I do noto care at all...Now I am free to look around me. How would Gladys suit?"

Those lovely moonlight nights on the Fence. The pipes, the comrades--tho very few, alas, for a Sheff man--the songs, the fun, the 'Y-a-a-a's" How it lures one away from work and ambition.

I recall the few happy hours upon the placid bosom of Lake Whitney. These form my choicest memories. I have seen the yellow moon climb lazily up beyond East Rock, frosting all the landscape and marking with a golden finger a rippling path across the mirrored lake, filling youthful hearts with joy and delight and love, 'witching sentiments, and a vague and nameless longing".

And then the contrast to Yale Field. The baseball game between the Freshmen and the Sophs was on , and we "let loose all gell in pandemonium of cannon, firecracker, shotguns, revolvers, rattles, fishhorns, street car gongs and tambourines, and all the hoarse yells ~~knock~~ which would combine in a loud cheer for '97. Compared with o our din the cheers of the Freshmen were like the singing of a cricket on the rear axle of a thunderbolt making fast time for Blockton. We fired guns at the first baseman's head when he was catching a runner out. We threw cannon crackers at him. Bunches went off under his feet but he never muffed. Despite all our din and skull-duggery the Freshmen won the game ! And that night the Freshmen sat upon the Sophomore fence."

"How wildly arson-minded did I join in the building and maintaining despite the Campus cops of the gigantic bonfire on Omega Lambda Chi night, and again, fascinated, watched the calcium light parades of the Junior Secret Societies. Or from my attic I heard afar the mellow songs of the Alpha Delta Phi's, to which my father had belonged, chanting throughout the long spring night; and far off across the campus beneath the elms the mellow, heart-gripping notes of 'Amici'" (Note GHC. Lee had a heck of a lot more sense than his father, tho the old man's nature was calling deep within him. Lee had work to do, and a grid to invent!)

"And again. Coming back from returning the empty pop bottles to Traeger's we heard a barrel crash from the 4th. floor of North Middle, and loud 'Y-a-a-a s' resulted. Then Dayton and I, after patiently waiting for th cop, took two ash can tops up and fired them down on the sidewalk, one after another. They made a deafening crash,"

Now I note this entry: "Tried to invent a telephone relay". 11 years later I invented it!

Thus ended my Junior Year at Yale. I didn't get the Essay Prize after all.No one did. 40 years later the editors of the Yale Scientific Magazine esteemed it good enough to republish!!!

Went to Block Island and got a job as waiter at the Highland House. Another tough and generall unpleasant summer. Beside my board I earned a negligible sum of $" My vacations have all been like medicine and I dread their advent and rejoice when they are ended. My sleeping quarters were in a noisy, filthy hole, on a hard mattress and a broken-down bed, sheets thrown on the filthy floor, oaths, scrapping, tobacco smoke and noise all around me. It was good to get back to the clean, soft bed at Mrs. Barker's. On the other hand, the gnub at th dump where I had to eat made me long for the board at the Highland House.

Sept. 1895. Senior Year commences.We Seniors ran the Freshmen Rush. We bought large quantities of firecrackers and fireworks, crackers, 2 kegs of beer, etc. I used one of Mrs. B's nightgowns, made a hoopskirt by using barrel hoops, tied my big '97 hat down to me a sunbonnet, and to protect my face from sausage skins and inflated bladders which were to be flying around. I blew up an inner tube of a bike and it was the best there was, would swipe off plug hats fine. Also gave quick, stunning blows on bare heads. Then the band struck up and we got in line, making a wierd sight in the Yale dance, from sidewalk to sidewalk. The sidewlks were jammed and the townspeople enjoyed it.

Sept. 30. First experimental work of my engineering course. I am studying elec. eng.

The Youth's Companion returned my mss. My last attempt at story writing, also my only one. The last of a long series of zealous attempts for prizes, all of which failed, also inventions, puzlès, compasses, micromotors, ear-cleaners, pants-creasers, Bible prizes, underground trolley condiits, essays--all n.g. except my trial for the Yale Sci. Mag. Yet I am not discouraged.

I went canoeing with my friend yeaterday, a perfect day of Indian Summer. We went up Lake Whutney and the narrow, toruous channel that feeds it, passing in all 18 dams or rapids, We went up and past milldams where we carried the canoe, up thru rapids and shallows, along quiet canals, over smooth lakes and millponds, thru lovely woodlands, beautiful tho seared and leafless, under country bridges by brown meadows and near old New England farmhouses, again under low overhanging branches of large trees. Out again into the open whence came charming views of country fields an orchards , and in the distance looming old Mt. Carmel, purple with haze in the waning twilight. It was really the most romantic time I have ever had.
I know of nothing that could furnish more ideal, more nearly perfect enjoyment than that twilight hour when we were floating down in the valley through shaded wood and fields rusty with the glow of sunset, now in a stilled tunnel where the only sound was rhw ripple of the black water on the rocks, then out upon the ~~board~~broad lake where the glow of evening and the bright twinkling lights of the factory were reflected in the still depths, a glorious background against which the long bare limbs of trees were shown in double picture and three fold beauty. And to crown all, the daintiest thinnest crescent of the new moon beamed down upon us and her own reflection, a golden bow on a russet field. I never was more entranced.

I have been actually elected as one of the Class Historians. I suppose my article in the Scientific on Aerial Navigation had much to do ~~it~~ with it. I have heard from several that mine was about the best article yet appearing in the Magazine.

Sunday: studied a little; wore cap and gown to Chapel. I can now, with no fear of sin, study a little or skate on Sunday. My old ideas of what God expects of us, what Commandments are for, and their origin, are broadened considerably; and with it my hopes for ultimate reform in all good essential things are much encouraged.

"Bought a book on Tesla's high frequency currents" (Note GHC. First inkling of the future!)

Went to NY and canvassed for ads for the Yale Sci.Monthly. Got only ~~$4~~ $5 worth, just enough to pay expenses....Christmas vacation,went to Boston,canvassed for ads, stopping with my mother's cousin at Roxbury. During the stayhad some pleasant visits with my cousin Helen, who is very pretty, tho her hair isn't as light as my ideal. I got her promise to come to dance at the Yale Prom. I must now learn to dance. She has my Yale pin." I can't say whether the seeds of what may be a future love for this rare, fair second cousin of mine are sown or not". (Note GHC.

Lee is very romantic. It may be that the lack of schoolgirl acquaintances during his grammar and high school days among the Rebs and Nigs caused him to be thrown into the delightful mysteries of feminine company without previous ~~in~~ vaccination)

"I note that the word 'damn' occures more and more in my diary, replacing 'damn'. This is an indication that I am getting on. (NoteGHC. That from a Junior in college)

So far I have had no conditions, tho I came very near that sad state more than once. My hopes for Sigma Chi and appointments are pretty slim.

The second cousin's name is Helen Wyatt. GHC

"The queens we have in the dancing class are not very good looking, I must say, but I don't care as long as I can practice on them"

January 26. Received telegram: "Father was hurt by falling- medical attention secured-will keep you informed". I had so hoped that my parents would live thru long years of peace and happiness, until I have a home for my dear ones and that they may live to see me make the college independent. If God is a God of love as well as of infinite wisdom he must interfere. I want to believe he does. Can I, intelligently?

Jan. 27. Papa died. Went to the bathroom, and, returning, became dizzy, lost his balance, and fell the full length of the stairs. He received awful blows on his temple and nose. He never regained full consciousness and reained, gradually sinking, till Monday evening at five (Jan. 27) when he peacefully and painlessly passed away. "A Man of God has gone to God. A heroic task of sacrificing labor, of hardy unstinting noble labor, is done. A sweet rest is granted to the great soul who asked it not.

James Brown came to the home at the beginning, before Father died. Prayers were offered unceasingly, but to no effect~~x~~. God does not interfere, and it leaves me with the thouhht that the influence of faith, unshaken belief, and ernest desire, together or separately, ~~xxxx~~x were not able to work any good".

The interment was at Sherbourne, and of course I was there. Mama's goodbye almost broke my heart. My tall form, my arm circled about her, was a comfort and reliance to her which was pitiful. I whispered she must live for us now. That was a comforting word to her.

I can, by borrowing from Prof. Brush and others, stay for another year. I want to prepare for Tesla's laboratory.

I got an appointment, and must keep my mark up to 3 from now on, and write an acceptable thesis on Laval's Steam Turbine for graduation. (Note GHC. Better get the name right, Doc.)

The best plan would be for mother to take a house here in the summer and perhaps pay the rent from student boarders. Perhaps sister Mary can teach music here. Mother always pined for society;here thre are many opportunities for it, also for lectures, music, etc. I am looking for a rooming house that is for rent. Poor father left about $6000 which is more than we expected.

"No longer does a faith in Divine Supervision or destiny warrant my faith in

a long life. This depends upon common sense, care, and good luck. Father held the helm until the direction was assured and the course true, and it shll go on even as he wished. But I am---fatherless!

Sigma Chi elections were given out, but to my chagrin and surprise I got none. My low mark last term kept me out, I suppose, tho I thoyght that my magazine work, which is excellent and original, and my promise of future original achievements, interest in science, etc. would pull me on. Byt The Powers ordered otherwise. They say that a few may be taken in later, if the show exceptional merit. (Note by Lee de Forest many years later: 'Evidently some of us did, for 33 years later Yalecalled me back to hand me the Sigma Chi, just 33 years too late.) I have l arned, however, to take disappointment philosopically and nonchalantly. I shall show them some day what a mistake they made. I will honor them then and not they me. (Note GHC. As per de Forests note some lines above, he was wuite a prophet in those days!)

Top spinning for us Seniors is now the gr at rage and it's lots of fun pegging at tops, 15 or 20 buzzing with great din simultaneously.

Marcg 2. How I did grind on my thesis and it is now done, 65 pages. I did several original stunts and formulas which highly elated me,but I did it for my own mathematical benefit, and once having begun I carried out my plans, for a de Forest of this clan 'never leaves a wedge in the rail', as Papa so often told me and wrote me.

I am in a out as great straits for money as I ever could be. I had not a cent to buy a French book before the recitation, but borrowed one. I had to write home for a V. Friday unexpectedly my scholarship was paid and I am out of debt. Now is a critical point in the curve of my life, for I am about to seek by correspondance work with Tesla. We have originated at Sheff a debating club. It decided at the first meeting that Sheff should have a four year course. (Note GHC. It must have been only three years in de Forest's time)
(one page if diary extracts missing, p. 132) — See p. 23a

Saturday night the Muse was with me and I wrote a Class Song. I borrowed $100 from Brush at last,but he murmured that of course I wished to hand it right over to the School on my debt. I felt cheap! I only got $10 out of it, and have to pay the interest. I am collecting enough from ads to live on.

I must look out or all my principles will be gone in this sweeping wave of rationalism and philosophy that evolutionary belief has gradually developed in me. I am not half so sure about matters of behaviousr as I was when I first embraced the belief.

My Class Song was not accepted, tho I thought it good, and there was only one other in competition. Here it is, for future reference:

(To the tune of Integer Vitae)

Closely the hour of parting draws before us.,
Swiftly the days, bright laden, journeyed o'er us,
Classmates in farewell throng united a parting chorus,
Praise to '96 and Yale.

Fondly the tendrils Friendship weaves are gleaming,
Thrice blessed in years of closest class commingling,
Distant scenes nor lapse of years nor changes Time is bringing
Shall dim our love for Yale.

Brightly the memories endless in succession
Bring to each heart a flood of sweet reflection;
Such are undying, pledge of fond affection
Through life for dear old Yale.

(Future reference note, 1946, GHC. About the worst I've ever seen, Eee! And this is said by the guy who was Class Poet for the Senior Class of 1903, Mass. Inst. of Tech. Such UN-rhyming I never hope to see again. End of excerbation.)

The second term closed Wednesday and I jumped at once into work, first on the Laval turbine thesis, then on to Hastings' Electricity Notes , working 11 hours one day, and keeping steadily at it. I must finish up the Classbook article on Senior Week, and collect subscriptions.

At last am on the track of a good house for us, on Freshman Row, No. 387. Our future home. I burden the mails with accounts to Mama.

I wrote to Nikola Tesla, without a single recommendation or introduction. I year or two ago I should have looked for Mr. Tesla to come up on the next train to interview me,but time and repeated disappointments mave seasoned my omtimistic faith in the potency of my star of destiny....To my greay joy and surprise Tesla deigned to answer, and that favorably.

The first Scientific Monthly editorial banquet was a grand success. Elegant menu, smooth champagne and wines, some very good toasts, cigars, and entrancing music the while. I felt in another world.

Because Harvard wouldn't row us this year, the crew left for Henley. I wanted to rouse things, wrote to the News, stirring them up to do something, and it appeared incorporated in an editorial! Me!

Commencement. Our Class Day exercises in cap and gown were very impressive. I am honored as one of the first twenty in a class of 157 to go on the platform to receive the diplomas from Pres. Dwight. Class Statistics: I am voted the nerviest in the Class, as well as the Homeliest. (Note GHC. For once, I unqualifiedly agree)

At the Senior Prom I and some others got into the Prom food-enclosure, where I asked the French chef to unlock the back gate while I shouldred a whole case of claret and marched out with it before all the cops. We brewed a beautiful punch at Barbour's. At dawn foru of us marched about the old Campus and sang gloriously in the fresh mornin air, of Yale and the 'dear old South'. .....Once again after a gap of some months the family has a Yale ~~xxx~~ alumnus in it.

June 29. We three took the first meal in our new home, 387 Temple St. It was sad for Mama. I worked hard unpacking the Talladega goods and getting the house furnished and settled. Now the dread of a long vacation without work. The promised job in an elec. shop in Milford did not pan out.

July 28. Finally went to work with my lunch box in my hand, windinf magnets and tending insulating machines, earning only my carfare, and that for only a week. I am now inventing a chainless bicycle and writing C lumbia and Victor about it. All hopes for summer and funds wane with the winds. I study assiduously, however.

The Pope Co. rejected my chainless bicycle gear invention. My motto is Hope all things; expect nothing".

Sept 15 1896. Went to Poli's to see the Cinematograph, my first motion picture. Thus began my first post-graduate year.

Sept. 28. Went to work in the lab, finding the value of H. Wrote Tesla for advice; he congratulates me on studying under such a able man as Prof. Gibbs. Cast my first vote--for McKinley and Sound Money. I attended the outside lecture courses open to Yale men. One was devoted to Tennyson's Maud, which opened my eyes to the wealth and beauty and deep sentiment in that noble poem. (Note GHC. It was my prime favorite, too, Lee, and still is. I read it, memorized, it, fell in love ith it around that same date, 1896)

I look to England now for money for my bearing invention, and still hope for bicycle adoption.

How happy the Academic man. He who lives apart is a recluse , a grind indeed.

Tried to get the Senior Class to have their picture taken at Randall's. $50 in it for me. But they plump for Pach. Stires and I now working on a Prom Souvenir. Book. The proof of the book shows that it is going to be a beauty but material comes in slow.

Now the Yale Prom, my first and only prom. I had earned a snug sum from the Prom Souvenir Book, and Helen Wyatt is coming as my guest. The weather turned frightfully cold, and Helen with it. I hadn't started early enough to learn to dance. Every time I attempted to reverse I met with severe reversals. Next a.m. I learned that Helen was down with appendicitis.

Saturday I completed the invention of my "equationer" for fourth power equations, based on the Wheatstone bridge principle. I explained it to Prof. Pierpont and he ordered me to read a paper on it before the Math. Club. But still I didn't make Sigma Chi this year, either.

Note GHC. One thing stands out throughout all these diary entries: Doc never was discouraged. If he failed the first time, he tried, tried again.)

I got my poem " Since Yesterday" back from the Century. Strange! (Note GHC. Not strange at all, Lee, judging by (1) your Class Ode; and (2) the many poems, chiefly ribald, which you have sent to me during the years --or were they centuries.)

I re-read Emerson's essay on Self-Reliance. That is a continual inspiration to me, a tonic, and an effective backbone builder. I can subscribe to some of its utterances as mine, though half unrecognized before.

I got the long-expected word "Impractical" from Delaval. I will make a model and prove I am right and then I will be independent. (Note GHC. At least he finally has come around to spelling the name more correctly; before it was 'Laval')

We are now trying to get ads for a Regatta Souvenir book. I have pounded the streets of NY for weary miles, seeking ads.

Reading Poincaré. It is tiresome reading, but the insight ~~into~~ this mathematical study gives of the forms and laws of electrical phenomena is wonderful., Alas, how little of real practical knowledge as to the application of mathematics to engineering problems did I acquire at Yale. A thorough-going training in manipulation og mathematical equations I obtained, but absolutely no instruction as to how to apply these keen tools to actual problems in physics and in engineering.

All thru the subsequent years I have cherished my 7 or 8 thick note books filled with wierd cabalistic hieroglyphics, chiefly successions of 's, curls, and double-triple integral symbols, "all greek" to me now, but which in fond delusion I had hoped to find time some day to review and understand. (Note GHC. Amen to that,Lee. Me too. What you really mean is that you are an experimenter and not a physicist)

My professor in Mathematics, Prof. J Willard Gibbs, is now recognized as one of the greatest mathematical minds that America has ever produced. But he dealt solely with his own systems of mathematical symbols and analyses, and now with conventional math. He did not undertake to instruct his pupils in practical methods for applying his system to such problems as they would encounter in commercial research labs. We could follow his reasoning, understand his theories, and that was all.

I want to spend another still higher year of study here. I have applied for a graduate fellowship,$400. I aim at Tesla. My electrical lab work has been too careless, I am told; I will have to go back for the rest of the year to precision, principles, accuracy.

On returning from NY in search of ads, I climed up the side of a slowly travelling freight, sat down, and reviewed the whole fleet anchored in the river, their big guns belching thunder as the USS DOLPH IN (and I) passed them!

Thursday. I saw Tesla for the first time. He became quite cordial and communicative, and I have great hopes of getting in with him as mathematical assistant. He must turn first to commercial lines and retrieve his fast disappearing fortune, then enlarge and take in 2 or 3 assistants. Traded an ad for a mandolin and will practice on that.

Dear old Yale. I love her every whit. Now, in spring, every street is an archway, a chancel of leaves, each view a dark shado wed vista backed by the darm grown or gray of turret and hall of College House; this makes a dreamer of me and fills me with sweet love and sadly tender regret.I love Yale; there is no other spot. Truly, always this is the Divine University. (Note GHC. Wish I could have gone overboard about MIT that way, Lee)

Wednesday I did some tutoring, the first I ever did.

I am reading Maxwell and Hertz in German. It means weeks of teeth-pulling work before I can read technical German. I looked everywhere for a job. A most unhappy discontented summer.

My diary becomes filled more and more with verbose descriptions of the natural beauty around Yale and New Haven, as Lake Whitney and East Rock Park. I spent many silent trysts there alone, by moonlight, stealing stealthily home to compose a prose poem of description. The influence of Poe on my pen was becoming clear and discernible.

One incident occured during that dreary summer which influenced all my future study and career. Frederick Reed, my former prof. of Latin and Greek at Talladega, paid us a breif visit at New Haven. He showed keen interest in my work and my plans for the future. He strongly urged that I stay at Yale for my Doctor's degree. Quoting Emerson he said to me "Anchor in port grandly, or sail the seas with God". This in discussing the "expanding universe" of my mind and its growing agnosticism; he advocated liberalism as my course.

Sept. 5. Worked reporting for the Journal and Courier; earned $ 5. Graphically reported the Bradford Fair.

In my diary I again inveigh against the methods and the meaning of the Church as I had know it, its worship of the past, its blindness to modern throught and the truths of science. "No Shakespeare with his inspired humanity , no Spencer with his practical philosophy, no Tennyson with his beauty and his truth, nor any Emerson with his breadth and bold unloosening of the soul, can be considered worthy of attention in the Sacred Place, when there are fabulous creatures like Enoch or Noah, chieftains like Abraham, idolators like Isaac, royal savages such as David, or wily old liars like Eli and Elijah to claim our reverence--I want to find an ismless sect that is no sect, broad and open as God's happiness, their creed but the one word 'Truth', their sanctuary, the world; their church, the lecture room, the laboratory, the theatre, the library; the tenets of their faith a zeal for Truth in all its forms, social, psychical, physical, all interwove and inseparable; their ministers men of thought, of boldness, of refreshing originality, men of research., guides, redeemers, benefactors, obeying the Almighty Effort and advancing on Chaos and the Dark. Their gospel shall be "Universal Happiness' and their scriptures 'Evolution'. In this church of truth methinks my whole and utmost being could devoutly worship. (Note GHC. Perhaps it was lucky that Lee was saved from going all out for this religion of his, and becoming a scientific Jesus Christ. He might have been the founder of what would have been appropriately called Christian Science, the name now adopted by those who are not scientists as Lee thought of the term)

Our rooms are all rented. This home life with its continual nagging and pitiful hypocrosies is terribly irksome and this term I shall relish a Bohemian independence with a stolid smoker or free thinking philosopher as my room-mate.

Oct. 3. Moved to room in 63 W. Divinity Hall, 'Home of the Great Unwashed'. Varnished the floor, plastered and kalsomined the walls, then got a professional to do it all over again. Made a fine window seat from an old lounge. Put up the flag, Yale souvenirs, atc. I feel like a student again! It is almost like life on the Campus.

Oct. 11. I am doing Hertz' expts in the lab, looking out for original investigations. I find I am longing for some sweet girl to love. Luckily for me the object is not to be found. (Note GHC. Profound wisdom indeeded. If the same had only applied to his later life, when he was a wireless man, his life would have been happier, and more full of financial emolument.)

At last all my Soivenir debts are paid except the big interest-bearing one. That doesn't count. This is better than suicide!

Worked nights in the lab with the Lecher wire resonator...May this be my lot in life, to live in a little artificial world, away from the crowd and its friction, surrounded by companions and tasks of my own choosing,thus to gain insight into the great world and the universe of Science.

Dec. 27. Put in some good vacation work with Hertz , and lab work at night.

During the two years when I roomed in West Divinity Hall I continued to board at Mother's home on Temple St.

As the time for Junior Prom approached I again worked very hard getting out the new Prom book. It is the daintiest and neatest book I have ever seen. I am proud of it. It took finely-over 600 copies sold. Now I can pay my debt to Brush. (Note GHC. Lee's editorial bent is the same as mine. I have edited and practically written all of the Veteran Wireless Yearbooks, and, this last(1946) year, the souvenir book for the joint meeting of IRE, VWOA and others.)

I am spending much time on Laplace's functions, necessary to read Maxwell.I am frightened at the vast amount to be known before I prepare for actual problems and would desire a third year here and a Ph.D if at the end I can step in with Tesla.

"I was getting right along with my work and talking about a Ph.D. with Prof. Gibbs when, like a damned fool, I worked with a battery in Winchester Hall one night during a Sheff lecture. The lantern lamp blew a fuse and of course I was blamed" The audience was dismissed by candlelight and I was dismissed by daylight of the next morning. I fear this ends my original research. This is the culmination of all the things they have found wrong with me. Months before, I had driven some nails into the oak lab table in the basement of Winchester Hall,around which I had twined some recalcitrant stiff wires; these were found and the vials of Hasting's wrath were poured on my head. " A man who doesn't know better than to drive nails into a table will never amount to anything", I was told, with sarcasm and opporbrium added to the remarks. Now the affair of the storage battery fuse is just one too many. Out from Sheff I must get instanter, or even more quickly....I proved in the lab that I was not in the least to blame for that lamp accident, but I suffer innocently. Hastings is still after me, with a ferocious tone to his sarcasm. He is positively insulting to any man's self-respect and I would not endure him save for my degree.

Feb. 28. The war with Spain hangs fire. Sat. night, when it was announced that the Senate had recognized Cuba's independence an impromptu parade started on the campus and wended its way thru town. At the usual bonfire I won my spurs to the title of "celebration celebrity" and "bonfire bonhomme" with the two Campus cops, who asked me "Brother de Forest, what are you planning on doing tonight?". I rigged up a dummy of butcher Weyler which we burned at the bonfire. I sacrificed my duck pants, study coat and old hat to the patriotism of the moment.

Conceived the idea of a big "Old Glory" for West Divinity; got permission to canvas, and got subscriptions, so now a 12x18 flag will be spread to the breeze tomorrow. Sheff seniors are forming a machine gun battery to go to the front. I know it is wiser for me to stay. It is my duty to, now, when all has been outlayed on my education and I am about ready to begin to repay the debt. No, I must stay here and prepar for Tesla. I should prefer to go in the Navy.

April 25. The war spirit got a stronger hold on me. The project of a Yale Light Artillery battery was too tempting. My father had valued his Army years very highly; the experience would doubtless be very valuable to me. I cannot brave the idea of another summer fizzle such as last year, and I am sure the war will be over so I can return here in the Fall.

The Yale Artillery Company must be but a platoon in the Connecticut Battery. That is a curtailment and siappointment to us, but 40 to 50 of us will go. So I rushed off to Niantic to enlist in the Yale Battery. "I think I can be a bugler, which will be a fat cinch---a horse, two red stripes on pant legs,and no guard duty. My old cornet practice holds me well now".

Arrived too late to get into Yale Platoon. Hung around camp a week waiting for an opening. We were booted out of camp; slept in the straw of the mess house, eating crackers, pie, etc., sometimes to the tune of but 30¢ a day. Slept again in a horse stall, in the straw. No one knows anything. No guns, no sabers, no horses.

May 17. Passed physical exam. May 18. The whole Battery was mustered in. We stood with bared heads, right hands uplifted, swearing to defend the U S against all her enemies whomsoever.

Weary weeks of drill and guard duty--then I got that job of bugler!

Sloth characterizes Washington, and this Battery. I stood guard for interminable hours in the drenching rain outside the Captain's tent.Had he but known it, I was the worst enemy he had this side of Cuba! Guard duty, then substitute driver,then t the hope held out that I would be trumpeter.

July 3rd. Cervera's fleet destroyed. It is now over. We are bitterly disappointed not to leave Niantic. We were ordered to Porto Rico but Peace came before we left. I now hope for discharge in Sept.

Mid-July. At last I am a trumpeter,and wear the double red stripes.An end to guard duty, thank God. It is fine to blow signals for drill amidst the rushing guns, plunging horses and caissons. I love to blow the long tattoo, and especially Semper Fidelis. But most of all it was my delight to stand in the moonlight night and then. slowly, gently, with all the tenderness of a lingering farewell, breathe those soft, soothing notes which mean surcease from care to the weary soldier's heart:-

TAPE

Out with the lights
Out with lights,
Every one
Day is done
Night has come
"Rest is near" sounds soft and clear.
Slumber on.

We came home Sept. 15. Lucky were we that we stayed in Niantic. Those who went to camp were overworked, underfed; had the poorest of medical care; their vitality was exhausted. When hardship and disease came they fell by hundreds. Those returning were emaciated, weak, an Army of wrecks, to carry for years awful marks of the Nation's shame. More men died in the National Camps than on foreign soil.

I am stouter and stronger, healthy and hearty. The experience was a good one for me, physically. I feel fine. The 4½ mos. of constant out of door life, must have had that effect. I brought back $40 clear and hope for $60 when mustered out. For awhile Ialmost had to strap myself to a chair to continue my studying, but I kept at it, 8 to 10 hours a day.

Am taking orders for photographs taken in camp and made thus $10. I always seem to be lost in the financial woods.

I have had a model made of my pipe improvement and have sent it to a manufacturer

Oct. 31. Re-read notes on Hertz and recommenced lab work on elec. waves.Since Has-

tings will not have me, on account of my "fuse trouble",Prof. Wright has taken me on, to work in the Sloane Lab.

We are enduring a terrific blizzard. The storm is fiercely beautiful. The chisel of the wind carved and hewed in majestic fashion great forms, huge parapets, facades and statuary from the pure marble of the snow. Alas, how quickly does the smirching hand of Man defile her handiwork, how soon his filthand soil have marred the perfectness. It is ever thus with Man and Nature; one beautifies, the other mars.

Nov. 28 1898. I continued building my Lecher system in the basement of Sloane Lab.

Dec. 17 to Jan. 1, 1899. Vacation. Busy reviewing Maxwell for the exam. (Lee's diary is now full of deep thoughts on abstract philosophy, and he is reading Huxley's "Hume". He is apparently in a node as far as girls are concerned, as--"Observed the festive Prom girl about the street; felt no thrill, saw not the mysterious, yearned not for Her!". Writing for a job with Charles Brush, Alex. J. Wurts, Crehore of the "Sine Telegraph Co."--always hoping against hope for Tesla.

Working hard on my thesis. I have never worked so hard as this year. Thru winter and spring, 6 days a week, each morning for 4 long hours were spent in the cold, dark basement of Sloane, carefully sliding the little wire bridges along the tightly stretched parallel wires of my Lecher system, while peering into the little box containing my glow tube. Thus I endeavour to locate the loci of nodes and antinodes, to measure the wave lengths of the ultra high frequency oscillations,self-excited by my little Blondlot spark generator immersed in a shallow glass can of kerosene. The subject of my thesis was " Reflection of Hertzian waves from the Ends of Parallel Wires. I was seeking to determine, by observation and by theory the divergence between the actual and the calculated final quarter-wave-lengths of the Lecher system, a problem which had been originally suggested to me by Prof. Harry Bumstead of Sheff.

I have received the finest letter from Nettie Wallace, girl friend of a few days of my boyhood. The inevitable copy of my Prom book is on it way to Council Bluffs on its insinuating mission.

April9. A week ago Saturday I went to NY to see Dr. Crehore and Col. Squires about a job with their new Sine Wave Telegraph Co. (Note GHC. Isn't that 'Squier'?)

Now all is done but to make the typed copy of my thesis. Oh, the dreary, dreary hours in the cold darkness alone in that cellar, peeping at a glow tube that would not glow aright, running back and forth to correct a fault in some contrary interrupter. Now it is done and it should secure the degree which I seek.

This is the best year's work of all my course, with no exercise but the bicycle, no theaters,just work. I am alone, ride alone, see few I know. I am a lonely "old grad", out of spirit with the undergraduates and their frivolities.

My lab work is done. The coherer work came out all right and demonstrated the correctness of my first assumptions. I have mailed an article to the American Journal of Science. Got back my pipe filter idea,"not practical to make commercially". Another "pipe dream " dissipated. My inventions will succeed yet!

June 18 1899. This marks the end of six years here, the last two filled with hard work and nothing much else.

I am thin; cheeks sunken. I am tired. Now I will rest, ride and play, live a day.

DR. LEE DE FOREST Ph. D.!!!!!!.

After "the last celebration" when "Charley Warren, now a Dean at Sheff, Holmes Jackson, later a distinguished physician,a nd Lee de Forest (Ph.D) engaging in a mad triple dance around the floor of Anderson's Gym, while others swung monkey-like from one swinging ring to the next, clearing a wide swath as they preogressed around the gymnasium". Then next day- Packing up, weary and with confused emotions;the end of it all; Finis to Yale.This pretty room is a wreck, and so am I.

I went West on a Christian Rndeavour excursion. A day in Chicago with dear Cousin Nellie, then off to Council Bluffs. Jessie and Nettie are here, two of the dearest, choicest of God's girls. I think I am beginning to love again.

July 14. And now there is no doubt of it.It grows day by day, and at night an over-hadowing presence falls o'er my dreaming wanderings.Vague, omnipresent Jessie, the true, the gentle, the bewitching. Words are powerless to attempt to describe the depth of the rapture of the newfound joy that floods me when I look into her radiant face , into those deep, eloquent eyes,and see there love that answers my own. It is so strange so unexpected. My fate is sealed.

August 12. Away to Chicago. With my aunt and her daughter Nellie. The third place I applied for a job, the Western Electric Co., Clinton St., took me into their Dynamo Dept. I work like a nigger from 7 am to 5: 15. Too much chasing of parts and mopping grease for me to learn much.$8 a week. My room and breakfast cost me $8 a month so I hope to save $8 at least. How long before I can buy for my little girl the ring?

She writes me. What a torture to my heart her letters tell. Cold and distant words. I borrowed $10 abd rushed to Council Bluffs. I came to tell her that it was true love, the truest love, we held together,that "We needs must love the highest when we see it'." Now she said that she knew not her heart, doubted if she had a heart. Next night we drove to the train, as of old in the bright days of romance, speaking the last words of confidence and counsel I told her that I would be ever true--"Old Yale is true!".I kissed her once as we parted. I left a pencilled message in her hand, "I love you" and she waved it aloft as we separated.

I applied to the head of the experimental lab at the Western Electric works and got transferred to the 7th. floor. Cleaner, lighter work, in telephone cables.

My earlier analysis at Yale was that "Jessie is a heartless flirt". Despite that warning I had not been on my guard, and for years to come I paid the penalty in pain.

Oct. 8 1899. Working on telephone switchboards now. Oct. 15, promoted to the telephone lab, goal of my hopes. William Warren Dean was in charge of the lab; he it was who became my ideal, handsome, with a sparkle in his eye, keen minded and ingenious. With me were Ray Manson, George Schofield and A D T Libby. From the engineering dept. upstaris came frequently on business errands a tall, slender, likeable fellow, Ed Smythe. A close friendship soon grew between Smythe, Dean and myself.

There is one free private library here, the Crerar, cozy, with dark wood tables and and shaded lamps, where the chairs just seem to fit. I take great comfort in reading there. I haveb begun a systematic search thru Science Abstracts, Wiedemann's Annalen, etc.,for some hint or suggestion of an idea for a new form of detector for wireless signals. I had build a Branly coherer at Yale and used it. Marcohi's coherer, and tapping-back, did not appeal to me.Itwas too slow and complicated.

(Note GHC. Lee was not working with telephone apparatus, whose design, once made, stayed the same for a long time. He was dealing with telephone currents. But his

thoughts were with the frequencies of Hertz, of Lecher, of Tesla. And so his eager mind was rapidly turning toward the mysteries of ether communication. Why did he not go to Tesla and try for a job there? Was it that siren Jessie had ensnared him, and had made him seek work in near-by Chicago so that he might see her from time to time.? As one who knows Lee de Forest, I strongly believe that this was the case)

Finally, in the April number(1899) of WiédemannIs Annalen in an article by

Aschkinass, I found a brief description of a phenomenon newly discovered which promised to be the solution to my problem.(how to make a self-operating, sensitive, rapid-acting detector for radio reception. GHC)He showed that two copper electrodes in methyl alcohol and air showed coherer action when close together, but when at the same or greater distance apart, in water, gave an anti-coherer action. The normally small resistance of the gap becomes greater under the action of electric waves,spontaneously resumes its low resistance. He also described a thin piece of tinfoil laid upon a plate of glass and cut in two with a razor. When a battery was connected across the terminals, and a drop of water placed over the gap,he could hear in the telephone receiver in the circuit a weak, ripping sound,when a spark generator excited electric waves in the vicinity. But the action observed was erratic and irregular, undependable. But this seemed to offer a solution to my problem, which, in a previous page of my diary, I had stated to be: " What wireless telegraphy requires is a self restoring detector, which would permit the operator to hear in the headphones the sound, as it were, of the transmitter spark" (Note GHC. From the typed copy of de Forest's Diary which I am here copying, the date of entry of the foregoing was November 5, 1899)

My notebooks contain many pages of description of the experiments by Aschkinass and Neugschwender, conducted with characteristic German thoroughness. Here was what I needed as a start,and I promptly began to duplicate Neugschwender's experiments in a small corner in the Western Electric Laboratory in Chicago, devoting much of my spare noon hour, and a half hour or more at night before the doors were locked.

Dean and Smythe, co-workers of mine in the Western Electric Laboratory, began to take casual interest in what I was doing, although neither knew much about wireless telegraphy or Hertzian waves, nor shared my enthusiastic belief as to the enormous developments in electrical science which awaited further perfection of the crude transmitting and receiving apparatus which was then in use in Europe. Reluctantly and half-heartedly I still continued to devote the working hours in the laboratory to my assigned tasks in telephony.

I still find myself thinking, and remembering, and hoping. Often I am surprised that this is so, that after all this lapse of time the sense of loneliness is still so sharp. The evenings in this room are very long,and the air seems full of voices and their echoes, and the night of faces. These are but sad companions, and I haunt the library to read and study, for there I can forget awhile, and in the atmosphere is science and great men realities seem less real. Had I never seen the Vision life would seem full enough in the poor, careless happiness of old, but now having seen I cannot lose it if I would, and Launfal-like 'Must follow thru all sorrow". With Her, ah, the richness of that vision of life! For the wildest dreams of the future have never approached in radiance the beauty of a life made rich by such a one. I dar not ~~xinx~~ think of it-and Fate.

Dec. 25 1899. While the wee nights must be diligently given to Science and my work one I owe to Music. I should afford this much for culture and the finer power (tho for sweet pleasure also) So I must give Sundays to the poets and philosophers, to the deep and true thoughts, for I must cherish zealously the highest beauty, poetry and romance. In my education itself there has been little of literature, art, essay--far too little. But at last by reading and natural sympathies some part of this soul has been awakened and stimulated to a great craving,and a little of

of inborn talent found. All the finest and noblest of my character have grown from this, and the thoughts that Science has bred of God and Nature have been deepened and made beautiful. I am pitifully in need of more. What paltry stock have most young men, and how cheaply rated. In this at least I can be above the average, and of finer strings.

Dec. 31,1899/ Have received my first raise, $10 a week. I shall soon begin to live indeed, buy a pair of new socks, a phonograph, and an automobile, and move into a steam heated flat before next winter. Never again shall I endure the discomfort of a stove, nor wear the same collar longer than three days.I can now have my shoes shined twice a week.

The century is over. It ends my years of preparation, and my real work begins. Boarding with Aunt Hattie makes it less lonely, and Nell is a fine girl and a comrade, and we take long walks and enjoy musical treats together. But it isn't Yale and the society and the dear confidences of the old days.

Jan. 28 1900. Grand Opera, from Romeo and Juliet. So sweet and simple a thing as a lover's kiss must be drawn out over several octaves and the whole stage, from basso profundo to F in altissimo, with violent accompaniment of the three stereotyped operatic gestures, the right hand, the left hand, and the two together, approximately above the heart. When we seek to embellish Shakespeare in this manner we make it a farce and rob the poetry of its truest power by this spectacular excess.

I have written a last letter to Jessie. The deep nature of the fine ideals that I saw in this winsome songbird, have withered away, and this rare portrait which hallows my wall is merely a mythical divinity that lived only in an artist's inspiration. I mourn the sweet creature that I knew, -dead, and my heart her grave.

She was alike in mind, alike in soul, and together we roamed an ethereal world. We heard the thrill of Nature's melody in exquisite strains like fine spun threads of golden light, weaving a fairy web. We journed with Poe and the fair Eleanora in the Valley of the Many-Colored Grass. We revelled in the beauty o Ruskin, in Maud, and the Princess' Song. Was such a companionship not worth keeping? Would you spurn it thus?

After seeing Sothern and Harned play "The Sunken Bell", Lee decided to call his shattered romance by that name. "Sunken is the Bell. The Bell that I had found and sought to lift upon the heights. It has fallen, it is sunken, it is past. The loss has left me crushed and comfortless these weary, weary months. But tho bells sink, yet the sound is true, and shall ring again.

Mar h 18. The days drag wearily by, in this den looking out at the desolate sky and these surroundings, awaiting a chance to live. Fretting at what is, I revel in Chicago's music--music amid Chigao's mud and ugliness and utter savagery.

(March 18 1900) Experiments on my new wireless "Responder", as I then called it, began to occupy more and more of my time. My work on telephone tests and devices was never brilliant, to speak charitably, for my thoughts were ever elsewhere.Dean became progressively more impatient with my work,but was too considerate to fire me, altho he saw little of merit or promise in the experiments I was wrapped up in. Certainly he saw no possibility that the great Western Electric Company would ever become interested in Wireless Communication!

One day he exclaimed: "Look here, de Forest. You'll never make a telephone engineer. As far as I am concerned you can go to hell, in your own way, Do as you damn please!" With typical recklessness I took him at his word,turned to my little corner where I had my spark gap and responder parts,and thereafter spent 8 hours a day at my own delectable tests, totally oblivious to the telephone work going on about me and for which I was supposed to be paid .

Following the German idea,which was obviously impractical as a wireless detector, I sought to overcome the pernicious tendency of the Responder to stop responding after a few seconds or minutes of operation , due to the fact that the fluid across the gap soon became electrically decomposed by the passage of the tiny current. I searched for other electrides and decohering fluids,. The fact that as yet no one in particular except Mr. Marconi and Prof. Shaby wanted to communicate without wires made it all the more interesting, and gave me courage to continue, as an American pioneer.

Now it was that Ed Smythe proved himself to be a practical, modern, electrically-minded engineer. He was swift to grab the significance of my experiments, watched my work with interest, discussed the problems with me, and occasionally contributed helpful practical criticism and advice.

(Then follows in my diary an ecstatic description of Lohengrin, which I first heard from the 25¢ seat of the Castle Square Opera Company, at Studebaker Hall. Then Tannhauser, Aida, and others, glorious manna on which for the first time I fed my hungry soul).

April 8,1900. At last I have the opportunity to do experimental work in w.t. On the Lake first, then with the Navy, then navies, foreign travel, scientific investigations, success! This came as the result of my having written to Prof. Johnson of Milwaukee, pres. of the newly organized American W.T. Co.; Not long after he came to see me in Chicago and asked me to join his concern asking what wages I would want. I gulped twice, screwed up my courage, and hesitatingly suggested $15 a week. It was accepted; probably he was prepared to pay twice as much.

Milwaukee. May 1,1900. Started on my w.t. work,at 809 Grand Ave. Prof. Johnson and his assistant, Fournier, were working on an impractical system of wireless reception, employing a coherer with iron filings (of all possible materials!) which were decohered by little puffs of air blown thru the tube by a clock-driven pump. My diary says almost nothing about the experiments, but is filled with descriptions of the natural beauty of the scenery which I saw from the lofty point on which the w.t.sta . was located.

A tower was erected at South Point,and my task was to make a receiver operate there. The sending sta. had a large induction coil, and spark gap. It was located in the Johnson factory, in the middle of Milwaukee. The pneumatically controlled coherer was useless, tho the idea had worked well in Johnson's automatic heat control thermostat, known the world over.

After a few weeks of waiting for signals to come thru, I realized that it was a waste of time to work with Johnson.He had given me an assistant, Lyman, a German, who knew something about plumbing but absolutely nothing about electricity.

Becoming disgusted with the Johnson-Fournier "non-receiving set", I brought out my Chicago responder and a telephone receiver, and within an hour was receiving signals from Johnson's "plop-plop" transmitter. Lyman, slyly watching over my shoulder, soom grasped the idea of what I was doing.

The work continued for 3 months. Lyman then begged me to give my responder to the Company and when I refused he told about it to Johnson and I was called up on the carpet before him. I told him that the responder was my invention and would be used in no company but my own. So I wasfired and took the night boat back to Chicago.

Sept. 3 1900. The 'wave-trap' (note GHC, possibly the Responder) did it. I was fired by the Prof. Now for our own patent.I am starting in a new job with poor pay. But I am on the right track and feel that it is destined to make me independent.

Now I am back in "Skunk City".

Nights I worked with partner Smythe in my room, on the Responder. Without much delay I got a job as Asst. Ed. on the staff of the Western Electrician, chiefly because of my ability to translate from the French many interesting electrical papers which had just been presented at the International Exposition at Paris. Salary-$10 per week. Every night not spent in the Library was devoted to experimenting with the xxxxxx xxxxxxx electrolytic anti-coherer. Smythe was comparatively rich, earning $30 a week. Naturally, our budget for experimetal work was very limited. We tried connecting the responders in series-parallel, to overcome their perversrse inclination to clog and cease responding. Some of the arrangements used show no little ingenuity. Xxxxxxf Hosts of others were sketched out but never actually constructed, due to lack of finances.

Here ixxaa significant entry in the de Forest notebook, written in Smythe's handwriting:

"On the evening of September 19, 1900, experiments were made to determine the manner in which the operation of the induction coil affects the light given off from a Welsbach burner, a phenomenon which had first been observed by de Forest on the evening of Sept. 10th. By adjusting the flow of air and gas a condition was at last obtained where the light responded readily to the influence of the coil spark. This was when the flow was so adjusted that the mantle was slightly less than its maximum brilliancy and when portions of it were at what appeared to be a red heat.Such portions when the coil was operated would immediately become heated to whiteness. The increase in the brilliancy of the light seemed to amount to several candle-power. The light appears to respond very quickly to making and breaking of the induction coil circuit. If anything the response to the making is a little quicker than to the breaking of the circuit. The coil was some 12 to 15' distant from the light. The spark gap was 1/8" long. Current supplied by two cells of storage battery;interrupter of the hammer type. The Welsbach gas burner was some six ft. from the floor, gas pipe connecting to the burner probably ran down inside the wall.(Note: Doc here inserts in ink "¡", probably meaning "Couldn't he see it at the time?????)

To eliminate any possible ultra-violet rays a tin box was held between the burner and the spark gap, about one inch from the latter. No noticable difference in the action on the matter was observed." (Note GHC. Doesn't he mean 'of the latter'?)

Thus, we eliminated the effect of the ultra-violet light, but did not consider that of the sound waves upon the flame (stupidly enough, but very fortunately).

" A possible explanation of this phenomena seems to be the expansion of the cylindrical body of heated and highly sensitive gases within and about the mantle, this latter serving merely as a holder to keep the gases spread out in their most sensitive positions. The electrification of these gases by passage of a Hertzian wave may cause expansion and force the heated gases down upon the cooler and dark portions of the mantle, as we noticed was the case. This explanation would account for the sluggishness of the response, the intertia of the whole mass of gases having to be first overcome. A surplus of carbon over air must be had before the phenomenon is noticable. This may mean that there must be a surplus in the gas of heated but uncombined carbon conductting particles to take part in this expansion noted. Possibly when these carbon particles are thus expanded and spread over new and non-incandescent portions of the mantle, still very hot; they can then take xxxx a better part in the combustion, and increased light results. Is there not here at least ananalogy beterrn this effect of electromagnetic waves on heated gases and the xxxxxxx intimate connedtion between sunspots and the magnetic storms that accompany them? Electromagnetic storm causes a light expansion and repulsion amoung the particles of the heated gases of the photosphere about some small spot of cooler gases,and incipent sunspots. This spot is thus made to enlarge and becomes very noticable. The spot corresponds to the cavity within our mantle, surrounded by incandenscent gases."

Fortunately we did not vlose the door of the closet into which we had placed the coil until some time after the above entries in the notebook. In the meantime I continued faithfully my experiments with the Responder, with different materials and sizes for the electrodes, different solutions, various applied voltages, inserting moistened silk,or blotting paper wet with India ink, in the narrow gap between the electrodes.

Oct. 28. I have begun to hazard my job with the Eestern Electrician by working half-time in the lab of Armour Institute, teaching two nights weekly at Lewis Institute, I am risking mediocricy and weak contentment for a chance of great success.

Prof. Clarence Freeman at Armour Institute finally consented to allow me the run of the laboratory,for which Iagreed to take care of the apparatus therein and to assist the studentsin their work. My pay was of course cut in halfx by the Western Electrician and Smythe consented to advance me $5 a week. Soom Ed and Will Smythe, following my example, left Washin ton St. and we occupied two small rooms together in one of the small apartments of "Armour Flats", I began experimental work in the Armour Institute Oct. 29 Now I could use batteries, microscopes,indicating instruments to assist me in my work.

Nov. 3. Worked with gas flame. Light fell off to 1/3 or 1/2 its normal brilliancy which had to be very poor at best, when the spark was operated. This effect was very perceptible with primary spark only.

Nov. 5. "But wx sound rather than Hertzian waves are the cause, because: Shielded by brick and plaster partition 2' thick but with door between the two rooms open we found no diminution of effect, so long as the door was open a few inches. But when door was withing 2 or 3" of being closed, or completely shut, to a point where the sound of tthe spark becomes completely muffled to one out in the room holding tthe lamp, the effect falls off very decidedly, and then completely disappears. A copper wire was attached to the secondary of the induction coil and led out thru crack under door. No effect on light, even when wire was attached to lamp. Clapping the hands violently a few feet away from the lamp now has the same effect!"

But that exciting illusion had persisted in my mind so long, I had cogitated so intently in seeking some explanation for the observed supposed effect of Hertzian waves on incandescent gases, that notwithstanding this shocking disappointment on finding the action to be merely acoustic, I was determined nevertheless that th desired action and effect did exist. And given opportunity, I was determined to find it. I find this significant remark in my lab note book of that time:

"Several have mentioned the weak acoustic action on a coherer; from analogy might I bot then expect an electromagnetic action lurking somewhere in the sensitive flame, since that responds so to acoustic vibration?" I was convinced that this action existed, and was ready to find it when opportunity afforded.

Thru the fall and winter months o that year my notebooks are crowded with details of an infinite number of experiments seeking to improve my responder, carried on in the spacious laboratory of Armour Institute.

As electrolyte I tried everything imaginable, from dolute ammonia to Woodbury's Facial Cream, singly and in combination. and with various fabric bodies. Tin electrodes I finally found to be the best, between which Im inserted thin pastes compounded of lycopodium powder or lead peroxide.

Sometimes the responder would remain sensitive for hours, even days at a time, then suddenly clog.

Aug., 1900, Smythe and I applied for our first patent, directed to our various improvements which would distinguish our investion from the Aschinass disclosure and claim as broadly as possible what we considered would be practical and patentable. Of necessity, Smythe became my financier. Notebook entries:

Aug. 29	Lent de Forest;patent application.....	$22.50
"	personal	1.00
Later:	Received from de Forest	6.00
	and	17 .50

Our financial relationship finally depanded a contract, dated Dec. 1,1900:

" For one month from date , the agrdement to be renwed monthly so long as mutually satisfactory, E H Smythe agrres to advance to L. de Forest $5 per week, L de Forest to be considered as putting in $13.00 per week. If a company to promote their invention be organized the second party is to receive from the first party (note, L de F., " de Forest")payment in stock at par to the value of $600.less the cash expenses already paid by E. W. Smythe (note GHC. It was E.H. Smythe above)for expenses incident to the experiments, attorney's fees, etc. If either party is compelled to desist from the work, pr payments, the amount thus represented is to be taken into consideration in the final settlement. If no organization is effected the financial status of the twoparties is to be considered equal, and settled as it stands".

Soon the experiments became so engrossing that it was impracticable for me to continue to work even half time for the Western Electrician. So once more I crossed the Rubicon, burned my bridges, and with only rhe amount of $5 paid by Lewis Institute per week, and an equal amount advanced by Smythe, determined to continue my life as an inventor.

By July 1, 1901, the account stood:

Advanced by de Forest	$40.31
by Smythe	262. 28

Dec. 23 1900."What of myself and my state?...I renounced good and fairly promis ing positions for my faith in an idea and in myself....Money,incluence, xxxxxxxxxx acquaintances I have none. In industry, diligence, I am not lacking;courage I have; optimism has ever been a cardinal characteristic of my youth. ...Smythe has been cautious, diffident, lacking confidence, as he well might...Time is short and Marconi sails fine and weather-worthy boats, and these boats are already headed toward America....If our craft cannot meet him next spring it might as well sink now. Smythe earns an abundant salary but needs send his salary home every week.... But who, forsooeth, can send a pittamce, even, to mt Dear Mother, and none deserves aid more! ...For solace I saw Aida at the Auditorium,and filled two diary pages with enthusiastic descriotion. "And now I hope to hear Esmeralda and Carmen. Then indeed thru my fancy the rich-hued dreams will dance a merry figure."

Feb. 10. I am building a reversing relay for the responder, and not being an expert machinist meet delays and failures. It would indeed be hard for me to drop these experiments and go back to a task in a great shop or under any employer, where I feel it impossible to feel deep interest in the work.

"I am not by nature melancholy. If I were it had fared xx badly with me many times. Rosy-hued omtimism with unbreakable legs is my cardinal point, and when I brood or write anent the melancholy side of life, or Nature, it is rather for the deeper emotions with which the beauty there is fraught."

"This is a great life I xxx lead. Talk about your Yale Bohemia-it is not in it. Here one does not lose caste by leaving off his cuffs or even by wearing a collar for two consecutive weeks, and a shirt for twice that interval. (Shades of Mum!CHC) If you go unshaved you pass for a single-taxer. My pants are getting thinner every day, and my coat smells loudly from fried potatoes at "The Comet";Sometimes I have but 10¢ in my pocket. But hail gentle springtime, when I can don my New Haven golf pants and hook my overcoat. I have 3 pair of low shoes, anc calculate that by going barefoot around the house and standing up to save my trousers I can keep going until time to wear spring attire. Poverty has forced me to discontinue all cospetic preparations except a bottle of witch hazrl and of hair renewer. "

Thru the microscope I have examined the responder. Minutest particles, all but invislble, are seen torn off the electrodes by the stress of electric force, and, floating in the fluid there, move across, some rapidly, some slowly, by strange and grotesque pathways, or directly to their goal. Tiny ferry boats, each laden with its little electric charge, unloading their etheric cargo at the opposite electrode, retrace their their wanderings, or, caught by a cohesive xx force, build up little bridges, trees, with branches of quaint and beautiful patterns.

By the pontoon bridges thus established, the current passed until the Hertz waves came . Then all was commotion and change. Tiny bubbles of hydrogen appeared among the particles, and, enlarging, slowly or suddenly, broke or burst apart the bridges, while the click in the telephone told the ear what the eye beheld, the rupture of the current's flow.

Yet were they persevering, these little ferry-men, and instantly reformed, locking hands and hastening from their sudden route back to build new paths and xx chains. And so the process continued, the local currents re-establishing, the ether currents braking up the highways of passage, with furious bubblings and agitations, a veritable tempest in a microscopic teapot.

May 20 1901. Experiments on the responder are nowexceedingly encouraging, and it is high time, for the clothes are nearly tattered, the shoes run down; the meal ticket pushed. Until now my transmissione tests had been confined to one room in the lab on the 2nd. fl. of the Institute. But now I set my table out in the long hall and moved a Ruhmkorff coil, battery, and string-manipulated key xxxxxxxxxxxxxxxx farther and farther, finally to the limit of the hall. Next we tried outdoors trials. My first transmittin antenna was 5 wooden barrel hoops 15' apart, with 6 strands of lamp cord stapled to the outside of the hoops, making a "bird-cage" antenna, perhaps the first one of this kind ever constructed. This Smythe and I hoisted to the top of the Armour Institute flagpole, the transmitter being moved to the window in the upper floor. The spark gap was connected between the antenna and a steam pipe ground The Institute had a Wehnelt interrupter, which I used instead of the slow hammer interrupter, as affording a signal easier to read in my telephone re-ceiver. This latter was of the ordinary hand-telephone type, not a "headset".

July 21 1901. "And now we have made our first long range test. The firstm tho shortest, was the most important of all, for it decided whether or not the invention was any good at all. I stood in the rain at the top of the Lakota Hotel, listening in the telehone receiver, and at last I heard the H's of the agrred signal!

"I have heard joyous symphonies of Beethoven,the stirring measures of Wagner, in music ringing thru the soul with all joy and inspiration, yet to my waiting ear the faint "whirr, whirr" of the first signals I receivedwere the sweetest music, the most enthralling sound ever heard by man!

Next day I went to see Ferdinaly Peck at the Auditorium, to get permission to string my antenna from the top of the Auditorium tower to a room at its base. He allowed me to do this, and was deeply interested in my plans.
This was four miles away from my transmitter, yet I heard Smythe's signals from the Armour Institute clearly. No attempt was made to use Morse, tho by learning the Morse Code, and translating every street car advertisement and sign as I travelled, I was becoming a fair Morse operator.

Prof. Freeman had been watching my work, and now he got excited.He had a friend who owned a good-sized yacht on the Lake, and arranged matters so our transmitter could be placed on it for further and longer tests. I listened xxxxxx auditorium and got signals from the yacht. (Note GHC. De Forest does not mention what distance was attained). I had the responder set up on the four-mile Crib. (Note GHC. The entries suggest that he heard signals till the yacht had passed out of sight over the horizon)

Emboldened by success,I forced the hands of my confreres and went to N Y City. Subsequent events as to the Chicago Associated Press authorities, Freeman's fame with them, and all, show this as having been a real diplomatic triumph for me. Sept 1 1901 I was in the home of Mr. Stires, 18 Lexington Ave., Jersey City.

I hope to interest some N Y journal to fit us out to report the coming International Yacht Races.In this we failed. These were dark days of doubt, hurry, rebuff but not discouragement. Not a little of the delay and disgust was due to Freeman demanding too much from capital.

"At last perseverance and patience were rewarded, and in this Max Stires, in whose house I am stopping, did yeoman service in persuasion, planning, and business negotiations. He is for me and I for him, and the Yale spirit will triumph! I wired for Sommer, our good mainstay, mechanic in this work. I urged Siedler, the wealthy old skinflint whom Stires had finally succeeded in mildly interesting, to order the generator made. This was Freeman's invention, consisting of a large number of micro-condensers, with a motor driven comOlicated commutator, the idea being to charge the condensers in parallel from a 500 volt D C generator and then discharge them in series across a spark gap.

"Delay in foreign patents was inevitable.but I have not let that delay the work itself. By dint of sheer personal insistance, planning, urging, openly or by circumvention, I have forced advance with all parties, just as I have had to do all the year past".

3 weeks after my arrival in the East, and only a month before the Races, almost despite my confreres, the actual work of xxxxx construction began.

"If a young man with scarce a year's experience and but 2 months out of the laboratory wanting in means and hampered in facilities, can now compete with Marconi after 5 years' development and backed by unlimited capital, then it would be a wonderful achievement. It is too early for confidence, and I am prepared for failure here,but the very best is being done.

It was against my better judgement that we used the Freeman transmitter.Its principle was new and untried. There was no factor of safety in it. I wished from the start to use an alternator and transformer. But Freeman's financial assistance, insignificant tho it was, back in Chi and here in the East, seemed absolutely essential, and so Smythe and I had to agree to his demands. Had the Regatta been held on time we could not have been prepared, but the assassination of Pres. McKinley postponed the event for five weeks. So we completed the apparatus, and installed it the day before the races, on a special tugboat which had been hired by the Publishers Press Association, whom Stires had succeeded in interesting.Marconi, as he had done before, had contracted with the Associated Press and the N Y Herald.

Nov. 10,1901. "What has passed since has been like a long nightmare, a hiatus in my life. The memory of it may be well forgotten save to appreciate rightly the better day, whenever that still fleeting time of award shall be. We failed at the Races almost completely. Freeman's transmitter broke down repeatedly. I left the hospital after three days, and a narrow escape from fever. Each day I arose at dawn and tottered to the boat, worked feverishly until I landed at Sandy Hook, then spent the day in helpless waiting for reports. Freeman "lay down", went to Chicago. Barbour came on to help me. The induction coil we then had to use was too small. The best we can say is that we gave Marconi a blacker eye than we ourselves received. "

Each transmitter had successfully interfered with the other's reception, so that the large newspaper headlines "WIRELESS REPORTS OF THE YACHT RACES" were strictly true, but the type of wireless actually used was the good old-fashioned wigwag.

"After it was all over and the shamrock and we had lost I went sick again. Barbour invited me for a week end at Rockaway.

Rockaway Beach Oct. 10 1901. Came here to regain health, forget, rest. It is well to be here by the sea and the silence, "where the sea outspreads its vastness endlessly, its beauty endlessly".

I returned to NY to find our financial affairs in desperate straits, Siedler unwilling to do anything, --cold feet--;mutual and general disgust for Freeman, ineffectual efforts to get him to withdraw. Smythe and I had made the fatal mistake of his allegiance, as I had feared so long.

Then I went to my home, after 2 1/3 years, back to the dear old town, to the elm-lined avenues, the new buildings, the old Yale, to my dear Mother. The cycle, so strangely spangled with joy and sorrow, was completed. I had returned.

I rested, revisited the old haunts, tramped again thru the glories of the autumn woodlands, by the well-known paths beside loved waters. Never did the town look so beautiful. Some ivy branch of memory must ever cling, while Life lasts, to Yale.

Dec. 1,1901. This day begins a new epoch . I have approached in those last weeks some 25 people, with rebuff, failure, and successive turndowns. I have looked with eagerness for the five dollars from Smythe every week, and have even asked with a self loathing heart for another, personal, loan from Siedler. But I have met and do know some generous men, real friends in need,with sympathy and with belief in me and my invention.John Firth is one. But for his persistent and well directed effort in my behalf I would have failed now, and probably forever. Smythe is true (but an awful weight), and E R Holden is another. He actually said to me 'call on me, de Forest, for another $5 a week. I have a checkbook here which is at your disposal any time".

Dec. 15. Holden, however, makes 26 who turned down my proposition. Smythe balks, for reasons. Now it is Siedler who objects. Marconi is in Nfld. and the papers are full of "Marconi". I scarcely dare , for my own sanity, to look into a paper. We raised $200 in a little pool, with $200 more promised, and I went again to work in White's machine shop in Jersey City. Building a new transmitter now, a.c., to replace the Freeman machine. I have still to do it all, be lawyer, diplomat, promoter, cash raiser, manager, inventor. For 2 or 3 weeks now I have been getting $15 a week, my high water mark of income at an age of 28 years.A Ph.D. and five years a graduate! My faithful light overcoat has lost its sleeve linings and is now fringing at the cuffs. My one pair of pants is bagging badly.

Dec. 22 1901. At last a contract is signed by me as President of the "Wireless Telegraph Company of America". Siedler resigned the post to sell 10% of it to Barbour for the munificent $1000 he has sunk in it.

" Never was one so handicapped, bound up and tied down with such a complication of friends, partners, collaborators, patrons, sponsors. etc as I have been from the start. 'Poverty', George says, 'is no disgrace, but it is damn ed inconvenient'. I got Freeman and Smythe to provide capital;now that capital has gone off in disgust, and I have to do it all over again, the promotion, the business, and all. I draw $5 a week to pursue my life'w work, in a field for which I have prepared myself from the start, the only imx field where I could work to best advantage and be happy". (Note GHC. And that field, my friends, is nothin more thax or less than to work as he damned pleased, at whatever interested him, without any question of practicability of of application to commercial usage. To wear no man's collar, but have that man buy collars for him. If ever a guy had colossal nerve, Lee had. And has. Nor did he have 'a vision', other than that he seemed to drift toward wireless communication. Marconi, at a younger age, and with no Auchinslass to give him a hint toward an invention, worked out his plans with much less technical resources than did de Forest, and made a whole system of w.t. work;then he sought commercial backing and did it. De Forest tried to get that backing on the basis of what was then only a dream, which was very nebulous even in his own mind)

"And now at last Siedler (he of the 'fatherly' interest--at 1500%---) and the thousand dollars, refusing from the start to aid us, refused to let others do so until he finally sold 10% to Bar our for $1000,and allowed the deal to go thru.
The contract is at last signed to raise $30,000 in 16 mos. for the treasury of a million dollar company. Siedler gets 45% and we 35%. And I get one fourth of this.
Meanwhile Marconi has made a coup d'etat. Whether or not the three dots he says he heard acame from England, or, like those Tesla has heard, from Mars, if I am aught of a prophet we w ll hear of no more trans-Atlantic messages for a time. As in all arts, this will develop slowly, not by leaps and bounds, such as from 100 to 2000 miles....If only my responder would not clog. That is still the greatfear in my heart, the mote in my vision. (Note GHC. What a nerve de Forest had, to try to raise money for a wireless telegraph company for which he had nothing of advantage--as yet. His induction coil and spark gap were even as Marconi's. His audion was a discarded idea of a gas flame's flicker. It came to fruition later, but we are talking of the end of 1901, when he was trying to start a company. Even his responder was not a working device--as he says above "if it only would not clog". And this idea of forming companies that had no real basis of existance followed him in all his future. Not a bitter comment, this, for I dearly appreciate him, but it must be said that luck was his chief invention at this, the threshold of his wireless career)

Jan. 13 1902. $20 per week, high water mark of my salary.Prospects of getting money from Snyder and White are encouraging. People are all credulity and sanguine on account of Marconi's feat. (Note GHC. Picture of Lee de Forest riding on Marconi's back!) This is a help to us but I do not expect to see him repeat his famous 'S' within a twelvemonth. This will give us our chance to show what we can do. Whether he actually received these signals or not he has offered no real proof which scientists can accept;all this great halloo and adulation with his wild talk of transAtlantic messages at one cent a word smacks of charlatinism, an the methods of the professional boomer. (Note GHC. The pot.....)

Feb. 9 1902. The treasurer of the new company, now organizing under the laws of Maine, for $3,000,000 is not overstocked. This, and the small calibre of our "fiscal agent" is my chiefest care, for 'with money all things (in wireless telegraphy) are possible'.

The new a.c. sender is a fine success. Now for a line from Cushing Buildin gin Jersey to Manhattan ere Mr. Stokes ejects us and our antenna from that eerie perch.

Feb. 18 1902. Not a dot or dash could I receive. Chicago telegraphs, asking the name of the new company. I replied 'It is wise and eminently fittin that my name be used in this connection. Had I not been willin a dozen times to risk

erarything (note, GHC. His pants!) throw myself and my life into the breech, nothing would ever have come of this scheme, if at last it ever amounts to aught. I myself performed 9/10 of the lab work,and did practically all of the interesting of capital, launched the business. The result is by no maeans assured, and I was hesitant as to whether or not to allow my name to be used in connection with this new enterprise, but having thru unshaken faith dared to take all the other risks, I decided to sdare to take this last one. If afailure should come, I might even be compelled to change my name!

Today, with the transmitter working well, I was able to get scarce a signal over the river to the Bowling Green Building. Why, Iam in despair to tell.

And so the De Forest Wireless Telegraph Company was formed, and under the magnetic enthusiasm an unceasing drive of Abraham White as president sufficient funds thru the sale of stock were obtained, so work could continue at the machine shop in Jersey City. A metal-framed, glass walled, glass roofed house was erected upon the roof of 17 State St., overlooking Battery Park and a station was installed at the Castleton Hotel, in Staten Island, both for demonstrations.

May 17 1902. I have been to Washington twice this week for that bid on the Alaskan routes, but Marconi got one, and Queen and Co. (for the Fessenden system) the the other. In our present embryonic condition I am glad we did not get the award. The problems facing us are sufficient. I am single handed, overworked, overburdened as it is. Fir all this I get $30 a week! My "multiple syntony" patent was delayed without excuse for 6 weeks and went in at last after another on the same lines had appeared. Note GHC. Look these up. Was the other Stone's?)
I shall put in at once a broad fundamental patent on telephony wit out wires by Hertz waves.

We haven now 2 stations on N Y Bay, another going up at Coney Island, land bought for another at Montauk Pt., soon two at Key West and Havana, at Atlantic City, Two steamboats to be fitted out next month, 2 NY offices, a shop, 13 patents pending, a payroll of $200 a week. Competion with Marconi incessant.

July 20 1902. I have been thru many experiences, pleasant and painful. Mama has left for the West. I wish I coued record a greater measure of actual success. The public displays a strange xxxxi scepticism and lethargy as to w.t. as an invest ment. But one man of means has been found with faith equal to my own. Without him, Abraham White, who has been to me all and more than a brother, the patient labor of years would have coma to naught. We have two attachments against us, creditors galore, and I dread to go about Jersey City, where I have seen my name and that of my beloved company, posted on the telephone poles.

July 27 1902. That is past now and bills are being paid. Demonstrations are in general successful. If only the 'sponder would stop balking and acting irregularly at times.

Here is an artxcle from the N Y World:

A NEW YORK RIVAL OF MARCONI

Far up in the air, on the roof of the Cheesborough Bldg., at No. 17 State Street, is a wireless telegraph station, of the existance of which few persons have heard.
The system employed is the invention of an American, a Yale man not yet 30 years old, and is in no respect similar to that invented by Marconi.
The operator here has exchanged messages withthe S S Deutschland while that vessel was 100 miles at sea,and for simple demonstration messages are constantly sent to another station located on the Hotel Castleton, on the heights of St. George, S,I., from which the replies made may be seen recorded as xxxxxl xxxfx undeniable proof.
It is asserted that the newest system has many advantages, notably in speed and freedom from interruption,over that of Marconi; that it is no longer an experiment;but is so far advanced that when next the big Hamburg-American liner Deutschland crosses from the other side commercial messages will be exchanged between it and the Manhattan station.
Plans are under way for the erection of five new stations along the Atlantic Coast.
The speed of transmission by the Marconi system is at present limited, by mechan-

ical barriers, to fewer than fifteen w.p.m., which is less than 1/3 the speed of the fastest work on land lines.
It is said that a sp ed of 40 w.p.m. has been reached by the new wireless system, which is good work on a land wire and beyond the skill of the average Morse opr.
The inventor of the new system is Lee de Forest, Yale, 1896. Dr. de Forest began his expts. in w.t. while he was yet in the University, has perfected himself in electrical science,and there is no doubt that his system is a success to a remarkable extent, however it may eventually compare with the Marconi system in operating at long distances.
The crowning experiment to date-with the Deutschland-was made on April 12 last (1902) The ship passed out of this port at 1 p.m. and the de Forest station on Staten Island was in communication with her till 7: 15 p.m.
This was done before, de Forest says, when the ship was 70 miles off this port.
The distance covered is limited, he says, as in the Marconi system, only by the electrical energy generated. In talking with the Deutschland a strength of only 25,000 volts, giving less than $\frac{1}{2}$" spark gap, was used.
Dr. de Forest was found at his station on the State St. building by a writer for the Sunday World magazine. He is a young man of athletic appearance, six feet tall, strong-limbed, alert in manner and speech.
'Perhaps the greatest feature of this system', said he, 'is the receiver or responder employed. This instrument works on a principle diametrically opposite to that of the Marconi coherer. In the latter the current is ordinarily broken by the film of gas or air surrounding the filings.'
When the elec. oscillations, intercepted in their passage thru the ether by the upright wire. traverse the coherer at its base these filings ar packed together, or cohered, and the local circuit is thus established. This condition will persist until some outside mechanical force is applied to br ak up the chains of filings by shock or ta pping.
But perhaps the greatest disadvantage arising from the use of a decohering mechanism is the slow speed of word transmission whihh this system necessitates. The speed of sending by the Marconi system is limited by the capacity of the coherer, decpherer and registering device, and great care must be observed by the sending operator not to exceed in speed the ability of the receiver to record.
It was partly with this fact in mind that the form of key universally used by Marconi operators was designed.
This is really more like the throttle lever on a locomotive than the ordinary Morse key.
With the automatic responder of the American system, a closed-circuit device, the local current is ordinarily going thru it,energizing the magnets of the telephone or relay in circuit. The normal resistance of the responder is some 50 ohms.
When the electric wave traverses it, in its passage from the upright wire to earth, its action is to suddenly increase the resistance of the responder, or to open the circuit altogether. This action of course gives a click in the telephone or on the relay.(Note GHC. You DO mean a hum corresponding to the a.c. action on the distant spark gap, now don't you, Doc?)
Now, instantly the electric wave has passed, the action of the local battery is to close again the circuit at the responder and the original conditions are automatically restored. This automatic quality is the great virtue of the anti-coherer principle, allowing the use of the telephone receiver and high speeds of telegraphing.

It was 6 months after the fiasco of the International Yacht Races that I ventured to hire my next operator. The first w.t. sta. in America, located in a specially constructed penthouse of steel and glass on the roof of 17 State St., Battery Park, N Y City (Note,GHC. What were the Marconi people using for stations, Doc? Trailers?) was nearing completion. A brokerage house opr, Wescoe by name, was the first employed for my Jersey City transmitter tests, but he only on part time. A little later a smooth-faced sallow-complexioned young man insisted on visiting me on the rroof, day after day, askin when the sta. would be ready for operation. He explained, t[illegible] opr. he [illegible] Barnhart, Wireless [illegible]

He explained that he, William Barnhardt, intended to be the first full-time American w.t. operator."Barney" was a fast W U opr, employed in a downtown office. He spent his lunch hours in the pent house station, watching the installation of the 110/5000 v. transformer, the glass-plate/tinfoil condenser, double spark gap and other crude equipment, on an oak operating table. (Note GHC. Doc, didn't you know then that there were Marconi men at the various Marconi stations in and around New York, who were operators? Then why the dig about this Barney being the "first"?)

The cumbersome key,with ½" copper contacts breaking in oil, interested Barney. But he soon showed he could sent 25 wpm on this monstrosity. This, and his eager willingness to instal the birdcage antenna on the corner flagpole convinced me that he was just the man to be "Chief Operator". He gave up a good job with W U for a very precarious salary with me of $18 per week, the "per" meaning "perhaps". But he was so keenly int rested in this brand new wonder, "wireless" that he accepted. His first job was to lure away another operator from WU or Postal, as we needed one for the Hotel Castleton, 7 mi. away, on Staten Island. In the spring of 1902 Barney brought over a stocky young man, bespectacled and keen of mien, Harry Mac Horton,a press-wire operator. He, too, came with us, and dropped the "Harry" for "Mac". His enthusiastic, whole-souled, unselfish devotion to wireless, (and to "Doc") I have never seen surpassed or equalled.

HOW he could send! As soon as we had established communication between Battery Park and Staten I. Mac and Barney began to flip Philip's Code across to each other at 30/40 wpm. Nothing could stop them, nor static nor transformer breakdown. I've actually seen Mac copying messages of greeting from some NY financier to his enquiring friend at Staten I. for 20 mins. after the N Y transmitter had blown up. (Note GHC. Only too true, Doc, but why boast about it?)
"Never say die" and "You can't stop a Yank" were Mac Horton's pet phrases, Wages were no object to those young pioneers. Everyone left a good job with W U or on a broker's wire to come with us, and it was with sad frequency that the payroll was missed on many a Saturday. Mac, or Barney, or "Pop" Athearn or Hughes would match to see whose "biscuit" would go to the hock-shop so that the gang might eat over Sunday. They knew that wireless had a future that some day would handsomely reward them. It was the game, the fun, the unequalled satisfaction of traversing new lands, of overcoming strange new obstacles, of doing that which no one else had done before,that spurred them on to wireless. In other words, the spirit of pioneering. "How their more cautious, less imaginative . less daring friends down on Broad St. envied them! (Note GHC. I wonder, Doc! Maybe if you had known then what those Broad St. men, who had an ideal of their own, even if he wasn't so erratically brilliant, thought of your gang, you wouldn't have penned the above. And I know what I am talking about!)

Those were the days when a good wireless op was able to rig up an anti-coherer with a needle and two pieces of aluminum wire, or pencil graphite. Mac Horton used to boast that a wireless man could always rig up a detector with materials he would find in his pocket.

We used double head fones then, Holtzer Cabot type, or the Sullican of England. Baldwin wasn't known in those days. What miracles of reception thru static and jamming the boys performed, which would absolutely floor skilled operators of today. "Clamp the cans on your head and damn well get under the table" was the precept for long distance reception thru static. Hold your breath, remember the message, and then come up for air to write it down.

In the summer of 1902, tho our longest reliable transmission was the 7 miles to Staten Island, we boldly bid for the job of reporting for the Signal Corps the War Maneuvers off the eastern end of Long Island Sound. Old Gen. Greeley gave us the job, and Mac Horton and Pop Athearn built most of the apparatus, installed it on the leased tug boat "Uniquwe" and at Ft. Mansfield. An oil-engine belt-drive, a small 60 cycle generator feeding into a 1 kw. lighting transformer were bolted to the deck of the boat, and in a temporary shack at the Fort, about 20 yds behind the 6" gun battery. At the first salvo at the Fort the entire recg app. jumped 2' into the air and fell on the floor. But it was so simple--a mercury-carbon

anti-coherer, dry battery, tuning coil and headphones, that it was undamaged, and was thereafter suspended from the ceiling beams by springs and strings.

The simplicity of our apparatus, the absence of interference, and the sleepless vigilance and tireless resourcefulness of our two operators brought us complete success and a fat check from the Signal Corps Disbursement Office a few weeks later.

During that momentous week, Horton slept about 10 hours. Pop and I fared a little better. There had been blowouts and burn-outs in the Unique's transformer, and Mac spent his rest hours in rewinding transformers and re-assembling glass plate condensers in oil.

The manoeuvers over, I boarded the tug at New London and told Mac I'd take the watch while he got some sleep. Before many moments the the transformer began again to emit squeaks and groans, accompanied by little black spirals of vile-smelling smoke, from under the cast iron cover-- I knew at once that it had burned out again. So I sank in the mate's bunk and in a second was asleep, to be violently awakened by Mac's violent shaking, demanding " Doc, what in hell did you do to the transformer, and for God's sake, where's the booze?"

Aug. 31 1902. "Fort Mansfield, R I. I am sitting in our little station here, phones to my ear, awaiting a message from our tugboat, lost on the broad waters of the Sound. This work is my vacation, all I'll take. Our tugboat takes us to Block Island, Montauk Pt., Watch Hill, New London, and all those ports and little islands about these waters. I eat ravenously, sleep heartily when at all, living in the open, tramping miles of white sea sand, listening to the roar of sea surges and the howl of whistling shells. Oh, the East is the place for Life, New York the centre, and Wireless Telegraphy the choice of all callings."

Oct. 12,1902. 430 West 118 St., NY, Columbia Arms, bachelor's flat, six rooms and bath, rented entire by the "Fools' Syndicate", Geo. Barbour and myself. It is not far from Riverside Drive, where I can take the long, peaceful, meditative walks which mean so much to me.

(Note GHC. Around this same date are many "poems" by Doc, some in so-called verse, others in prose. The latter rhymed better than the former! Doc is sure some corny "poet". Now and then, however, in prose, he actually slips into a beautiful piece of description, almost always concerning Nature and her moods. As to Girls and their moods, his second most popular theme, he writes very lousily.)

(Some of the titles will suffice: Her Portrait; Dream Rose; Echo Vale; Since Yesterday; Long Ago; My Night; To My Jessie; Evening in Autumn; Maud Kerri in Opera at the Studebaker; Turret Vista; Slumber Sea; etc.)

One will suffice as a pattern:

THE SPIDER AND THE FLY

The moon is a spider, spun a web of silk cloud
Across the roof of the sky
And tangled all up, with his net as a shroud,
A lone little star, like a fly.

The others took flight in their pity
And scurried down into the West,
While some of them clung the black trees among,
And sought them what shelter was best.

But the merciful breeze brushed the cobwebs away,
A-sobbing, and robbing the moon of her prey.

L'Envoi:
You are the moon, and I a poor star,
And grace is the lace of your web,
But my light is more fair for the fetters I wear,
And though the saw me you enchain me,
And though your cold gleam would have slain me,
Yet the whirlwinds that fray my dear bondage away
Might leave me sobbing.

(this should have been addressed to Miss Mixed Metaphor. GHC)

It was in the fall of 1902 that my operator staff was increased by Harry Brown and by "Sunny Jim" Easton (later to become U S Consul at Port Limon after working there for years as the best wireless operator inSouth America. Our stations began to grow in number. In the winter of 1902-3 the U S Navy wished to test this new American system in competion with German apparatus, between Annapolis and the Washington Navy Yard. Mac and Ahearn were assigned for the job. They built the apparatus at Jersey City and tested it out, then shipped it to the Navy. For these boys were not only operators; they knew how to build and above all to repair, whether it be in the black, stinking oil of some transformer which had burned out, or the equally repulsive oily clothing of our glass-plate condensers. If ground plates had to be placed under frozen soil or under ice two feet thick, they did not seek laborers, but dug into the job themselves. And therein lies exactly the secret of the swift progress of American de Forest in those early days.It was the spirit of "do or die",regardless of hardship or sacrifice.

Oct. 6 1902. George, the executive engineer of the de Forest Co., is completing stations at Poughkeepsie and Newburgh, with which we will try the conductive power of this river for wireless.

Dec. 4 1902. As a result of our good work for the Signal Corps, the Navy decided about Xmas to try us out. So during the holiday season we showed some future admirals how superior our Yankee system with its AC generator and transformer, its simple electrolytic receiver (what, Doc? Adopting Fessenden's detector and abandoning your own???GHC) and head phones to the sputtering hammer interrupter, spark coil, and artistically lacquered brass gadgets of coherer, relay, tapper, Morse inker of the heretofore exclusively employed German equipment of the Slaby Arco company. (Note GHC. In writing this history, look thru my records for the relative number of German, de Forest, etc. sets in use, down the years)

S C Hooper was a midshipman at Annapolis at that time. He well remembers the first wireless "news scoop" engineered here, whem Horton flashed to Athearn and me at Washington the first news of the accident to the Secretary of the Navy,when the horses of his carriage ran away, severely injuring him. I telephoned the details to the Washington newspapers, long before the got the news by wire.

At Toronto a promoter by the name of Thompson , backed by wealthy Senator Kerr of the Dominion Parliament, had organized the de Forest W T Co of Canada,and bought two sets of apparatus conditioned on their successful operation between Toronto and Hamilton. Horton, Athearn and I went to Canada to engineer this test.

We had great difficulty during that cold winter test to work 70 miles between Toronto and Hamilton, but our final success was spectacular, and the press gave us full credit.

April 5 1903. The directors of my company, notibably Ferdinand Peck of Chicago, have decided that the time has come to erect a huge station on the Pacific Coast, to send across the Pacific. Cape Flattery, Wash., was selected as the site. It was the westermost point of the U S. The Seattle firm of Kilbourne and Clark wished to contract to build the station. I was sent to make arrangements. En route I visited our stations at Toronto and Hamilton, and selected a station site on the lake near Cleveland, one in Chicago, Kansas City, St. Louis and Omaha.

At Hamilton I made an experiment that I had long had in mind, that the mass of trackside telegraph wires acted as effective wave chutes to pick up all along their lengths relatively large amounts of wireless radiations, concentrate these into a relatively confined zone, and thus conduct this energy over long distances, with small losses relative to those suffered by the unguided, cross-country "grounded" waves. I took my tiny portable detector box and 100' of antenna wire, walked down the tracks from Hamilton towards Toronto,

and when a mile from town strung my wire between two telegraph poles, as high as I could reach. I skinned the bark off a small bush for my earth connection******* and awaited the schedule hour for sendin from Toronto. The strength of signal was positively amazing, showing that my "guided wave" theory was correct. This same idea was checked later at Block Island, and after my 1906 confirmations formed the basis of a broad patent issued to me several years thereafter. Yet to date no practical com mercial application of this idea has been made. (Note GHC. Bosh. That test was surely inconclusive. In the first place, a signal from a station ONE MILE AWAY couldn't help but be "amazing". Next, you didn't walk away in a direction at right angles to the wire lines, a mile from Toronto, and see what signal you would have gotten with "grounded" waves. My guess it that it might have amazed you, too, even had you used the most unengineering ground of a "skinned bush".)

Of this fact, every radio installation on a railway train, or in a touring automobile is a convincing demonstration.

April 19 1903. Returned from Seattle. The newspaper clippings tell of the wild, majestic scenery around Cape Flattery, of our perilous ascent of the steep canyon to the brow of the hill, forced marching thru a primitive jungle, thru chaparral brush that reached shoulder high and threw us headlong many times.Finally we came to the edge of the giant promontory, flanked by the great mouth of the Straits de Fuca and by the boundless expanse of the Pacific. There I stood, 150' above the ocean, across whose great expanse I planned to send the silent voices of the ether to distant lands.

The difficulties of construction in such a site challenged all the resources of Walter Clark. But he and Charlie Kilbourne finally hoisted a donkey engine and sawmill from a barge to that lofty plateau, and work on the towers was begun. Before these were completed, however, financial difficulties of the Eastern Company forced discontinuance.

Doc was at his old tricks again. May 27 1903 he writes to one "Nanet", asking if his name is removed from the lintel of her heart's door. " Do you no longer droop your dream eyes where their reflection lies steeped in the sea?" he asks. And he asks again "for the dear old confidences".

Now going backward. February, 1902. My good friend, fonfirmed and inveterate believer in the merits and the future of de Forest wireless, John Firth, now journeyed on our behalf to England, to interest Sir. Thos. Lipton in the idea of equipping his yacht, the ERIN, with wireless before her voyage from Clyde Bank to NY, as tender to his Shamrock III, in his approaching third attempt to lift the America Cup. Firth, with his London Ally, John Z. McGuire, succeeded in showing Sir Thomas what it would mean for word of his flotilla's approach to reach America long before it anchored by its shores. They also showed the practical advantage of being in touch with shore all the time the ERIN lay at anchor off ~~Xxx~~ Sandy Hook, and throughout the course of the races.

Horton took across the~~x~~ set and installed it.He rebuilt it when he got to Glascow ~~Xxx~~ It had been planned to instal the set in some cubbyhole below decks on the Erin, but now with Horton there! Into the wheelhouse and the Captain's private quarters the apparatus went, all encased by the Glascow carpenter in the finest teakwood, fit to stand beside the yacht's piano. The ~~xxxxx~~ generator was located in the engine room, after two bilge pumps were removed and relocated, by Horton's orders, so that the best possible location could be had for our source of power.

Anticipating rough weather, the two antenna spars were built and installed to withstand any hurricane.Phosphor bronze wires, an American specialthy comprised the antenna, and insulated as no "Limey" Sparks had ever seen in Blighty.

They sailed, and for 3 weeks we awaited word from them. At Steeplechase Park,

n Coney Island, the first wireless mast on ~~xxxxxx~~ New York land had been erected, a three-sticker,180' high, hemp-guyed. The clapboard shack above the piles by the ld Boardwalk housed Sunny Jim Easton, Pop Athearn and Harry Brown, in their turns, covering the 24 hours of the day, even when the Erin was 300 miles out, alling and listening. I began to keep them company constatly as the hour of the R Erin's arrival drew near. Remember, at that time the old Cunarder LUCANIA was the nly trans-Atlantic vessel equipped with wireless. (Note GHC. This seems incorrect. heck from Government records in my library)

We knew that Horton would do his best, even tho he was not a good sailor. All we ould do was to wait. One bleak day, when our hopes had almost foundered--as we had feared was the fate of the Erin, I approached the shack to see one of the boys waving Aerogram blank---"He's got us. Jim's copying Mac now". There sat Easton, with tears actually coursing down his face,so happy was he to learn that all was well with Horton and with de Forest wireless. Horton had first picked up Coney Island 75 miles from Sandy Hook and was now clipping a long report to Sir Thomas, telling of the Shamrock's condition and crossing.It was a full day after the first call before the Erin little flotilla anchored inside Sandy Hook , and Horton landed for a rest. He had literally been lashed to his chair, for the Erin had pitched and rolled 60 degrees- and Mac had been seasick the whole time!

Mac had started calling Coney Island 1000 miles out,so great was his faith in de Forest Wireless,and had scarcely slept since then. Call, tune, listen in vain, sea sick and weary, for three days and nights before he picked up up, and then another day before he heard Easton's " OH 73 OM"

Lipon had arranged with the Assoc. Press to route all his press news direct from the Erin, whether anchored or ~~xxxx~~ cruising in N Ywaters, via the Coney Island station, and Vosburg was sent to replace Horton. He lived aboard that summer as one of the crew.

Vosburg was another tried and trusty veteran of the first "Old Guard", one of the few still in the game. In 1902 he had gone withBarbour , my Yale classmate, our construction engineer, to a lone sand pit near Cape Hatteras to erect the first commercial station on the Atlantic Coast. They erected a tall, four-square timber tower there, tho all they could get for helpers were lazy, shiftless Carolina crackers. ...Soon Vosburg and the boys at Steelplechase Park were exchanging messages by Philips code. Two of them knew Continental and delighted to talk slowly to the Lucania when she was in port, then increasing their speed till Sparks and his ohhrer -relay system were completely "lost"---above 15 wpm. Coney Island was the first station in the world to copy on a "mill".

When Shamrock III and the Defender were tuning up for the races, I took Barnhart---who had just installed the first press ~~xxxxxx~~ wireless station on earth, at Pt Judith, R.I., for the Providence Journal (Note GHC. How about Massie?)---to Block Island to put in the other end of the press circuit. Soon for the first time in ~~xxxxxxx~~ newspaper history daily news items, hot from the mainland, began to appear in an insular journal, published on Block Island. (Note GHC. Not so, Doc. Didn't you know of previous work on Catalina Island? Ask Bob Marriott!!!)

But soon after a terrific storm levelled the Block Island mast. I hastened from NY to Block Island, and Barnhart took me to the shack. There he had connected the wires of the telephone line, on its 15' poles, extending across the Island toward Pt. Judith, and was using it as a receiving antenna, and signals on this directional, horizontal antenna (used for the first time in history)(note GHC. I would surely have to check this, Doc, old boy. You never were much as a historian or chronographer!) were coming in much louder than they formerly came on the vertical aerial. This confirmed what I had discovered a year before at Hamilton, Ont.

For the races we had loaded a huge tug with a 5 kw dc motor--60 cycle generator set, and enough storage batteries set on her after deck to nearly sink her. We were determined this time to jam the Marconi-equipped vessel, instead of vice versa as the year before. But the two squatty spars did not afford a suitable antenna, and although our signals were plenty strong for the distance to Coney Island, they were of low spark frequency (Note GHC. Just how a small antenna meant a low spark frequency is beyond me!) and our tuning (and Marconi's too, for that matter) was too broad to afford much protection against mutual jamming. Then, too, a new and entirely unexpected sea-serpent appeared over the Sandy Hook horizon., A two masted brick schooner (he means 'for carrying brick', GHC) towed about aimlessly by a tug (for this pirate caravan was not permitted to follow the races) had on board a lively kerosene engine driving a 2 kw 120 cycle generator, a well-designed spark transmitter, and a speedy operator who knew reams of ribald poetry and all the cuss words and obscenity in the English language. These, in good Morse, he hurled into the ether from 10 am till sunset and neither the Marconi yacht nor deForest's Publishers' Press could get a word in sparkwise. (Note GHC. See biog. of Pickard, Class 4, Book 1, Clark Library, showing the "newspaper code" they used.)

Also, Fessenden had just opened a station at the Atlantic Highlands, chiefly to show the world that the only real system of tuning was the Fessenden.

A complete log of the operators' pleasantries during those two weeks of Sept., 1903, would have made spicy reading for the Federal Communications Commission of today!

After 2 days of wireless failure and flag signalling, I ralized that my floating Goliath was just a floating bum; so, taking a leaf out of my Armour Institute tests of two years previous, where a high-pitch spark was generated by a Wehnelt interrupter and Ruhmkorf coil, Brown and Sthearn and I installed one overnight in our tug, replacing the 5 kw 60 cycle geneterator. (Note GHC. In these notes Doc calls it a "high frequency" test, but as that is reserved for radio frequencies, I am in this transcription changing the term to "high pitch", which it really was.)

I couldn't find a ready-made electrolytic interrupter in all NY, but with a collection of long, thin steel rods in a porcelain tube, dipping down into an earthen ware crock containing dilute sulphuric adid and a lead plate cathode, we managed fairly well. Only the end of the steel rod was consumed to rapidly so that it was necessary to push it down further into the acid every minute or so. "This process, while the high tension spark was in operation, on the deck of a tug tearing across the rough seas, with conducting salt spray flying over everything, the entire ensemble mounted on top of 100 acid-leaking storage batteries--we had no time to unload these now useless supernumeraries on the dock) called foe skill cum dogged heroism cum saving sense of humor.

I can still see Harry Brown perched on a wooden stool, for better insulation, with wry face and rich profanity reaching over at that jar of acid and gently tapping down the end of the steel wire with a small tack hammer, whenever the sound of the spark became gutteral and irregular! But this queer gear turned the trick. Our shrill, squealy signal, while not loud, nevertheless could be read by the keen ears at the Coney Island head phones thru Marconi's hammer-like spark, thru the more musical notes from the 120 cycle set of the pirate's brick schooner, Harry Shoemaker at the key, and the bursts of God's static which were frequently thrown in for good measure.

The last of the 1903 yacht races was finally reported, to the quasi-satisfaction of the Publishers' Press Association; our signals, tho faint, could get thru where low pitch signals, though 10 times as powerful, were useless.

As a result of our with on the ERIN, the British P O that fall invited a demonstration of the "amazing" Yankee wireless system in competion with their own, across the Irish Channel(where Sir Oliver Lodge had shortly before essayed a trial of the Muirhead system) from Hollyhead, Wales, to Howth, near Dublin. Horton and I

assembled two sets , and, trusting to find the necessary engine equipment and another good operator in London, sailed on the S S Majestic. This was my first trip abroad.

Oct. 18 1903. S S Majestic at sea. Horton is teaching me to telegraph, which I have long ~~ix~~ desired to do. We have the new electrolytic responder**** on board and were in touch with NY for 140 miles.

Sunday Nov. 1 1903. London. Hotel Victoria. Horton and I attended services at the Abbey. De Forest speaks of the "dark and lofty chancels of stone, blackened by the dust of centuries", the dim light filtering down through stained and mullioned windows far above m2"; The deep and solemn voice of the gr at organ, its dim notes, like the dim shadows speaking vaguely of the old traditions, the greatness of the Past, the Glory of Nations, the frailty and transientness of Man. " But he adds: " The Past is not all. Tradition shackles while it charms and blinds. Soon I would tire of these ancient aisles. Alr ady the grimed walls of the antique buildings of London are losing for me their picturesqueness. Their true ugliness, their ill adaptibility to the uses of today, are beginning to oppress me. In my veins there is too much of the Oxygen of Now. The Sunlight is better than the shadows of the Abbey". Spoken indeed like an inventor, one who brought undreamed-of implements to bring man in a few years to greater progress than centuries past had brought him.

Holyhead, Wales.Nov. 8 1903. The wireless station here, overlooking 'South Stack Light', stands on a rocky eminence, typical of this sullen coast of Wales. This crest of trap rock and spar rises a sheer 400' above the ocean. Never was a wierder setting. "Well wrought the sages when they named this sea height "Holy Head"

This ends book One of the de Forest Diaries.
Copied by G H Clark, October, 1946

The following pages are abstracted from Dr. de Forest's Diary No. 2, "The Radio Era".

The abstracting was done by G. F. J. Tyne, who felt that much of the "love content" in the de Forest diary was not sufficiently valuable for the intended purpose of the abstracting, i,e,m the writing of a Life of Dr. de Forest, which at that time was in the mind of Mr. Tyne to prepare. Events changed his intention, however, and it was suggested that this be done by G. H. Clark, (who had intended to do it all the time!) *

Mr, Clark disagreed with the views of Mr. Tyne, feeling that the love passages, and also some of the descriptive pages written by Dr. de Forest to show his great appreciation of Nature and Beauty, were indeed an essential part of any biography of the Inventor of the Grid. Hence, Mr, Clark went over the diary, and added, in red, certain passages which he considered might be later used.

It is to be admitted, however, that even Mr. Clark omitted much, much indeed, of the cornier portions of the Dr.'s brainchildren, and to that extent Mr. Tyne was vindicated in his opinion.

* at vwoa dinner to de Forest Jan. 28, 1947, on the occasion of his acceptance of the Edison Gold medal from the AIEE, Clark said that he was working on the biography of Dr. deForest. Said he " But now about my auto-biography? I have taken three months off and am planning to write the book then".
Sic transit ----
But does it ??

I'll never forget the hardships we endured on the cold bleak cliffs of Holyhead that wet November, 800 feet above the raging Channel of St. George. Nor the nights with Horton and Cornish (our British operator), fighting off chilblains with the aid of 3-Star Hennesy before the roaring fire of the old Howth Bar.

It was no snap to get our English Fairbanks-Morse engine and the 120-cycle American generator up to rocky trail, and installed in a portable clapboard shack, whose roof we had to anchor down with ropes and rock to keep the winds from rolling our outfit over the brink of the cliff of Holyhead.

November 13: "I have said little of late concerning my life's work, difficulties, hopes, fears. I have been too busy to think much of these things but have gone fighting ahead, thankful that the old order has changed for the present (as good or as poor as this is) and optimistically trusting that the future will bring all things well. Yet even now, two or three years from the dark period, affairs in De Forest Wireless are far from satisfactory; and it all hinges, as it always has with me, on finances.

"The Company is ever in debt, slow and poor in its payments, precarious in its revenues, always with one foot in the financial grave, up and down barely afloat, poorly directed in receipts, expenditures and general policy. Lack of genuine business acuman and judgment of men, employees and stock buyers, on the part of "A.W.", his determinations on obviously foolish developments, his bias towards stock selling and indifference to the real business before us, commercial working, his indifference to many just and imperative obligations - all have tried my patience again and again, and kept the Company continually in hot water. Yet his courage, enthusiasm, grit, and generally his loyalty to me are wonderful, seldom to be found, and deserve all credit and admiration.

"But I am always in straights for money, am owed by the company many hundreds of dollars. My own end of the business, the Laboratory (the very essence of our success) is always slighted. Never have I had a tithe of the money needed for successfully conducting my work. I am forever putting my slender funds into the Laboratory account. My many patents are always paid for by myself. My family also suffers, for I cannot see necessary work held up while I have a dollar in hand.

"Even here in a strange land, on a mission of the importance of this, where a genuine world-wide publicity is attached, promises volubly made are forgotten, work is hampered and endangered. I am always restricted and embarrassed for want of a few pounds. Reports from the office are hardly vouchsafed me at all; my explicit and written directions as to operations during my absence are disregarded, and my urgent appeals for funds ignored.

Insert after Tyne paragraph 1.

In twilight I passed on the boat for Dublin, by the red eye of the break-water light, into the outer harbor. Spreading the mist and shadows above its head, the town sank to slumber in the cave of the black hill. The evening winds stirred not the bands of the red West, but a slender wireless mast, like a thorn, was thrust thru the curtains of crimson clouds, brocaded with gold stars.

I came up on deck in the morning as we sailed into the River Liffey. Pale skies at dawn, deeping to blue above the river of Silentness, and the City of Dublin not yet awakenened! A graceful ship of the olden style, full rigged, soon to depart for distant harbors, rode at her moorings. Her noble spars outspread a maze of graceful tracery against the dawn. Now they ensnared and held my fancy, those spider webs of delicate lines, festooned with the dew pearls, -the lines of a ship which sails to the sea, at rest in the dawn of morning. At once it was MY barque and galleon, home from the realms of boy-ish dreams, freighted with fancy's treasures, bright as those early skies, home from what boundless seas, what undiscovered islands, what far-off, unattainable shores!

And now it was necessary for me to travel from Holyhead to Howth, to check on the progress of that station.

At last, the day of the test when the dignified silk-hatted officiel delegates from the G.P.O. in London arrived at each station to watch us do our Yankee damndest. They wrote out code messages which Horton and Cornish (who was exceptionally fast for an English-trained operator), ripped across "with looseness" at 35 words per minute in continental morse. The Lodge-Muirhead system had exhibited a maximum of 18 words per minute (when it functioned). Then the officials themselves gingerly donned the "cans", the first time they had ever received code through telephone receivers, and conversed slowly back and forth, with no difficulty except that due to their inexperience in sound receiving by spark note. In sheer amazement they witnessed the ease and speed with which my two boys, eighty miles apart, slammed up and down the antenna transfer switch and got back their replies from their chattering American keys, far faster than the officials could write off their messages. It was, in short, a day of complete triumph for American Wireless, almost at the very birthplace of wireless telegraphy - an eye- and ear-opener indeed for Englishmen.

The tardy report of their tests and findings finally filtered through the cumbersome files of the British General Post Office - and there the matter rested and died. For Great Britain decided that any wireless system as simple and rapid as ours could not possibly be safe and reliable; the more dignified European methods of Marconi, Lodge, and Slaby-Arco must be, by the very nature of their strictly scientific origins, "quite the best, don't you know."

However, it was not long thereafter before alternating current generator transmitters, self-restoring detectors and headphone receivers began to appear in certain British (and German)wireless stations.

Our bleak November labors had at least driven a nail into the coherer's coffin, and (unofficially) into official concrete.

"I had a very interesting interview with Sir Thomas Lipton Tuesday last. He seemed willing or eager to go into the British Company, but with that marvelous sagacity and practical business insight which had so often characterized the policies and methods of "100 Broadway", the plan which McGuire and I had finally arranged with a promising firm in London to float, (and a wonderfully good chance considering the market and our patent position generally) is nowise good enough for the Home Office. Much good money was wasted in cables, when I saw that if anything was to be done at all to profit from this wonderfully fine work we had done in England it was necessary to get assent immediately, and I am back on that errand.

"Had it not been for this stupid and precarious attitude at home I would be coming back with a sense of having rounded up and completed as fine a bit of work as one can well hope to do in three months, and with a feeling of security for good plans and most excellent prospects for foreign developments.

"And this despite the bigoted conceipt of Muirhead, the attack of the German company on the electro-sponder and other devices I use, and the consolidation between these two with combined attack on our patent position. But I trust that I can soon bring judgment and wisdom into their counsels and save the situation before it be too late and the good work all lost.

"If I cannot then I shall act alone and independently with the help of my English friends. I shall no longer jeopardize my name and future by abject assent to the wild and impossible schemes that seem lately to have taken away the senses from the New York directors.

But definite good did result from that first American invasion of the European ether.

Horton and I returned on the same old ship, "Majestic", with Capt. Lionel James, famed War Correspondent of the London Times, en route, via New York, for the Orient, where Russo-Japanese war clouds were then threatening. We learned of his presence as we sailed from Liverpool. Also that Prof. Fessenden, my greatest wireless rival, was likewise returning to America. Whereupon Horton and I promptly made James' acquaintance, and between us never left him alone for one waking hour, all the way across! By the time our ice-clad vessel sighted Sandy Hook, New Year's Day, 1904, we had thoroughly sold Capt. James the idea that his way to be up-to-date and scoop the entire press world was to take with him to Japan two complete De Forest wireless sets, like those we had so satisfactorily demonstrated across the Irish Sea.

Lionel James tarried in New York just long enough to sell his idea to the London and the New York "Times", and leaving strict orders that this equipment must be enroute for Yokohama within two weeks, took a fast train for Seattle.

Then was another wireless impossibility accomplished. There was no proper equipment available except those two sets in Holyhead and Howth. We cabled our British representative, who fortunately was very much of an American, to instantly locate Cornish, our "limey" operator, get him to pack up and express to Liverpool both wireless sets, then rusting in their shacks on those far separated bleak cliffs.

I believe no Englishman ever before hustled as Cornish bustled. He had thoroughly learned how from Horton, and a trip to America and Asia was to be his reward if he could catch that boat. He properly packed and brought two tons of machinery on board as personal luggage. That just saved our bacon. The entire equipment was unloaded, overhauled, repaired, repacked, and jammed into a chartered express car direct for Seattle within thirty-six hours after the ship docked. But the excitement and triumph was too much for Cornish, "Butinsky" as Mac Horton had nicknamed him. Prohibition might have saved him for the Japanese Expedition; but this was fifteen years before Volstead!

Hence a frantic call for volunteers. Pop Athearn was already slated to go west with Cornish. Harry Brown, of the recent Yacht Race reporting, answered the call. So these two fine American wireless operators accompanied the express car to Seattle, just caught the "Umpress of China," saved the day for ourselves and Lionel James. And again made wireless history, which caused the entire world to wake up and take heed regarding the utility of this startling new American enterprise.

Never before had Wireless been used for press reporting. Here was an ideal opportunity - war maneuvers around the China Sea, where existed no means of communication whatsoever, save by boat and courier; a situation which James' active mind had instantly visualized when we pointed out its possibilities. He had chartered a swift tug for his press scout work, the Haimun by name, destined to make history in war news. He and his boat were ready when my two men arrived in Shanghai. The equipment was transferred to the Haimun's deck, and she speeded off for Wei-Hai Wei. Working like demons, Pop Athearn and Harry Brown installed our set indoors on the Haimun. The motor and generator purchased in New York were belt-driven, for there had been no time to assemble a single motor-generator machine. But the sturdy English Fairbanks-Morse engine from far-off Holyhead was there ready for short duty.

On a bleak hillside 300 feet above Wei-Hai Wei, not far from the cable terminus, Brown and Fraser, James' aid, were landed with their full equipment, a mass of big bamboo, cordage, and about a hundred coolies, none speaking better than pidgin-English. It was "root, hog, or die", for Capt. James couldn't delay a day in getting on his cruising press job, wireless or no wireless. Athearn stayed on board to be ready to flash in the first news, wherever that tug boat might be, whenever the shore antenna was up. So again an American wireless operator, Harry Brown, performed the impossible; taught those Chinks to build, raise, and guy a 160-foot mast of spliced bamboo, erect shacks for engine station and sleeping quarters, plant copper plates away down to the sea; and actually went into commission and "raised" the Haimun in less than three weeks after he was abandoned on that desert point!

And then Lionel James promptly began to electrify the press of the world. His American wireless enabled the London Times, and its New York and Philadelphia correspondent papers, to scoop the other newspapers - not by hours, but frequently by days.

His luck had him close by Admiral Togo's fleet when the Russia "Petropavlovsk" was sunk. After the Russion fleet had returned to Port Arthur, Togo steamed up, hoisted his battle flags, and gave his historic warning to the garrison there. When the "Korietz" fired the first shot, James handed to Athearn the famous message that the first shot had been fired. Brown, ever alert, waiting day and night alone, caught the word and shot it into the London Times office hours before the shot was fired (on account of the time differential).

Not long before the Japanese bottled up Port Arthur's harbor, this little dispatch boat, Haimun, was overtaken by the Russian cruiser, Bayan, far out at sea. Capt. James, knowing the temper of the Russians towards the London Times, appreciated full well what might result to him and his party - but he had with him a weapon more powerful than guns or armament. Invisible, following wherever his boat sailed, was an etheric call, an intangible news-channel, linking them with the very heart of London, on the other side of the world and keeping him in touch with the might of Great Britain's power.

So, as the Bayan drew nigh, he aerographed to Wei-Hai-Wei, "I am about to be boarded by the Bayan. If you don't hear from me within three hours, notify the Times and British Consul." It was a moment of dramatic interest and suspense. Perhaps the peace of Europe hung on the outcome of the Bayan's visit. Which would it be? Would the world and England know his fate? Prompt and faithful, as on a wire, came back the reply from Athearn at Wei-Hai-Wei, eighty-five miles across the sea. "O.K., will notify as requested." The Bayan's officers approached and boarded the boat. They read the message and its reply. They knew they were at that instant watched by the eye of London; and they departed leaving the plucky correspondent and his amazing wireless boat unharmed.

It is safe to say that never in the annals of telegraphy had any service performed a more faithful work at a critical time than did the De Forest system on board the Times boat Haimun on that morning far out in the Yellow Sea.

Cruising all about the Yellow Sea, from Chemulpo Harbor, 240 miles away, and even when at Nagasaki to coal, Pop kept always in touch with Brown at Wei-Hai-Wei. One notable war message of 800 words flashed over this distance at twenty-five words a minute, without a single error. And that, remember, was in

early 1904, when wireless over such distances and for swift press purposes was an ansolutely untried experiment. Nothing whatever today - true. But those two lads made wireless history. Made such significant history that after the first six weeks of war, during which period Lionel James and his wireless continued consistently to scoop the press of the world, the Japanese military authorities suddenly revoked his permit, and summarily dismantled his tug, forcing him thereafter to resume the tedious, time-honored methods of his competitors. "It ceased because the system proved to be of far greater excellence than was believed by the Japanese to be possible; far superior to their own military and naval wireless system of communication." These were the exact words of Capt. James at a banquet given in November, 1904, in London, in honor of him and the Americans who had amazed the newspaper world by the astonishing efficiency of our wireless in war journalism.

It had proven indeed a lucky chance that Horton and I had caught the ship at Liverpool, which carried Lionel James to our shores. But it was a sore disappointment to both Horton and Cornish that neither could accompany to the Orient the wireless gear which they had so brilliantly broken in across the Channel of St. George.

Other tasks, more prosaic, but more in the line of practical experimentation and perfection to commercial needs, awaited these two. It had now been decided to attempt, also for the first time in wireless history, commercial communication over 180 miles of frozen land and ice-jammed lake-shore - between Cleveland and Buffalo. Mac went to Nottingham, a few miles east of Cleveland, where Barbour, back from Hatteras, was erecting two 210-foot masts, and a fan antenna.

Cornish and J. A. Wallace, summoned from his work on the old Toronto-Hamilton wireless circuit, met me at Bay View, a frozen desolation west of Buffalo. There contractors were erecting a station similar to Cleveland's.

I'll never forget the icy dreariness of that lonely location, where we toiled through the bleak winter months of 1904 - installing a huge goliath of a recalcitrant oil engine, which Wallace called "The Cow", and which required all of us, and any tramps in the neighborhood, to stand on its fly-wheel spokes, to start her going. Nor the agony of raising again and again that fan aerial after sleet had piled it and the stiffened hemp halyards an inch thick in ice.

Nor the multitudinous trenches radiating from and surrounding the shack, for the first ground system of its type - in ice-locked earth, the broken window panes in the

road-house where we slept congealed beneath a foot thickness of blankets, the wash pitcher frozen solid each morning, the leathery flapjacks which "Butinsky" used to fry for supper - so consistently tough that I pasted postage stamps on one and mailed it to New York.

And meantime, Horton and Elmer Bucher, a young cub op. he had picked up at Cleveland, toiled and suffered similarly. While we tested and tried, wire-telegraphed and tested, back and forth, tuning and re-tuning, puncturing glass-plate condensers in icy oil, thrown wholly on our own resources; for New York sent us little of apparatus, and less of money.

But at last, when it seemed that our wireless efforts must end before that endless winter terminated - we began to exchange messages occasionally, and then with gratifying regularity - a new world's record.

At last came the day of formal opening; exchange of greetings by the two Mayors, press representatives present, concocting all imaginable tests to determine whether or not this new thing, wireless, was genuine, or a clever fake worked over a wire concealed under the Lake Erie ice.

I think it was the following morning when the newspaper of Cleveland and Buffalo carried in bold-type the announcements of this "Marvelous Success" that Horton was taken to the hospital for an emergency operation - appendicitis. E. K. Bucher, now one of the Vice Presidents of the RCA, whose career in wireless and radio there began, carried on efficiently in Mac's absence. That early Cleveland station stood for years in sight of the Lake Shore trains, and gave to countless big business men of New York and Chicago their first concrete idea that "Wireless" was an actuality and could some day play a vital part in their own business communications.

"One can little know how tremendously busy my life has been of late, how filled with various experiences, hardships of one kind and another, privations, poverty still, living at the Bay View Station along with Cornish, cooking our own meals, making our own bunks, engaged in all kinds of labors, scientific, bucolic and otherwise. How many the difficulties and experiments before at last perfect communication was established between Cleveland and Buffalo, 180 miles over frozen land and solid ice, the greatest distance ever covered in this country. Then I rushed back here to New York to prepare a paper to be read before the Franklin Institute. A month's work must be done in a week, and all the accumulated duties of the last seven weeks' worked off the slate. Then there is the hateful patent suit by my arch-enemy Fessenden to think about. Were not most of these orduous tasks also engrossing, fascinating, and of intense interest one would tire of life and lie down in weary despair. But as it is it is a life well worth living, of full accomplishment, such perchance as is not given to many.

"Those who once enter this work, on whom the enticing spell of the 'wireless' once falls, never quite it - no matter what the demands on strength, on patience, nor how great the sacrifices, always hopeful, always in effort, fascinated forever. Witness Abraham White, our faithful operators, my laboratory helpers, and all our agents and aides."

Early in the spring of 1903 I visited Prof. Fessenden at his home and laboratory, which was then at Fortress Monroe, Virginia, where I first met Dr. Frederick Vreeland, his assistant. They were using at that time a form of electrolytic detector for wireless signals, which, while resembling mine in the fact that both were anti-cohering devices, nevertheless differed in that it used a fine Walliston wire, dipping into a solution of dilute acid in which also was immersed a carbon or platinum cathode, with one or two volts potential applied across these two electrodes, in series with a telephone receiver. At that time Vreeland confidentially informed me that he, and not Prof. Fessenden, was the inventor of this novel type of detector.

Upon my return to New York I began reading up the history of the Wallaston wire and its various applications to the art. In the course of this research I came across an item in the Electrical World by Prof. Pupin, disclosing that he, long previously to Fessenden, had used a fine platinum wire, insulated except at its end and immersed in an acid-electolyte. This device of Pupin's acted as a very efficient rectifier of weak electric currents. Thereupon I immediately set my able assistant, Clifford D. Babcock, upon the problem of designing a practical form of electrolytic rectifier using a minute insulated end, following along the Pupin idea, which was not patented. After some months of busy experimentation Babcock produced what we called the "spade" electrode, in which a thin piece of platinum leaf, almost completely insulated in a sealed off glass tube so that only its extreme end surface was exposed, acted as a very efficient rectifier of minute high frequency currents. This "spade" electrode device served as a very efficient wireless detector, was not apt to be burned off or destroyed by a severe shot of static, as was usually the case with the Fessenden and Vreeland electrode, and which to us and our patent attorneys seemed, in view of the Pupin disclosure, to be entirely free from the Fessenden patent claims. Thereafter the "goo" type of anti-coherer responder which we had been using up to that date was officially replaced by the "spade" electrolytic detector.

The success which the De Forest Wireless Telegraph System achieved, even in 1902, prompted efforts on the part of the American Marconi Company to stop us by means of patent litigation. A suit was brought in the Federal District Court, Judge Townsend presiding, under the original U.S. Patent of Marconi, which claimed broadly the coherer in combination

with the upright wire and earth connection. This was the first of an endless series of patent litigation waged against me and my Company, and by us in turn against infringers of my patents, litigation which has harrassed and held back the development of the art throughout its long history. And which has resulted chiefly in the enrichment of a host of able patent attorneys, and which would undoubtedly eventually have resulted in an absolute and unconscionable monopoly enjoyed not by the original inventors and pioneers who might legally and justly have enjoyed same, but by those interests who had amassed and could command the most gigantic aggregation of capital.

Ultimately it was the action of Congress first in passing anti-trust legislation, and thereafter investigation and prosecution on the part of the United States Attorney General under the Sherman and Clayton Anti-Trust Acts which have resulted in rather essential liberalization of this patent situation. Whereby today those who are legitimately interested in carrying on a manufacturing, if not operating, business of radio apparatus, are enabled so to do by the payment of not too exorbitant royalties.

However, it required many years of hair-splitting on the part of lawyers and judges, and brow-furrowing on the part of inventors and investors, before a chaotic condition in American wireless and radio was eventually brought to some semblance of law and order.

But that original litigation with the Marconi Company worried me not a little. The Marconi stock jobbers used the newspaper publicity to the utmost possible extent to discourage investors from continuing to finance the growing American-De Forest Company. The newspapers in those years flamed with grandiloquent claims and counter-claims, flamboyant advertisements, notices of counter-suits for patent infringement, libel, and slander. Those were merry days indeed down on Wall and Broad, where speculation in low-priced wireless stocks was rampant. In such battles Abraham White proved himself to be a man of metal. He understood very thoroughly the arts and the wiles of stock manipulation. He equipped a small demonstration automobile with a tiny transmitter, stationed it on Broad Street, flashed De Forest stock quotations in nearby brokers' offices, and defied the "Italian camp!" This daring and spectacular coup resulted in no end of favorable press notices, to the encouragement of our forces, the discomfiture of Marconi's stock salesmen.

And so it went on, pro and con, to the enrichment of stock brokers and gamblers, but to the embarrassment and hamstringing of those who were sincerely striving to put the new art of wireless on a profitable commercial basis.

Eventually Judge Townsend held the most threatening claims of the Marconi patent to be invalid, or uninfringed by us, to my infinite relief and satisfaction. His invalidation was chiefly based on the earlier work and disclosure of Sr. Oliver Lodge, the Russian, Popoff, and Branley, the French savant, who was unquestionably the originator of the coherer - a device by the way which was never used in America.

But now in 1903 a new patent infringement suit was brought, this time by Prof. Fessenden against our recent employment of the Wollaston wire electrolytic detector, or receifier. This action dragged on for three years and prompted me, as stated above, to develop the "spade electrode" electrolytic rectifier or detector, based on the early Pupin disclosure.

In 1902-3 I removed my laboratory from 24 Morris Street, Jersey City, where it had been since 1901, when I first arrived in New York, to a small upper loft at 27 Thames Street, New York City. At this stage I hired a queer appearing, brilliant inventive chap endowed with an encyclopediomemory, by the name of Clifford D. Babcock. He had had wide experience with various inventors, Edison among others, and came to me fired with the determination to work with me in wireless development lines. I greatly required at that time just such an assistant; and inasmuch as he, like myself, was willing to work for practically nothing and promises, he was duly employed.

At this period I was particularly determined to resume my investigations of the gas flame detector of wireless signals, based upon my earlier observations in Chicago with the Welsbach gas burner mantle, a subject which had always been in the back of my mind. Accordingly I rigged up a Bensen burner, inserted therein two platinum electrodes, to which were connected in series the telephone receiver and dry battery. To one of these electrodes I connected an antenna wire running out the window and out the top of a flag pole on the building roof; the other to a water pipe, for "ground" connection. Then I began to listen for wireless signals from one or two ships which were at that time then equipped with wireless down in New York Bay. It was not long thereafter until I succeeded in obtaining signals, genuine wireless signals, with this gas flame detector, a result which abundantly justified the faith and confidence I had conceived back in the hall bedroom in Chicago, that a radically new type of sensitive wireless detector could be developed on the principle of using incandescent gases as the translating medium. For here there was no possibility of my being misled, or that the signals which I heard might be that result of any other action upon the gas flame than that of the true electrical waves or high frequency currents received from a distant transmitter.

But as usual I was so hampered for funds during this periods that I could make but very slow progress with this new line of research, busied as I continuously was with the absolute necessity of building up and putting on a commercial basis the De Forest Wiress Telegraph System.

It was obvious that the gas flame would be an impractical device on shipboard, so I next sought to heat incandescent gases directly by the electric current. Babcock possessed a small carbon-arc lamp, and we carried out experiments using this strange device as a detector. It responded to my spark signals too, but was terrifically noisy. We wasted little time on that device. Our next attempt, to heat the incandescent gases by means of a carbon filament lamp, might be classed as pathetic. Babcock possessed an old Sprengle mercury air-pump, and we attempted to construct and exhaust our own incandescent lamps by these crude means. Babcock I found was only an indifferent glass-blower. Our efforts here resulted only in continued failure and disappointment.

I was working in the greatest secrecy at this time, because I believed that I had in my little laboratory something destined to be of the utmost importance in the wireless art; but our repeated failures to accomplish what I was after with our own crude implements and skill finally induced me to follow Babcock's urgent advice to lay the problem of constructing an incandescent lamp containing a carbon or tantalum filament and a small platinum plate, adjusted to contain the optimum amount of gas, in the hands of a manufacturer of miniature incandescent lamps, whose shop was not far from mine, by the name of McCandless. McCandless fortunately was an independent, and took a sympathetic interest in what I was endeavoring to work out.

The development of the Audion from this stage on is so completely outlined in the Paper which I read before the Franklin Institute in 1920, the bulk of which is here appended - that it will not be necessary at this time for me to continue with a detailed description of the evolutionary (and revolutionary) experiments, which resulted, three years after I had resumed my work with the Bunsen burner, in 1903 - in the three-electrod Audion detector and amplifier.

The American nation was now focusing its thought on the forthcoming World's Exposition, then in frantic preparation at St. Louis. My Company was invited to make a Wireless exhibit there, and I was summoned from the bleak isolation of Bay View Buffalo to direct those diverse installations. We had several, chief of which was that installed on the steel De Forest Tower, by far the tallest structure at the Exposition.

That installation, in a glass house on the first platform one hundred feet above the ground, attracted unprecedented interest among the public. None had ever seen a wireless station, few knew that wireless telegraphy was an accomplished fact. The staccato crackel of our spark when purposely unmuffled brought them swarming from all over that end of the Exposition grounds.

I had sent for two of the best and most reliable operators whom I had trained in Canada, Billy Fennell and Charley Cooper, to come on to help me install this first tower station, and the one at the exhibit of the American De Forest Wireless Telegraph Company in the Palace of Electricity. These clever, enthusiastic, and hard working boys were kept so busy at installing new stations, and in explaining the mysteries of wireless to the gaping, questioning multitudes that it became at once evident local St. Louis telegraph talent must be immediately broken in. Candidates were not hard to find. Fascinated by the glamour, the wonder, of sending on a Morse key and receiving code in buzzing dots and dashes in a pair of telephone receivers, with absolutely no wire whatever extending between the two stations, every telegrapher in St. Louis came up to see us, perhaps to tell his skill with "the cans", at his first day off.

I remember especially two of these, W. W. McQueen and Wm. Acker, bright, clean cut, fast operators.

Before the Fair was a week old the St. Louis Post-Dispatch requested me to install a receiver at their downtown station, some five miles distant, for a regular press news service from the Fair. When Fennell shot the first message "like a ton of bricks" into Cooper at the Post-Dispatch office from Governor Francis at the Exposition to the St. Louis Mayor, flaring headlines heralded this "Triumph of Science!" Soon these four men of mine were all swamped in work. Other recruits eagerly offered and the best only were chosen.

Harry Reynolds was put in charge of our exhibit transmitter in the Electricity Building, while Charley Cooper moved to Springfield, Ill. to put in the first of the two-link wireless chains already mapped out to give commercial telegraph service with Chicago.

Bright minds now began to concoct all imaginable kinds of stunts for this new, rapidly spreading wonder, American wireless. Roy Knabenshue, renowned balloonist, undertook some flights from the Exposition grounds. "Could wireless reach far above the earth's surface?" Our theory taught us that these new strange Hertzian waves were "grounded" to the earth, their feet slid over the conducting surface, their heads extending up some distance, none knew how high, above the earth. That was

why we could telegraph over mountains and the earth's horizon. Wireless to a balloon had never in all the world been tried.

The St. Louis "Star" asked the question. Knabenshue offered the means for the experiment. McQueen, our fearless Irishman, volunteered for the test. I was in New York at the time. McQueen had been carefully taught that to send, or receive, messages by wireless an upright antenna and an earth connection were indispensable. So he threaded the aerial wire high up into the net of the balloon bag. The problem of an earth connection in a free balloon stumped him not at all. At the last moment before the take-off he appeared with a large tin pail filled with nice fresh earth, heaving it into the basket, stuck the ground-wire from his portable receiver deep into this "earth", and the pair cut loose for a wireless flight for Science!

I doubt if a single one of the wondering throng standing about the basket thought for an instant of the absurdity of the thing. Acker at the Tower key was blazing away and the balloon became a small bubble in the sky, then a speck on the horizon.

They descended in Illinois, and McQueen was soon telephoning triumphantly to the "Star" copies of the fragmentary messages he had received all the way up and down. Proof positive that wireless waves travelled high, but nevertheless always sought the shortest path to "earth".

Wireless history again in the making - easily made in those primitive days of beginnings.

Charley Cooper began to bring in the De Forest Tower station at Springfield 110 miles north, as soon as he had his mast and aerial up. But the signal strength, especially during the severe static of that 1904 summer, convinced me that we could never raise Chicago with that 10 KW transmitter located so high above the earth's surface, and its antenna necessarily so close to the steel framework.

Immediately plans were outlined for a new giant station, the largest yet dreamed of in America. For not in all the world had anyone yet dared to aspire to do commercial wireless over 300 miles across dry country. Up on Art Hill, above the "Jerusalem" concession a great gaunt wooden cross of latticed timber was erected 210 feet high. In the neat shack near its base a 20 KW spark transmitter was erected -- with huge glass plate condensers immersed in oil, contained in four stout wooden "coffins", and connected in series-parallel. But there I soon learned that if electrical energy increases as the square of the voltage, troubles and breakdowns increased as the cube or fourth power!

Shortly before the new Jerusalem "record breaker" (of condenser plates) was begun an eager-eyed, curly-haired, gaunt-faced operator had introduced himself to me at the Tower as Frank E. Butler, a New York Central train dispatcher from Toledo, on a hurried sight-seeing visit to the Fair. He simply would not leave the wireless stations. At one or the other I invariably found Butler. When I told him I had no present vacancies he told me, very simply, and with a snap of his firm jaw: "I'm going to be a wireless operator. Pay or no pay, I won't go home again." I smiled approvingly, understandingly, for I knew exactly how he felt. "Wireless!" Repeated refusals meant nothing to Frank. Up in the new shack he volunteered to help unpack the newly arrived equipment from the Jersey City factory. A huge pile of excelsior was left in a corner. "I'm nearly broke, Dr de Forest. Can I sleep on that tonight? I'll watch this apparatus for you." I said "Yes" - test his sincerity. When I arrived early next morning he had cleaned up the place and most of the condenser plates were coated with tin foil and properly arranged in their tanks. That was too much for me. "Butler, if you want to work for me here I'll try to get you on at half pay - the best we can do just now." Doctor, I'm going to be your assistant if you'll just tell me what to do. Damn the salary. Wireless is enough." So Frank Butler, of Toledo, went wireless, and is at it in his home town even unto this day. Because of his intelligence, keen interest, demonstrated loyalty, and willingness to do anything and everything quickly, neatly, without question or complaint, day or night, I soon placed Butler in charge of that new big station at the Fair.

There we experimented for many weeks in privacy, free from the maddening crowds around our other wireless exhibits. Butler, I found, could not only telegraph well but had a pleasing address, was a fine demonstrator, explainer, and could express himself clearly, graphically. I'll let him describe for you those early weeks in St. Louis in his own words!

"This new experimental one, the 'Jerusalem Station', was the first high-powered wireless station in the world. It was soon found that many of the principles employed in the ten-kilowatt station at the De Forest Tower did not apply to the new station with its 60,000 volts of oscillating current. Heretofore we had been handling just a big lot of current, while now, comparatively, we were playing with miniature lightning of static electricity and did not know very well how to handle it.

"The spark-gap condensers, instead of being Leyden jars, were made in heavy two-inch plank boxes, seven feet long, two and one-half feet high and equally wide, and liquid-tight to hold kerosene. Immersed therein were two large sections of plate glass upon which heavy sheets of tinfoil were pasted

on both sides. Each complete tray weighed about a ton, and from four to six of these tanks were used. High transformers, six or seven feet high, 'stepped up' the tremendous voltage. The spark gaps had terminals one and one half inches in diameter upon which a cold blast of air from an electric blower was constantly blown. Telegraph keys, even of extra large design, were impossible to use, so we devised a long handle arrangement which operated like a pump. The contact points were encased in a tank of oil to prevent arcing and fusing. Imagine pumping water at the old town pump for half an hour - that's how we sent signals before we discovered a better way. Our test signal was always the Morse letter 'D' consisting of 'dash, dot, dot'. This would be sent out for hours at a time. We occasionally changed the helix adjustment or the condensers.

"Our experiments continued to result in nothing but one failure after another. Sometimes, after days and nights of hard, painstaking work building up the series of condensers, we would 'blow up' the entire set in an instant, smashing the heavy glass plates to small pieces, blowing kerosene all over us and over the premises, only to gather up the fragments, rebuild with new glass and tinfoil, change the experiment, and try another hook-up. Static electricity was so free and unharnessed in this station, that it was not at all uncommon to get a 'poke' in the head or elbow if one came within a foot of the apparatus while it was sending. The roar from the spark gap could be heard a block away and it held its own in noise intensity with the ballyhoo bagpipes of the Jerusalem exhibit on the one side and the cannonading in the Boer War Exhibit on the other. The odor of ozone mixed with kerosene, was always present, if not pleasant.

"And hour after hour, one of us was listening in with the headphones with ears strained to the utmost. Nothing in that long period of experimenting was more tiresome than this.

Control of the apparatus having been achieved, we immediately began to smash records for distance. The first event was on September 5th, when communication was established between St. Louis and Springfield, Ill., a distance of 105 miles. On this occasion, President Francis of the World's Fair sent the following wireless message to Governor Yates of Illinois:

"I salute you as the distinguished executive of a great commonwealth by the modern means of communication, the wireless telegraph, a great achievement of science, of the marvelous advancement of which this Universal Exposition furnished many interesting evidence. I hope to see you within these grounds often during the remaining three months of the St.Louis World's Fair."

Shortly afterwards communication was established with the Railway Exchange Building in Chicago, a distance of 300 miles.

This was indeed a stride in progress, fulfilling careful promises, crowning long and discouraging efforts. Especially significant was it that the formal opening of the St. Louis-Chicago service should occur on Electricity Day at the Fair with the Jury of Awards and the Delegates of the Electrical Congress present.

It is amusing to recall the elaborate precautions this austere body of officials took to make certain that this new service was actually by wireless. Some of the party was stationed at Chicago and the remainder at St. Louis.

The famous Steinmetz was Chairman of the Electrical Committee, but he was not present on this occasion. The actual conduct of the tests was under the direction of William Hammer of New York. I knew Hammer well from my earliest days in New York. He had followed my work closely and had been an occasional visitor to my Exhibit in St. Louis. But it was evident now that he did not intend to be flim-flammed or hoodwinked by any possible chicanery.

The attitude of the Committee was that I was attempting to claim something which was obviously impossible of accomplishment. The St. Louis branch of the Committee acted as if they were under sealed orders from Chicago. They had no idea as to just what tests they would be called upon to make until they opened the envelope. This obviously was to prevent any of my shop from becoming previously apprised, and thus enabled to work some sort of legerdemain upon the astute Committee.

Chicago would call up on the long-distance phone and ask for a certain code signal or cabalistic word. All these were duly transmitted and correctly received at Chicago. Then St. Louis would wireless Chicago to repeat certain words or messages over the long-distance phone. The wireless transmission met every requirement, one hundred per cent.

Complete communication was maintained all afternoon to their entire satisfaction and as a result we were awarded the Grand Prize and Gold Medal, which were the highest honors bestowed upon any exhibitor.

Those months at St. Louis at the World's Fair were among the most delightful and happiest of my life. Success followed success, triumph after triumph, and to live and work among the beauties of that Exposition filled my beauty-loving heart and romantic nature of their very depths.

The continued reports of the success of the London Times - De Forest Expedition to the Far East were immeasurably gratifying: "They have placarded all the elevated stations in New York with the 'Times-De Forest' posters and wrought great wrath upon our rivals, Marconi, Fessenden, Gra-Arco!"

"The first of June, '04, saw me back in New York for the Navy tests, where by speed, accuracy and cutting out of Fessenden's vicious interference in the distance tests with the Topeka, the system has won the avowed admiration of the Naval Board.

"And now within one month as well a result of that splended work Mr. White was able to secure the largest contract ever entered into by our Government for long-distance stations at Panama, Cuba, Pensacola, Key West, Porto Rico. These contracts fulfilled will place De Forest Wireless beyond all peradventure long in the lead in America, if not in the world.

In one of my old scrap-books covering my work of 1904 I find an article from a New Haven paper which so well briefly epitomizes the work done that year by my associates and myself that I am tempted to reproduce it here. It gives a graphic impression of the wonder with which the wireless triumphs of that day were regarded.

"FEATS OF WIRELESS

Overland Messages from St. Louis to Chicago

Dr. Lee de Forest Leads All Rival Scientists

Over the Buildings of the World's Fair City,
Over the State of Illinois, and Then
Across the Heart of Chicago Went His
Message

Dr. Lee de Forest has recently accomplished what is considered by many scientists the most wonderful feat in the history of wireless telegraphy. He has established direct and regular communication between the De Forest station at St.Louis and the station on the north side of Chicago. The distance is 290 miles and what makes the accomplishment most wonderful of all is the fact that only thirty horse power of electric energy is used for this extreme distance. Over the buildings at St. Louis, over the whole state of Illinois, and its many towns, and then across the heart of Chicago, in spite of its steel skyscrapers, elevated railways, and a labyrinth of power wires, the subtle Hertzian waves bearing the de Forest messages go,

Insert after para. 3 of Tyne page 17

Sept. 18. At last the aim of a year and a half is accomplished-a great goal reached.

Not since that primitive night when I stood in the rain above the roof of the Dakota Hotel three years ago and heard for the first time the sound of wireless signals has such a joy reached me as when, last week, again in Chicago, I heard the signals fromSt. Louis, This was indeed a giant stride in my progress, fulfilling careful promises, realzing patient hopes, crowning a long and discouraging effort.

Especially significant was it that the formal opening should occur on Electricity Day at the Fair, with the Jury and Delegates of the Electrical Congress present. Since then the service has been contonuous and many paid messages are daily received for transmission to Springfield and Chicago.

true to their destination, and are accurately read by the operator. This distance it is estimated by the wirelessly wise is equivalent to 2000 miles over seas, where there are no objects to ensnare the electric currents, as they go by at the speed of light.

This wonderful development has afforded a sensation for the Congress of electricians assembled at the Exposition. The wireless line was tested Sept. 14th by the Department of Electricity and Prof. Goldborough, chief of the department, reported: "I have the honor to announce that the jurors report every message sent from St. Louis has been received in Chicago with perfect accuracy. I heartily congratulate Dr. de Forest and his co-workers."

On the first day this St. Louis-Chicago "line" was opened, President Abraham White of the American de Forest Co. sent the following aerogram of congratulation:

"Dr. de Forest, Vice President and Scientific Director,
North Side Station, Chicago, Ill.

As the name of Morse, Cyrus W. Field and Alexander Graham Bell are inseparable from the telegraph, submarine cable and the telephone so is that of Lee de Forest linked now in perpetuity with the history and development of wireless telegraphy. The success that the De Forest system is attaining under your brilliant genius, unequalled ability in your art, forceful energies and untiring efforts is more than gratifying to me and your associates generally are to be congratulated upon having the good fortune, the opportunity to be identified with such a splendid project.

Your successful work is recalled now more clearly than ever. Where others have failed you have succeeded, notably in the war maneuvers of 1902 and 1903; the navy tests; the great lakes; service on Sir Thomas Lipton's yacht Erin; the international yacht races; the splendid work in Great Britain, under the auspices of the British Postoffice department; the magnificent work of the De Forest system in the Far East in reporting by wireless the Russo-Japan war news from the steamer Haimun to Wei-Hai-Wei, China, which attracted world-wide attention; the uninterrupted wireless service in Central America for the United Fruit Company, which has been so successful for months past; the World's Fair wireless news service for the St. Louis papers; the overland wireless transmission from the fair grounds to Springfield, Ill., and now to Chicago from St. Louis to the station on the North Side, which was intended for lake business.

No dollar mark can measure the immense value to the world at large of the De Forest system, not only with respect to its influence and bearing upon commerce and civilization, but to its capabilities in connection with saving of life and property.

That you are the first genius to solve the problem and overcome obstacles which many of the leading scientists of the world and the bright minds of the world have been working on for years, has been repeatedly demonstrated in your brilliant wireless work during the past few years, and when the world at large realizes the great importance and value of your practical wireless work, as well as scientific efforts, it will undoubtedly accord to you the credit that is honestly due to you, and which your masterly command of the art of wireless telegraphy entitles you to.

To say that you deserve the success you are attaining is but a mild expression from one whose good fortune it was to realize and appreciate your genius and extraordinary ability from the moment that your honest and manly presentation of the subject influenced him in becoming identified with you and your wireless work."

The Chicago and St. Louis connection is now being operated to transmit messages for the general public just as the telegraph companies operate and it is only a question of several weeks before this service will be extended to the De Forest stations at Cleveland, Milwaukee, Fort Worth and Dallas, and to those under construction in Kansas City and many other cities of the region. These stations are put up under an arrangement with Armour & Co., and other firms, to supply them with private wireless service, but the stations will also be used to give service to the general public. The estimated cost of wireless service for distances of 100 miles or over is less than one-twentieth the cost of service by wire and there is no doubt that wireless telegraphy will prove a serious competitor with the wire systems.

The De Forest Company is developing a similar chain of stations in the East. The station soon to be erected in New Haven on City Point will communicate with both Providence and New York direct, if not Boston, and from New York connection will be made with Philadelphia, Baltimore, and Washington. The New York, Providence and Washington stations have been erected. The New York station is located on the roof of the twenty story sky-scraper at 42 Broadway.

Alexander Graham Bell has said that wireless telegraphy will supplant every cable in the world. The United States Army has installed De Forest apparatus with perfect success in place of cable beneath Nome and St. Michaels in Alaska. The Navy has recently contracted for de Forest stations at Panama, Cuba, Porto Rico, Key West and Pensacola, covering ranges of from 1000 to 450 miles and after his triumph at St. Louis and Chicago Dr. de Forest has expressed absolute confidence of

covering these long stretches. It is a matter of no small gratification to New Haveners that this inventor, who was for six years a resident of the city and a graduate of Yale, has met with a success which has placed him in the front rank of American inventors."

"The day of Revenue had at last arrived!

In October, 1904, I embarked on the S.S. Baltic for a brief one week's stay in London, chiefly to attend a dinner extended to me and Capt. Lionel James, then returned from his world famous successes in reporting by wireless the naval war between Russia and Japan, and to help McGuire close the British deal on which he had been working assiduously for the past year.

October 3rd: "Returning on Kaiser Wilhelm II. My week in London passed slowly enough and I regret to say without all the results I had hoped to accomplish there. Conditions for bringing out the English Company look very favorable, and my presence in London, interviews with cable men and others interested doubtless had a hastening effect - but finalities were not for me this time. I managed to briefly visit the historic London Tower, that ancient monument of Royal crime cruelty, intrigue and ambition.

"The Dinner given to me on October 25th at the Cecil was a great success, notwithstanding that it was called on less than a week's notice, unheard of in England, and was moreover in competition with one given also on Tuesday night by the Pilgrims Society to the officers of the Olympia.

"Sir William Preece was in the chair, and over sixty men attended, 'men of science and builders of the cable' (to quote from my brilliant extemporary speech which I had spent three days in carefully rehearsing).

"I was happy to say that we had the good fortune to have with us tonight the Author of those dispatches whose work with the Wireless Telegraph had added lustre even to the unparalleled position of the Times in War Journalism, Captain Lionel James."

"Insert after ~~para~~ last paragraph on Tyne page 24

Oct. 26 1904. An hour before sunset the great shio slipped softly in between grey walls of the jetty, past the round citadels of granite where the guns frown their bastions. Thus we stole softly into the wide waters of the harbor of Cherbourg, and letting slip our anchor a mile from the quay, awaited the coming of a pilot from shore. My first view of the land of France, ancient birthplace of my ancestors, romantic land of history. Far to the West stretched the low hills of Normandy, tinted with the softest hues, for the sun was low and a gentle wreathe of smoke from burning brushwood clung to their breasts .

The daylight passed as a wraith of smoke might vanish from sight, and as one by one the pale stars took up their watch above the sapphire sea our ship swung with the tide at its mooring, and steered toward my heart's desire.

The night was glorious beyond powers of description. A calm lay on the sea like a full moon's radiance turned into cataract of plunging pearl the tumultuous wake of our ship. Far astern to the starry horizon stretched a path of moonbeams, garlanded as it were, and transmuted into the watery element by the emerald foam which they illumined.

Arriving in New York I was soon rushed back to Chicago and St. Louis, to finish up the accumulated work, and then started for New Orleans to direct from there the erection of a station down at Southwest Pass, mouth of the Mississippi. Thence back to St. Louis again to be present at the last few happy days of the Fair Farewell.

As a direct result of the record-breaking wireless work performed by the high-power apparatus and the loyal, enthusiastic operators in charge of it at the Worlds' Fair at St. Louis in 1904, the United States Navy that fall awarded to the American De Forest Wireless Telegraph Company a contract for five of the most powerful stations which up to that date had ever been constructed anywhere on earth. San Juan, Porto Rico, Key West, Pensacola, Florida, Guantanamo, Cuba, and Colon, Isthmus of Panama, were the designated points. All transmitters were to be of 25 KW, input power, save at Pensacola where 10 KW was deemed sufficient power for reaching its only regular corresponding station, Key West.

There two ship-rigged masts supporting a double fan antenna were erected by Navy contractors, following plans drawn up by my company's engineers. While at each of the four other stations triangularly spaced wooden towers of square timber construction were raised to a height of 250 ft., to support an inverted pyramid of three fan antennae.

Well-designed "shacks" for wireless operators, engine and generator buildings, were constructed by the Navy's builders.

Even before the Fair closed its alluring gates I was busy with some of the "Old Guard", as well as some of the newly trained operators, in laying out the equipment for these new wireless "giants". Based upon our experience with the first 25 KW. 60 cycle transmitter by the tall Jerusalem crossarm mast we specified similar equipment, with kerosene-engine driven generators and exciters for some points. In others, like Key West, the generator (gigantic in the eyes of all those old wireless experts!) was installed in the Navy powerhouse, and motor driven. Frank Butler was sent to Pensacola, Mac Horton there and thence to Key West. These were to be our first Navy stations - the more distant ones to be equipped later, after we had learned from these first, relatively near stations how more surely to tackle those longer range, more puzzling jobs.

But meantime inland and Atlantic coast wireless matters of the American De Forest Company were by no means idle, nor neglected. At West Chicago a duplicate of the big St. Louis pioneer was nearing completion. Likewise a similar one at Kansas City. For fortunately (and also unfortunately, as it later proved) that summer of 1904 produced comparatively little static. Our initial success between the Worlds' Fair and Chicago was so gratifying that we saw immediate possibilities of successful overland competition with Western Union and Postal for commercial business traffic, at really "wireless rates" - not the almost identical tariffs with which present

day radio "competes" with wire and cable traffic. With Wm. Acker at "Chi", Billy Fennell and F. J. Taggart at "K.C.", Charley Cooper at Springfield - Frank Butler and later Acker's brother at East St. Louis ball park (whither, shortly after the Fair closed, the "Jerusalem" transmitter was removed) we soon saw actually realized my early dream of commercial wireless telegraphy overland; not restricted, as the European pioneers had done, to over-water communication.

The De Forest wireless apparatus was always plain, simple, easy to operate or service - built up largely of standard parts which could be procured locally - plate glass, tinfoil, wooden tanks, kerosene oil, condensers; lighting or power transformers, spark-gaps readily constructed and assembled, etc. Only the electrolytic receivers, the two or three-coil tuners, the head-phones need necessarily come from the Jersey City factory, on Montgomery street.

But our New York office was equally as active as our St. Louis headquarters - erecting Atlantic shore stations, from Maine to Cuba, and driving hard after coast vessel equipment. Our able and genial vice president, Charley Galbaith, had a winning way with skippers and fleet owners, most of whom were in those days stark skeptics as regards the possible need or utility of wireless. And the skippers, inured to gratifying isolation and independence of their New York office as soon as Sandy Hook was left astern, groused aplenty at the mention of wireless aboard. "The noise of that spark would disturb sleepy passengers - we don't want it!"

But what with Hughes and Barnhart, Wallace, Curtis, Cooper, Fennel (our three original "Canucks") - rushed from the West to temporarily man a coaster, or help erect a stick on a strategic sand bar; to break in green men as to how to insulate an antenna, or bring in a "rat-tail", how to toughen rebellious ears to tight-clamped "cans" all day and all night; how to see-saw on the slide-tuner, to read whispering Morse in buzzer signals, to "get under the table" and read a fist full through "growling static" - to keep the skipper pacified and "sold" on the value of wireless - even though it made him goddam the New York office - American wireless grew apace on the Atlantic Seaboard in 1904-05. And ere many months every coast city, Coney Island, Atlantic Highlands, Galilee, Atlantic City, Cape May, Norfolk, Charleston, Hatteras, Savannah, Jacksonville, Key West, and finally Havana - boasted of a single tall spar, pricking the barred clouds at sunset and pinning down to earth an invisible etheric mantle, of comfort and protection, spread over the mariner far out on the dark waters.

On January 1, 1905, I began at Pensacola my first tour of inspection of our growing Navy stations. There was Frank Butler, already adopted by some fine young gobs at the Navy yard. He was sleeping in a bunk, and eating his meals with the "Jack Tars" in their mess hall. The station was nearly ready for test out by the time I reached Key West. But little did Butler, nor I, then realize the months of baffling difficulties which must be fought through before Key West should hear the first peep out of "PN". More of that anon. I zigzagged

across Florida and finally reached Key West, where Horton and Cris "the terrible Swede" Olesson, most rigger extraordinary, greeted me on the dock.

Ensued weeks of wireless work and experimenting, the most fascinating and delightful in all my life's experience - lost to the hectic existence of northern cities, in that indolent Island of Delight - a sub-tropic sanctuary from the wintery blasts I had left behind. With the willing aid of Horton and the Navy ops - ever eager to be of service and to learn the secrets of this new wonder, was established the first really high-power wireless station in America, in the world for that matter, if one overlooked the clumsy lumbering "limey" outfit at Poldu, whose cannonade of spark could be heard by ear almost as far as its wireless signal reached!

Two delightful weeks spent in the little Navy shack in the grove of cocoanut palms, hewn partly away to clear space for our antenna wires, borne aloft by three slender white masts overlooking waters painted in such soft and vivid hues of green and violet as my eyes saw never before. And then, having mapped out the work ahead for Horton and his Navy aids, Watts, Marietti and the others, I fled that sub-tropic paradise for the chill north. My route thence lay through Washington, New York (where old "42 Broadway" station was just completing), Boston, Buffalo, Chicago, Kansas City, St. Louis - watching the work of installation and the new ops, in training at all these points - and then again south. Hard work, a multiplicity of tasks, voluminous correspondence accompanied me, followed me everywhere, night and day. Ah, but it was Wireless - it was Life!

I found the new station at Kansas City already in operation under the zealous efficiency of Billy Fennel, who greeted me with this Aerogram from our St. Louis headquarters: "Wallace wires as follows. Nottingham (Cleveland) reading Kansas City perfectly. Can you have K.C. send for Buffalo. Wire when. Congratulations."

J. H. Wallace was still in the old shack on the frozen shores of Bay View, near Buffalo. And Elmer Bucher was still faithfully plugging away on the lonely shore of Lake Erie at Nottingham. Fennel got my message off to Buffalo, nearly a thousand miles overland -- a new world's record, and Wallace was a happy op, as he pulled it in. And all through the winter wireless traffic was brisk between Chicago, East St. Louis and Kansas City. Every operator we had was keen to break a record, to receive a "wireless" further than his rivals. And thus new records were an almost weekly occurrence. Bucher, on January 10, 1906, picked up in Cleveland the Mallory S.S. Denver 10 miles south of the Diamond Shoals Light Ship, 533 miles in direct line, and the "Bermudian" when 200 miles from New York.

"On January 31st the 'Philadelphia' reporting to 42 Broadway when 130 miles out was picked up by the De Forest operator at Port Huron, Mich., some 600 miles away.

"These performances merit attention when it is considered that all the boats are equipped with 1 K.W. apparatus and with very short masts." I am quoting from no less an authority than the London "Electrician", which august journal considered such then unheard-of feats as well worth the chronicling. Today's hams who with 20 watts wig-wag to New Zealand never felt greater thrills than did our pioneer operators of 1904-05, in establishing such records as these. Then a wireless message from the mayor of Cleveland to the mayor of St. Louis was front-page, every time, hailed as a "Triumph of Science"!

I think it was on my next trip South that in New Orleans I first met Operator Baskerville, on one of the earliest of the United Fruit boats installed, whose mellow Dixie dialect, flowing like one of the Louisiana bayous, has been lazy music to my ears - unmistakable ever since. Baskerville and "Wiahless" have remained close companions for lo these "mighty nye thirty yeahs".

February 9, 1905. "And again Key West. I left Kansas City with the thermometer hugging the zero mark. Today I have been wandering about in my lightest clothes beneath a sky of the sunniest turquoise, drinking deep draughts of sweet mild air, wafted from off sub-tropic seas, laden with the perfume of flowers and luscious fruits."

"The Big Station is practically complete. Last night I made the first test of sending. Certainly her voice should be heard in far distant parts of this land of ours, and over many hundred leagues of sea.

"Friday night we heard Hatteras with great clearness, and even Kansas City! And last night we listened to the Cosmo 150 miles from New York, and even caught 42's answer to the ship!

Down at the little commercial station in Key West, at Las Brisas, I found Horton instructing our new civilian operator, Curtis - soon to be selected to superintend the installation of the fifth big Navy installation at Colon, Isthmus of Panama. Curtis learned his power stuff from the Navy Station at Key West, and thus became amply qualified for that last big job, where Goethal and Gorgas, under "T.R's." stimulation, were already digging the big ditch, and stamping out Yellow Jack.

But just now the little shack at Las Brisas was making wireless history. For the Key West City current was of a bastard frequency of 133 cycles. Why, godonly knew. But that little spark of Key West, Jr., had a sweet little singing note, when Curtis set the spark balls close together, which while apparently feeble could be distinguished through

static over distances up and down the coast quite unequalled by any big jammer then extant in all the wireless world. It frequently happened that ships far at sea could read Las Brisas when the 60 cycle 25 KW of "KW" was just a big noise lost in the louder roar of static.

We learned there and then, for the first time, the value of the high-frequency spark - one of approximately 400 per second; a fact which years later in a famous patent suit brought in New York under the Fessenden "high-frequency signal" patent was held by the U. S. federal judge to invalidate what would otherwise have dominated the entire wireless art for many years to come.

On this second visit of inspection to Key West, in February, 1905, I pushed on further south. Crossing with Horton to Havana we first supervised the installation of the commercial wireless station at Vedado - along the northern shore west of the Malecon.

A Havana daily was desirous of selling its news service to the then almost isolated local paper at Key West, which could ill afford the press cable rates charged. Then too my company had made rapid progress in equipping coasters touching Havana, and these demanded contact. We found it no easy cinch to establish reliable communication across that ninety mile gulf. The static even in winter was frequently terrific, far worse than at Key West; and there at Havana I had the first real opportunity to test out my then newly designed "triple pancake turned," for balancing out static. Two primary pancakes, wound of silk-insulated narrow flat ribbon, each with a separate condenser connected in shunt thereto, stood upright and opposite, in parallel planes, separated by a distance which could be varied from one to five inches. The secondary winding was of similar pancake form, its terminals connected to the detector circuit. A swinging arm, wiping over an arc on the outside face of each of the primary pancakes, permitted me to tune each primary winding separately. The antenna and earth were connected to both primary pancakes in parallel but in opposition, for "bucking out". I could thus tune each primary accurately to the desired signal, then spatially separate the two and carefully locate the secondary pancake midway between them until the signal completely disappeared. Then one of the primary contact arms was slightly moved, until the balance was very slightly upset for the slowly damped received wave train, while still remaining essentially equal for the strongly damped "jig" of the static impulse. I found this new fangled triple or balanced circuit, which my faithful assistant, C. D. Babcock, had just sent me from New York, remarkably effective for reading that high squeaky signal from Las Brisas at Key West, through static which completely swamped out all signals when the old two or three-coil slide tuner was employed. But of course the inevitable, preponderant "signal-noise" ratio intervened at times, to render all reception impossible.

Insert after para. 3 of Tyne's page 29

How different are the tintings here in Havana Harbor and those of the Gulf around ey West. There they smiled in eternal emerald bright with imprisoned sunlight. re the bay is the deepest of marine blue, a dark indigo like that of mid-Atlantic.

Thru the low, red scarf of the West the staff of our wireless mast at Vedado ierced, slender and black in silhouette. In how many lands far removed, and by at strange distant seas, are these wireless masts now planted, pinning down to closer and more intimate contact the texture of the ether to Earth, itin more and more the fabrics of the upper and the lower worlds, interlinking hought with Reality.

Had I then properly shielded my tuner and detector, as I did later (in 1909 in the historic interference fights between United Wireless and my Radio Telephone Company stations in New York and Philadelphia) - that Havana-Key West service, even lacking the later Audion detector and amplifier, would unquestionably have aroused world-wide comment. But, even as it was, that early balanced circuit idea was the first intelligent and practical step towards reducing static or close-up interference troubles; and was, I believe, the forerunner of all the legion of balanced or neutralizing "interference preventor" circuits which have since gummed up the archives of the patent office. And even today, with the addition of shielding, multi-stage amplification, and heterodyne reception to give the distinctive high pitched signal, I think one will find that "triple p.c." circuit a mighty neat and effective aid. However, pressing duties elsewhere prevented me from long experimenting with my "static eliminator" at Havana.

Frank Butler had gone some weeks previously from Pensacola to Guantanamo, Cuba, which the U. S. Navy had recently acquired as a Naval base and coaling station. There a lonely, desolate, inaccessible promontory jutting out into the giant harbor of Guantanamo was cleared of its tangled underbrush and mangrove, and there our second large wireless station was located. The site was five miles from the mouth of the Bay, for the officials wished their source of communication to remain unharmed by bombardment as long as possible. Instead of first considering its location from the point of its adaptability for wireless work, the sapient Navy officials selected it because that particular place was down on the blue-print from Washington as the spot, just as was every other building planned for the reservation. As a result a worse location could not have been chosen. The little peninsula upon which the station stood was wholly of coral formation, entirely dead as far as moisture or good ground facilities were concerned.

The weather, even at the commencement of the work, had been hot and dry, and the insects bothered the workmen to such a degree that work progressed slowly in the erection of the buildings and the installation of the apparatus. Frequently it was necessary to tie a towel around one's face, neck and head, leaving only opening to see and breathe. Wearing overalls and shirts saturated in kerosene was another expedient used to ward off the pestiferous insects.

The three 208 feet masts had been towed down from the States in sections. These masts were erected at each corner of a 300-foot equilateral triangle, with the station buildings in the center. Butler had directed that a stout cable be stretched between the tops of the three masts, and from each cable hung from individual insulators 45 stranded phosphor wires, tough and unruly as steel spring. The loose ends of these 135 wires were soldered together into a huge "rat-tail" at the center, anchored to a timber frame, and led into the condenser room through a great porcelain mushroom insulator. Altogether the three fans held 45,000 feet of wire.

I had a tedious and painful journey across Cuba by rail, and by small steamer from Santiago to Boqueron, name of the decrepit dock and shacks serving as terminals to the narrow trail winding through the dank jungle of the wireless clearing. There Butler and his three good Navy assistants seemed overjoyed to see me; John Watts, chief electrician, from New York; Ford V. Greaves from Minneapolis, Roscoe Kent from St. Paul. In addition was a civilian electrician, McLean. All five of these lads were slated for worthwhile work in developing American wireless there and later on. One of them, Ford Greaves, was later assistant engineer for the Federal Telegraph Commission in Washington, now Federal Radio Inspector at San Francisco.

Notwithstanding all I had heard from my correspondence with Butler I had no conception of the horrible conditions under which these enlisted and civilian operators were pioneering in wireless in Southern Cuba. Here indeed was a paradise for mosquitoes, fleas, horned toads, snakes, scorpions, centipedes, tarantulas, wildcats and all other kinds of tropical pests, flying and crawling. Testy Armiral Rogers, comfortably in white flannels aboard the old monitor "Amphritite" away out on Guantanamo Bay, was in command, and devil a lot did he, or his aides, give a damn for the comfort of those poor devils over in the jungle. Mosquito meshing had been requisitioned months before; and all in good time it should some day be received and finally delivered at the station. As there was no fresh water supply on account of the dead ground formation it was necessary to build a cement cistern to hold drinking water, supplied only too seldom by a Navy tug. When a wildcat fell into this cistern and drowned it proved necessary for Butler to cable the secretary of the Navy at Washington to secure belated action on the part of "Blinkey" Rogers' courteous and efficient staff to get the cistern pumped out, cleaned, and refilled with catless water.

A cursory examination through their volumes of Navy regulations, for peace or war, had disclosed no reference whatever to govern procedure in case a wild-cat should drown in inland waters. Moreover the Naval base possessed no feline pulmotor. So, obviously there was nothing whatever which could be done under such regrettable circumstances. Not until Secretary Taft, in Washington, instructed them. A short time afterwards a case of yellow fever broke out in the nearby laborers' camp, and Butler's three Navy companions were ordered to vacate the station and go aboard ship until the disease subsided. This inhuman action left Butler helpless and alone at the station with deadly danger imminent. Again he sought succor from the Navy Department, with instant and satisfactory results.

These latter episodes transpired after my visit to that hell-hole of wireless, March, 1905, when the weather was fine and relatively cool. But even then static was fierce, and scorpions more so. I was mighty glad to sling my hammock from the engine room rafters, using the twelve inch belt as a step-up, where only mosquitoes, gnats, and blue-bottle flies could reach me.

I had brought a set of larger triple pancakes, fine wire wound in spiral form upon three sheets of glass, to tune in the long wave signals from Key West, Porto Rico and Colon. My men there went eagerly to work with these devices whenever they were not immersed in oil and grease from the great transmitter condensers, transformers, or generator. Occasionally, for good measure, lightning would strike, and burst an entire roomful of condensers - just finished after two weeks of hard work - throwing oil and plate-glass all over the room and into the walls. Then "a small cyclone; another entire span of 15,000 feet antenna wire blew down". "Touched off station again and blower-motor (for spark gap) blew up." "Herd of horses from workmen's camp broke corral at night and demolished the guy wires on the entire aerial spans, twisting wires badly." "Earthquake at 4:43 p.m." "Lightning again struck the station at 4:15 p.m., blowing up one set of condensers."

There are brief excerpts from Butler's interesting diary of those infernal days through the endless summer and autumn of 1905. "October 17, finished new ground today." "November 7, Secretary of Navy Taft visited us today." And not until November 17 do we read: "Heard Key West and Pensacola first time." "December 10, Key West heard us first time." Blew up blower motor." "December 15, big two-ton transformer blew up." And thus was waged the plucky battle in the face of endless delays, set-backs, discouragements, but never relenting, never quitting, through to triumph and final Navy acceptance of the station in the following March.

Through such accidents as those here recounted we learned how to protect our apparatus from destructive high-frequency surges, how to design effective choke-coils, sufficient condenser capacity, and strength; and the makers of our transformers and generators, how to properly insulate their windings to stand up under the terrific transient voltages to which our high-power wireless transmitters subjected them.

Above the door of that Guantanamo shack was printed, even when I visited it, this legend: "Abandon hope, all ye who enter here, for verily this is hell." And in my scrapbook I find an artistically printed postcard: "GUANTANAMO BAY CUBA, (128 in the shade) is bounded on the north by 'DESPAIR'; on the east by 'MONOTONY', on the south by 'SOLITUDE', on the west by 'MISERY' - completely surrounded and infested by mosquitoes, sand flies, fleas, scorpions, centipedes and snakes - the place where Dante got his impression of 'hades' - no place like it on this earth.

"VIVA CUBA" (RATS)
(Signed) 73, FRANK

I returned from Guantanamo to the United States early in April, 1905, to resume the improvement of the large transmitting stations at Kansas City, Chicago and East St. Louis, where we had transplanted the original high-power transmitter from Art Hill on the now deserted Worlds' Fair grounds across the Mississippi.

Insert xxxxx after p. 32 of Tyne copy, after words "Signed,73,FRANK"

In New Orlaans I found that my dear little Senator's daughter--with whom I had just escaped eloping when I left the World's Fair for London--had a pleasant surprise for me, in the announcement of her coming marriage to a young Geor gian. The engraved announcement now nestles lovingly at my heart--like a cold lump of lead.

I plead mightily to elope once more;but The Invitations had gone forth and there was no redress.

Thus again are two lives blighted, and the old maxim that xxxxxxxx the route of true love lies over unballasted tract-bed and 30-pound rails again proved true.

During that summer I learned to my dismay that Nature had been very kind to us as regards static during the Worlds' Fair summer. For the summer of 1905 brought many days on end when it was found impossible to receive regular commercial messages between those widely separated stations, try as we might. Tentative contracts with brokers and meat packing houses, who were eager to avail themselves of our cut rate telegraph service, based on the remarkable success in transmitting their most complicated code messages during the preceding fall and winter from St. Louis and Kansas City, had now to be regretfully cancelled. We learned then for the first time just how vicious and brain defying God-made static interference could be. That fact was destined to have a profound and disastrous effect on carefully made plans for financing further developments of the American De Forest Wireless Telegraph Company.

In company with certain honest and sagacious directors of that company, Charles Galbraith in particular, I began now to argue against pushing further the ambitious plans of White, Wilson and stock salesmen who aspired to plant wireless stations all over the land as the promptest method of selling wireless "securities". Harry Shoemaker also, whose old and moribund International Wireless Telegraph Company we had absorbed in the fall of 1903, and who was now in charge of our busy Jersey City factory, agreed that we should lay future emphasis on marine rather than overland wireless. Galbraith, in charge of the Atlantic De Forest Wireless Telegraph Company, had been successfully busy, following two years of painful education of coastal ship owners as to the practical value of De Forest wireless on their vessels, battled valiantly with the White-Wilson group to induce them to spend all available funds upon the erection of more shore stations and the equipment of ships, coastal and trans-Atlantic. But such counsels were outvoted. The stock-jobbing forces were too strong - their success too alluring.

So I remained in the mid-West and battled with static throughout that summer, until Pensacola demanded my personal attention.

Ex-Confederate Army Colonel Christopher Columbus Wilson, stock promotor par-excellence, had his way to such a degree that wireless stations were now rushed up at Denver, Pueblo, Boulder and Fort Collins in Colorado. I visited these stations in July, but found scant encouragement there as to our ultimate ability to lick static in long distance overland communication with any tools then known to wireless.

But in St. Louis I did undertake one development which appeared to offer genuine commercial possibilities - wireless communication to passenger trains. President S. M. Felton of the Chicago & Alton became intensely interested in my proposal and afforded me every facility to prove how far and reliably message could be received on board the daylight limited while travelling between St. Louis and Chicago, from our 20 KW stations, one in East St. Louis and the other on the West Side of Chicago.

I strung the receiving antenna through the train parallel to the bell cord. The receiving instrument was installed in the compartment of the last coach of the train, ground connection made through a window to a truck on the outside of the car.

Three pairs of headphones were hooked up in series, so that Operator Ocker shouldn't enjoy all the fun alone (nor translate stray static into messages unchecked).

We heard not a peep until the train got out of the city jam and along the clear tracks across the river from East St. Louis. The top of the distant mast could just be discerned above the buildings on the East bank. Then the "Vs" began to rip in, "like a ton of bricks off the roof," as Ocker remarked. I had a pair of phones on and waited to see the effect of Merchants Bridge. Sure enough, just as I had anticipated, as we watched the locomotive tender, baggage car and first coaches slowly turn the curve and enter into the steel boxframe of the bridge the signals began to grow weaker, finally fade to nothing. And then as the first coaches emerged on the Illinois side of the river the welcome signals again began, louder and louder until our last car was again in the open.

As the flyer sped north the strength of signals began to slowly fade. Suddenly, when some twenty miles north, they had totally vanished. Keenly disappointed I glanced out the window - we were amid the low hills, far from the river's side. But Ocker, having already copied several messages addressed to the road officials aboard, was by no means satisfied, listened intently, doggedly. He knew that his brother, "O.B." was still carrying on as ordered. Suddenly the low pitched rattle of the call began again - grew loud. I looked out of the car window. There lay "Ole Man River" right along side again. After a few hundred yards the tracks led inland, and once more the call faded away into silence. Surely this was the last we should hear until nearing Chicago. But no - again the old familiar sounds, and sure enough again we were approaching the river side. This astonishing phenomenon was repeated three times, before the signals finally became too faint even for Ocker's ears - at a distance of fifty miles north of St. Louis.

To me it was a beautiful demonstration of the truth of the theory, which wireless pioneers had already accepted, that these mysterious waves follow water in preference to dry soil; that a relatively strong field of force follows the winding river and its moist conducting banks, for much greater distances than along parallel lines over dry country. Also that the mass of track-side wires played a most important part in this "wireless" transmission, and doubtless the rails also, which explained why our long, relatively low horizontal receiving antenna could pick up the signals from a vertical transmitter over such surprising distances, and even if the train were travelling in a direction at right angles to the radial lines of wave propagation from the transmitter.

And that observation of the total fading and restoring of strong signals as our train entered and emerged from Merchants Bridge completed the series of history-making, theory-confirming observations on that momentous day.

Read what the Chicago papers had to say of our afternoon's work the following morning: "With Alton Limited speeding at a rate of almost a mile a minute" (not so fast, Mr. Editor, compared with 186,000 per second!) "the first wireless telegram press message ever sent from a railway train was flashed to the Examiner office yesterday afternoon at a distance of forty-one miles from Chicago." (Ignore the slight reportorial error as to the direction in which the message was sent and received!) "From that time until the train was in the Union Depot constant communication between the office and the city was maintained by means of the De Forest Wireless System, and the beginning of a new era in railway safety signals was inaugrated. By means of the wireless telegraph it is now possible not only for a train to be in regular communication with every station on the line, but also for two moving trains to keep constantly in touch with one another.

"District Passenger Agent Walker and Wm. H. Ocker, Manager of the De Forest Company in Chicago, with other officials of the Chicago & Alton, were charmed with the success of the experiment; and its adoption as a safety method is assured. Shortly after leaving Dwight, seventy-three miles out of Chicago, the first connection with this city was established. The dots and dashes for a time came faintly, but before Joliet was reached the code was distinct, and first over the wires came this message from the Examiner: 'Rush bulletin on success of the test of wireless telegraph! The reply filed from the train at Joliet read as follows: "Examiner message first received. De Forest System on Alton Limited working perfectly! From that time until the train drew into the Union Depot the instruments were kept busy sending (sic) and receiving messages.

"President Felton and General Passenger Agent Carlton inquired from their Chicago offices as to the success of the test, while newspapers and others kept the operators busy answering queries.

Sucess is Assured

"'The fact that we can get in touch with any of our stations at a distance of forty-one miles,' said Mr. Ocker, 'is only a slight indication of what we can do when the trains are properly equipped and when other substations are established. Now we have relay stations only at Chicago, Springfield, and St. Louis, but later we will have them at regular intervals along the road. The receivers and wires on this train are for experimental purposes only. When we have proper wires and stations on the train it will be an easy matter to keep every passenger and freight train on the system in close touch, not only with the dispatchers, but with one another, and then I cannot see where an accident is possible.'"

"The experiment of yesterday has demonstrated for the first time that a wireless plant can be operated without the high towers heretofore considered necessary. While these are indispensable at the terminal stations of each circuit, it has been demonstrated that they are not essential for accuracy of transmission at short distances, and on this account the system is applicable to railroad work."

The historic tests here described took place in June, 1905. They were carried on for some days. The alton officials were thereby entirely convinced as to the practicability of wireless on fast traveling trains. Plans were eagerly discussed by their telegraph officials and myself, looking towards the permanent installation of a small transmitter, drawing its energy from storage battery carried in the baggage car and with properly insulated antenna mounted in links on top of the coaches, flexibly coupled together when the train was made up, the same as with the air and steam connections. But when it came to the question of which company was to pay for the equipment and installation the railroad economists decided that the proposed wireless service could hardly be self-supporting. And as an advertisement the road had already received a vast amount of world-wide advertising, absolutely free of charge. So why run a chance of exchanging black for red? And there you are! And there, once again, was young enthusiastic, far-sighted, pioneering Wireless, with another significant history-making, startling success to its credit - left holding the bag - of empty promises.

That was twenty-eight years ago - and even today scarcely a railroad train throughout the entire world is equipped for the unquestionably useful, worth-while wireless communication service which we then, along the banks of the old Mississippi proved to the world was a practicality. And even now, occasionally, we read of the "remarkable demonstration," the "amazing achievement" of transmitting radio signals to a fast train!

And now the Great Lakes were calling me. Those enterprising boys in Chicago, Ocker and Odell, by no means satisfied with the laurels they had won in the history-marking wirless tests on the Chicago & Alton Flyer, had sought new fields to conquer. This time on the lake.

As early as May that year, 1905, we had put on trial installations on the steamer "Indianapolis" for her first run of the season to Michigan City. W. H. Greenbaum was the operator, and on that first trip nearly won a glass arm sending back to Chicago some 60 messages from 40 incredulous press representatives on board - "All the way into Michigan City." Incredible! But now whether the germ idea originated in the fertile brain of Ocker or with Harry Perry, Bud White, and "Social" Smith, well known gamblers - the old steamer, "City of Traverse", had been covertly turned into a floating pool-room deluxe, with bookie stalls, bar fixtures, and all the paraphernalia to attract lovers of horse flesh - and a few fishing poles for appearances' sake. Up in the wheel-house was a complete wireless station in charge of new

operators skilled in pool room abbreviations. Thus manned and thus equipped, resplendent in a new coat of white paint, the City of Traverse sailed boldly out to defy the powers of the city of Chicago - out beyond the three-mile limit and to a watery spot where theoretically the three states of Illinois, Indiana, and Michigan mingled in one non-juridicial coalescence.

For several days this piratical craft sailed out laden to her gunwales with bookies and racing touts. The sudden popularity of these brief "Voyages to Nowhere," the dejected and wobbling swarms of "fishermen" who disembarked an hour after the distant race tracks closed for the day, aroused the suspicions of Chicago's Assistant Chief of Police, Schuettler.

Detectives disguised as applicants for operator's jobs, and coincidently a Chicago University instructor in physics, visited Mgr. Ocker at the Railway Exchange Wireless Office - inquired earnestly regarding the mysteries of Wireless, listened intently while Ocker flashed messages to nowhere, asked casually regarding the long wire leading up to the top of the corner flag pole - and departed.

Next morning's papers read: "Police Raid Wireless Office; Cut off Floating Pool Room Race Results."

"3:00 P.M. It's all off. The Coppers are here. No more results today." That was the last message flashed to the good ship "City of Traverse," latest device of the pool room men, from the general offices of the De Forest Wireless Company yesterday afternoon. Immediately thereafter Chief Schuettler's men took charge of the office and the betting far out on the Lake ceased.

"Wm. Ocker, local manager, with Edward Brandon and E. O'Brien, operators, were arrested; the expensive instruments torn out and taken to the Central Police Station."

"Out on the Lake 500 gamblers had received the results of three races at Sheepshead Bay and the speculation of the fourth, as well as races at Latonia and Highaldn Park was brisk. The favorites had been doing fair business all the afternoon, and the crowd was bitterly disappointed when returns ceased. Later on enough information trickled in from another wireless station (the 20 K.W. on the West Side, where Chas. E. Fischer was right onto his job!) to enable the books to pay off on the races played, but the sport was killed and if the work of Herman Schuettler goes for anything it will remain killed."

But the Chief figured too fast. He little knew the resourcefullness of Wireless and of Wireless men! Ocker and Odell at once retained the late Col. J. Hamilton Lewis, later U. S. Senator from Illinois, to make a test case of the right of the Company to furnish wireless news of any character. "It is my present intention," said Col. Lewis, "to proceed to the Federal Courts to test the rights of the Wireless Company to transmit any news, not vulgar or obscene, to any place or person, leaving the punishment for the improper use of such information such as gambling, to those who actually gamble."

"The difference in the position of the Western Union and the Wireless is this: The Western Union put machines into certain rooms and assumed to furnish news from their general offices; pool sheets were made in the same rooms. This was held in violation of

the ordinance because the rooms became pool rooms. The instruments in the general offices could not have been seized because they transmitted all kinds of news. My clients are not responsible for what transpires at other places as a result of the news which they transmit."

Whereas the Chief expressed himself as perfectly satisfied with the result of his raid: "Let them go ahead and make a test case of it." And the future Senator did. Application for an injunction restraining the authorities from interfering with the wireless as a common carrier was promptly made by Ocker.

"Those bulls simply couldn't hear it," said op. O'Brien to a reporter of the News. "The clicks of the incoming messages are so faint that an operator cannot hear them unless he wears a telephone receiver. How did those slick hawkshaws rubber in on our messages when they were outside the office? Then besides," as he became more confidential with the reporter, "the messages are never addressed. They are not addressed to the 'City of Traverse' or Harry Perry, or anyone connected with the gambling boat. How did the smart detectives know we were sending race results to that boat? They were sent out in all directions and anyone with a wireless receiver could have interpreted them!" Thus argued our logical culprit, out on bail. He well knew, or thought he did, that there were no cops equipped in those days, no police radio cars, not even a Federal Radio Commission spotter down the alley.

By July 20th the wireless case had been argued, a Federal injunction secured, and that Noah's Ark of strange animals was again launched. Declaring that a telegraph company has the right, under Federal law, to send telegrams even for gambling purposes, Judge Bethea issued an order restraining the Mayor, Chief of Police, et al, from interfering with the Wireless Company.

Assured that there would now be no more cessation of the race news, the doughty "City of Traverse" sailed the Lake again, crowded with sports, bookmakers, and touts, with bands playing and crowds shouting in the ecstasy of victory."

But, alas, what the authorities failed to accomplish was thoroughly effected next day by atmospheric conditions, brought about perhaps by the fervent prayers of church-goers ashore. Only the first race at Saratoga registered. After that static won each race by ten lengths, followed by "Book Beer," "Pretzel," and "Hot Dog" in the order named.

That night Ocker rushed two operators and a picked-up transmitter to Michigan City, to be nearer his floating goal next day. But now the City Hall began also to wax scientific in this battle of brains. The plan was to erect a mast and aerial on the roof of the City Hall so that when Commodore Ed White and "Social" Smith awaited returns on the first race his amazed guests would read on the bulletin board, "The eyes of the Lord are in every place, beholding the evil and the good!"

And when odds were posted on the second race, "Woe to him that gaineth on evil gain." For, unfortunately for the majesty of the law, static was too frequenty asleep on the beat and could not be relied on as "Public Defender."

Then the wireless war became indeed merry. Instead of upon the City Hall the police of Chicago decided to erect their station secretly on the Lake shore at Buffington, Ind. No sooner were its activities noted by our wireless staff than Ocker sent out a third station "to intercept the intercepter," as the reporters phrased it. "Nicola Tesla, Fessenden, and other wizards of the wireless telegraph," reads the Interocean of October 1st, "have been appealed to by Chief Collins, who hopes to have a fourth instrument that will intercept the messages of the Company's intercepter that is interfering with his intercepter. Should the Company retaliate and put in still another intercepter, the whole matter will solve itself into a 'war of intercepters'." What a theme for a movie scenario of today! Race tips and reports became entirely secondary, or tertiary.

And now the row became inter-State, and threatened to become international! State's Attorney Boone of Indiana proceeded to raid the City of Chicago's wireless station erected on the sovereign soil of that state to prey upon the "City of Traverse." And Detectives Helwig and Vanatta, arrested for carrying concealed weapons, were locked up over night in the Buffington hoosegow, while their new wireless set totally disappeared.

On their return from East Chicago, Indiana, Detectives Vanatta and Helwig of Chief Collins' newly organized wireless police squad (the first such in radio history!) announced that the entente cordiale between Indiana and Illinois has been messed up badly.

"---pinched by a bunch of yealy constables all broken out with tin stars," said Van incoherently. "And they kept you in the lock-up all last night?" the chief asked. "All night is right," assented Helwig solemnly. "And when we asked for something to eat the constable with the boots and the biggest star of all says, says he, 'We'll send you a sandwich by wireless, and a cup of coffee by heliograph!' What's heliograph, Chief?" "I think he ran last at Coney Island," said the Chief. And then, as if to add to the cost of their education in Wireless, the Morse detectives found they were out on $100 bail to return to Indiana to stand trial.

Some mighty interesting points of law, common carrier, common nuisance, municipal ordinance, and interstate commerce were involved and thrashed out during that thrilling wireless summer on the shores of Lake Michigan. Legal precedents which may even now be cited for or against the Radio Commission and censorship may be found in those time-yellowed columns from which I quote.

But at the last the cold lake winds won the battle for the police. "Bet Boat's Jig is Up," read the Record Herald of October 9th. "After bouts with gamblers' wiles Chief Collins face is wreathed in smiles."

Re use of wireless for gambling, as described on p. 39 of Tyne's copy of de Forest diary, see "poem" by a Chicago reporter, filed in first volume of Poetry", class 189, Clark Radio Collection.

As I have already recounted, while these interesting events were transpiring: Wireless to express trains, across the mountains of Colorado, and to the Gambling Boat on Lake Michigan - the plucky gangs of installers and operators down around the Gulf were struggling determinedly, resourcefully against almost overwhelming odds.

Through the stifling heat of that hot summer of 1905 Tradell at Pensacola Navy Yard and Horton in the torrid (then Devil's) Isle of Key West were battling terrific static in a vain effort to effect two-way communication.

The long distance work which our American wireless telegraph stations were performing in the early part of 1905 was really remarkable when measured by the standards of wireless communication at that time. As proof of this statement I would like to quote a letter which I received from the Department of the Navy at Washington, February 25, 1905:

"My dear Sir:

It is with great pleasure that I received your report to Chief Boatswain Hudson in charge of the Naval Station Key West Giving some details of communication between Key West and Kansas City, Key West and Chicago, Key West and Hatteras, also between Key West and vessels of the Red D Line.

Let me congratulate you upon your success. I think the communication with Chicago is ahead of anything that I know of. I have heard about long distance messages on the European side of the water through the Bureau's agents, but I was left with the impression that a long bow was necessary to produce them, rather than a long wave-length.

There was some hitch in the work of constructing the wireless station at Colon, but the matter has been straightened out and I have received a telegram from Mr. Overstreet (our contractor there) who tells me that work has been resumed, so I fully expect before a great while to hear of communication between Key West and Colon.

Very truly yours,
William Manning
Admiral

The big Key West transmitter which Horton and I had opened in the preceding March was frequently heard by Iradell, at best during those few still hours just at dawn when the relentless heat - lightning static would quiet and before the heat of the rising sun had stirred up its own vicious brand of growlers. But try as he might, juggle his condensers, helix and spark-gap as best he could, Iradell could never get one signal dot-dash across. There seemed to be a mysterious etheric barrier stretched across the eastern gulf through which the ten K.W. waves of PN simply could not penetrate.

Horton had been up to Pensacola to find the "nigger." He, quite naturally, looked first at the ground. The station was amid a desolate stretch of sand, dry as Sahara, even after torrential rains. Ten feet down however was salt water aplenty. He corraled all the niggers in the Navy Yard, set them to digging a gigantic pit, whose walls had to be planked as fast as dug, to prevent repeated cave-ins.

He bought up all the sheet copper in Pensacola, soldered it into one sheet fifteen feet square, with wide strips leading up for connection to the transmitter. One afternoon as the diggers and pumpers were leisurely working toward the watery bottom of that pit, Horton's weather eye spied a black cloud rising rapidly out of the Gulf. Instantly he sensed an approaching cloud-burst, which would inevitably have flooded his pit, refilled it with sand so tediously excavated, postponing indefinitely the termination of all his labors. "Get that copper plate into the bottom of that hole, boys, before she breaks - and I'll give every g.d. nigger among you two dollars apiece. Dig like hell!" And did they dig? - More sand flew over that coffer dam in the next ten minutes that those tar-heels had ever shoveled in one day. Just as the first great drops of the onrushing deluge fell the big copper sheet sunk into place under the salt ooze of the pit, and the job was saved. Five minutes later the hole was filled to the brim with rain and in-flowed sand. Luckily for Mac the two ship-rigged masts supporting the double-fan antenna survived the storm. Navy-rigged, they withstood many, equal and worse.

Next schedule hour Horton and Iradell "called" K.W., confidently expecting a prompt O.K. at last. But no; Key West went on calling, calling. The navy ops had heard nothing; that new ground was not the solution.

Baffled but not discouraged Mac Horton took counsel with the Navy Yard officers. One of these had drilled the well for drinking water, which stood near the wireless station. "How deep did you go down?" asked Horton. "Fifty feet," he replied. "But if I had stopped at forty feet or gone down sixty I would have found only salt water. This white sand here is about forty feet deep, and below that is a stratum of clay and stone some

twenty feet in thickness. Below that is an indefinite depth of sand." Whereupon it was determined that the upper or surface stratum of sand and salt water was merely a pie in a saucer resting well insulated upon a layer of high resistance soil.

Whereupon Mac secured some twelve forty-foot iron pipes and had these driven, or hosed, deep into the ground, arranged in a circle surrounding the house, their tops all bussed together, and tied into the strip lead from the copper plate.

With this combined ground Key West simply must hear Pensacola. But to his dismay, and contrary to all the laws of wireless and geology KW was yet deaf to PN. Discouraged, baffled, Horton wrote me all the details, and returned to the foul-smelling cistern water of Key West; just in time to escape being quarantined in Pensacola. For, to make matters worse yellowjack broke out early in July, and poor Iradell thereafter was confined to the Navy Yard reservation, denied as yet even the solace of sending official reports, except by Western Union, to his buddy at Key West.

But plenty of other stations were reading him, loud and clear. That was what made the situation all the more puzzling.

Finally it was decided that "the Doc" alone could correctly diagnose the strange ailment at PN. I must leave the blue lake, the humid heat of St. Louis, and get under the stegomyia netting of the yellow-fever quarantine, where one hundred degrees was considered comfortably cool. From my Diary: "Aug. 1905 - I have been an inmate of this old Navy Yard now three weeks, through the heat of mid-summer, striving to solve the wireless riddle, why Key West cannot hear us.

"The desired goal is not yet attained, but much hard work has been done, and so I feel the solution is so much the nearer. I am optimistic, determined. We have at least established good communication with our new station at South West Pass, two hundred miles distant, and begun to handle paid message to and from." (Note how eager we always were to meet that real test of success - paid messages.)

"Other and new apparatus is daily expected, and upon its arrival I hope to reach Key West quickly. That failing I have other tricks up my sleeve to try. ("You can't stop a Yank.")

"One reason I am less impatient at these delays, and less cast down - I really enjoy this kind of free and out-door life.

"I am sleeping in the Navy Wireless Station, all doors and windows open. I am tanned and burned, and not withstanding the terrific heat, the not too sumptuous nor too

diversified meals, never felt better in my life. Then too, I am working so entirely at my own work, actually living in it, that I feel content that it is so; and one who had a work to do cannot feel happy unless so living. At least I am freed (let me hope forever) of the drudgery of office work which so fretted during Pres. White's long absence from St. Louis. Neither the Company nor I can afford my time and energies in clerk's work.

"My mail still assumes prodigious proportions at times, I am constantly re-filling fountain pen, constantly buying supplies of stamps. Despite these deep and blinding sands, the scrub cactii and scant vegetation around me, this wretched hamlet and its dwellers, I find scenes of appealing beauty in sky and water."

At last the lot of Leyden jars arrived, substituting for the plate-glass in oil, which was forever breaking down when the spark gap was widened for higher voltages. An additional transmitting helix, also, to enable us to try longer wave-lengths and higher r.f. potentials. An air-blast on the improved spark gap, to give better quenching (altho we didn't then know it by that name).

And then the endless testing, changing of adjustments on helix and condenser, ding-dong, "D, D, D" - all through the night - sending and listening on schedule - much utilization of Western Union.

It was useless to attempt communication by daylight - static was absolutely continuous except late at night. Frequently I tried and retried every form of "static eliminator" circuit I had ever devised, with indifferent results, so terrific was the cloud-disturbance around Pensacola; especially where all the cloud-framed horizon was pink and lurid from the continual glowing flashes of heat lightning, with never a growl of thunder.

And when without either antenna, earth, or tuner connection to the electrolytic receiver I could still hear a constant grinding of the headphones I would resignedly lay down the "cans" and call upon the name of the Lord in prayer! That, my friends, was static, as we knew it away back in 1905, before Prof. Pupin, and other northern theorists began to patent "eliminators." Had these savants ever summered in Pensacola, Florida, they could have saved their patent fees!

Remember - we had no aid of wave-meter, nor even a hot-wire meter in those crude days of Wireless in the Raw. Consequently only by dint of "anchor spark gap" readings, and groaning of the transformer, or length of blue brush discharge, and by constant monitoring reports from South West Pass Station could we guess which was the best, or the most promising frequency, or correct length of a spark gap. We easily calculated our wave-lengths, but that solved no problems.

We simply, doggedly tried every degree of coupling for each separate wave length, and varied the spark gap and transformer primary inductance for every individual setting of antenna inductance and capacity, keeping systematic records of each as we progressed. On schedule times, and these during only a few hours of the late night, for the reasons stated.

And thus the torrid, soul-trying weeks wore away.

Until on September 3, five weeks after I ran the fever quarantine, as I was coming back to the wireless station, after a dawn-light cup of coffee - I saw Iradell standing in the door of the shack waving a yellow blank above his head. "They've got us; they've got us!" he feebly shouted. Mutely I grasped his hand and blinked blindly at the rising sun.

Again my Diary: "September 3. At last the triumph has come. I have achieved the long-sought end. Key West now hears this station. Another difficulty overcome, one more problem solved. In a few days I will be leaving this region now infested with yellow fever. Yet I shall not go without regrets. There are memories to cherish.

In an old issues of the "Electrical World" appearing in September, 1905, I find a forgotten item of my stay in Pensacola which is interesting as having transpired 20 years before listening to music by radio became a commonplace experience. The item reads:

"Applause by Wireless"

A novel application of the wireless telegraph transmitter was made the other night during one of the weekly band concerts given at the Pensacola Navy Yard.

The large wireless transmitter station is located near the band stand, and at the finish of a selection by the Navy Band the de Forest operators, who had been testing their wireless plant, by way of expressing their enthusiastic applause opened wide the great spark gap, as well as the doors of the sound proof "spark muffler," and then depressing the Morse key sent out a succession of long, loud dashes, the deafening sound of which could be heard for blocks around.

The spark is one of "low frequency" and its rattle, following upon the last notes of the music, sounded not unlike the outburst of thunderous applause from a vast multitude of clapping hands, only seven-fold louder than any ever heard before. The startled band master, recognizing the novelty of this sort of applause and impressed by the electrical enthusiasm of this new "claque," responded with the only encore of the

evening, to the great amusement of the wireless men and his audience in general.

But the most striking part of the whole proceeding came to light shortly afterwards when the de Forest operator at the station at New Orleans reported that precisely at that time he heard the succession of long, loud dashes, breaking up into the irregular clatter simulating the clapping of hands. So it proves that the band master of the Navy Yard Band at Pensacola has been honored by the most thunderous applause ever yet given in the history of music - applause heard 180 miles! Unfortunately the New Orleans operator was unable to hear the music prompting this etheric enthusiasm."

Little did that Navy band master realize that, thanks to what was developing in the near-by wireless shack, the time would come when not only the applause but the concert music itself would be heard over tens of thousands of square miles of space!

I have just come across, in an old scrap book covering the busy years of 1904-05 the actual text of that wireless messages ("Aerograms," we then styled them) sent from the Key West Naval Station to me, quarantined in the Pensacola Navy Yard. It reads:

Key West, Fla., 8-31-05

"Dr. Lee de Forest, Pensacola.

"Mercy" last night. Statis. Heard you today six fifteen to forty five faint. Seven fifty cut Havana out, brought you in,

A. C. Curtis"

Above it, on the same sheet of paper, I find written:

Pensacola, Fla., 8-31-05

"After seven months of futile and unflagging attempts by Butler, Horton, Iradell; after four long, hard weeks here, on the last day of the month, just within the limit, this msg. was received."

So it appears that the Navy, wearied by the long months of unsuccessful effort to establish two-way communication between Key West and Pensacola, had given our Company until Sept. 1st to demonstrate our ability to succeed. That code

word, "Mercy" signified that Key West had not been able to read P.A. during the preceding night on account of static.

The Navy Department at Washington was promptly notified, and arrangements made for the official tests the following week. These were successful, the gods of static resting during the early morning hours, and the navy officials thoroughly realizing that they could not expect wireless service when southern static was in ascendency. In this matter they were quite reasonable; and shortly thereafter the Navy Department's first check for their first two high-power stations, Key West and Pensacola, was in our St. Louis office. And was it welcomed - and photographed!

Just what it was we did to finally drive that hole through the atmospheric wall to Key West we never exactly knew. All factors finally helped - the perfect ground, the improved antenna, the perfected attuning of the primary to the antenna circuit, the reduced losses in the circuits; but most important, doubtless, we finally found a wave-length for which the sky wave (undreamed of at that period), or the shore-skirting wave, did not interfere with the ground-wave, or direct-travelling wave.

I could never convince myself that the peculiar geography of that West Florida coast line played no part in that strangely puzzling phenomenon.

Suffice it that so long as PN stayed on that lucky wave-length she never thereafter failed to raise K.W. - (the gods of static permitting, always).

Now-a-days with undamped transmitters, with audion amplifiers and t.r.f. no end, such difficulties are swept aside too quickly even to be noted. But in 1905 they "sure were hell." - And I doubt not that today a careful radio survey between Pensacola and Key West might reveal some quite unusual and extremely interesting interference phenomena.

Shortly after my return to New York from the South I journeyed to Canada to look after some of my Canadian patents.

"New York, Riverside Drive and 97th Street, Oct. 15, '05.

"Yoleerie"

"Here I have made my home again, in the city of all cities, the place of my choice. And I hope this time it is to last, that I may now begin again to put somewhat more within

the years of my living that the hurry and care of commercialism that so sears the heart. So I am again writing this at my old oak study desk, the one which served me so faithfully long ago, where I can again study, now in my new apartment high above and overlooking the wide spread Hudson. Thus another of my fond ideals is realized. I have chosen this with more immediate hope than ever, that it may indeed mean 'home' to me. For the heart grows lonely and wistful, despite increased success and all its cares.

"It is a mild night of Indian Summer, my front windows are open and I can look out at last upon the black velvet of the stream flecked with the light from the Palisades.

"Today also I have renewed my treasured acquaintance with the autumn beauties of Riverside, now in truth my 'front yard'. Again I have explored for a long distance the wild woods which crown the western precipice above the river.

"With me is rooming a fine chap by the name of Millett, whome I first met in Atlanta and who is determined to work up in the De Forest Wireless Company as my secretary.

And thus it was that by September 10th, I had jumped the yellow fever barricade between Florida and Alabama, and was once more at my desk. This for the first time in our brand new offices in "42 Broadway", destined to be famous in the annals of wireless for years to come.

In the great pent-house of this downtown skyscraper I now began to repeat the history made three years previously in the little glass house on top of 27 Battery Place. Only with this great difference, significant of the rapid progress we had been making in wireless during those few, work-packed years. Here at 42 Broadway was a tall steel mast, especially erected for the job - not a misused flag-pole; a two-room operating station; and, best of all, a large laboratory, where my good, old, ever-reliable assistant, C. D. Babcock ("Bab" to all our wireless world) presided.

And downstairs on the 16th floor, in the commodious offices of the company, clerks and secretaries under the direction of C. C. ("Charley") Galbraith (what old timer doesn't remember him?) were daily becoming more and more busy in handling the rapidly growing ship traffic and installation business of the Company. For the wireless idea had now begun to catch on in American maritime circles. New vessels were being equipped every week. The new factory on Montgomery Street, Exchange Place, Jersey City, presided over

Insert after para. 4 of Tyne's page 56

Yaleerie, bome of memories, bedecked with the old trophies of Yale, nine stories above the famous Drive, and perching in an eagle's cairn high above the Hudson: Dec. 23 1905. Alas, I cannot get the girls to take me seriously at all. I have lost interest in Helen Horn, as I did in Jane McHenry in New Orleans, and am hard in pursuit of another, but she also refuses to take my love-making seriously. I am about ready to quit in disgust and swear eternal celibacy. On my next trip I plan to see my "Golden Girl" in Kansas City. But no sooner will I see her than I will say "She is not for you; she resembles the ideal, perhaps, in certain ways, but is not. It is always the absent, the distant one who looks the sweetest and the most to be desired. When, after toil and humiliation I find the end of the Railbow, the pot of gold is not there but has been removed elsewhere. Thus I am forever chasing phantoms, feeling out my heart for mythical "Rantandeleins" who never exist save in my fond fancy. In some way it does not last, my fine lover's frenzy. I become all a-quiver and endeavour to imagine myself utterly happy and contented, that at last the search is ended and I am in love--and the next morning a fascinating curtain o wireless realities has arisen and beclouded all by fine blue sky, and I no longer behold any great stars or tenderest moonbeams.
So I lose interest and work on contentedly , not carin whether I again behold the object of my heart's adoration.
When will I get courage and a happy "Yes" to take that direful plunge. And if I do shall I say "Come in, fellows; the water's fine"? Or shall I miserably drown?
(Item from de Forest diary, 1910.- Yes--drown--like a poor, stone-weighted dog. Drown and die, oh my Soul.

See expansion of this intimate glimpse into de Forest's ego-soul on page 118 A.

by Harry Shoemaker and Midgely, whom the "Am. de Forest Wireless Telegraph Co." had taken over the year before from the "International Wireless Telegraph Co." was working nights to keep up with orders. There assembled were open-core, wax-impregnated transformers, transmitter "elixes" containing the Shoemaker type of spark gap, sending keys, and improved leyden jar condensers, 12 or 18 in a rack, depending on the size of the transmitter.

The Mallory, Clyde, Savannah, Red D, New York and Porto Rico S. S. companies, Atlantic coasters, Standard Oil tankers, numerous towing companies, had begun the race to equip their fleets. This demanded more shore stations: Bridgeport, New Haven, Boston, Portland, Montauk Point, Navesink Highlands, Atlantic City, Key West (commercial, at "La Brisas"), Havana, South West Pass, Galveston and the list kept growing.

And also on the Great Lakes. Such feats as operator Bucher pulled off when he shot from Cleveland the famous message of congratulations from Mayor Tom Johnson to Mayor McClellan on his renomination for Mayor of New York, and then pulled in the reply from our new "D. F." at Manhattan Beach, made wireless history; and convinced lake shippers that we could keep them in close touch with their vessels all over those waters. Result - stations at Detroit, Port Huron, etc., were added to those already at Buffalo, Cleveland (Nottingham), Michigan City, and Chicago.

All of this meant, of course, ever growing demands for new operators. A training school for such was now opened at 42 Broadway, in charge of Hughes, whose quiet demeanor, unruffled by anything, human or electrical, imbued many a future wireless hero with the conviction that calm work with key, head phones, and pencil was, after all, more effective in time of crisis than consternation and cussing.

It now became increasingly difficult to get suitable ops from W. U., Postal or broker's wires. And thus first began the era of the "ham." Young men, keen to learn about this new wonder, "Wireless", began to master the code (it was still American Morse, not "Continental", at the period of which I write) - and to haunt the Hughes' ante-room. This sanctum, incidentally, was the first authentic "static room" in the history of world wireless, and was the first so-named.

The lucky boys selected were one by one ushered into the sacred precincts of the upstairs penthouse, there to sit around, a lucky one with the spare phones on his head, the others imbibing, through the pungent odor of ozone and

nitrous oxide, such basic principles of wireless as they might absorb. And at last to actually touch the key and control that dazzling spark - to "actually put your own first out on the air, and to a ship one hundred miles at sea!"

Such sights as this in the "42" penthouse first gave to Frank Butler the idea which later led to the opening of the "American Wireless Institute" in Detroit, the first of a long list of similar successors which exist in amazing numbers (see the ad pages of any radio journal) even unto this day.

Ah! Those were the hey-days of wireless around old New York, almost coincident with the opening of the subway. "42 Broadway" began to make a name for herself all up and down the coast. Her men, among others I recall Burchard (Old "Burch"), Harley, Wallace, Jess, Hughes, "Pop" Athearn, back from his triumphs in war reporting from China Sea, and others - all competing to establish new distance records with ships and shore stations down the coast and up the Sound. "Doc, San Jacinto copied me into Galveston last night," or "Doc, see this one Burch pulled in from Sunny Jim Easton, in Port Lemon - relayed by the Denver." Or maybe it was from Guantamo, Cuba, and signed Ford Greaves or Roscoe Kent.

And speaking of tug boats, the good ship "Savage" on Consolidated Coal Co., New York to Baltimore, was the first ocean-going tug-boat to be regularly equipped. And old Capt. Seth Hand, one of the first in the maritime world to appreciate wireless, enjoyed the unique distinction of being the first master to himself send and receive messages - altho at such a moderate speed that I myself could copy him! When the Savage was first equipped, Capt. Hand, realizing the advantage of being his own operator (sic) determined not only to master the code but learned the practical part of wireless, so that he would be able, in case of an accident, to repair his apparatus, and no matter what happened to the coal market to be always in communication with headquarters. And for years Capt. Hand was, by all wireless ops, the best liked skipper on the Atlantic Coast. Would that there were today more such captains afloat, realizing, as he did, by actual experience, the ship operator's life and responsibilities!

There was great excitement in American wireless circles during October, 1905 over the successful use of our service by President Theodore Roosevelt during his cruise from New Orleans to Washington on the warship "West Virginia," one of the first two ships equipped with American wireless.

From our Cleveland station to the ship off Hatteras Gov. Herrick of Ohio (later Ambassador to France) sent, without benefit of relay, a friendly message. And lucky Bucher, at Nottingham, again distinguished himself by pulling in the reply from "T.R." Elmer was getting all the breaks!

By this time the fine work my boys had been accomplishing for the U. S. Navy, ashore and afloat, had brought about a complete reversal of the Navy's earlier avowed policy of requiring a tape-printer at each station for recording received messages. This absurd decision had compelled the purchase of a large number of German wireless sets, including coherers, during the preceding two years. But the simple electrolytic detector and head telephone receiver, coupled to the keen ear and clever wits of Yankee operators, had in 1905 put all this fine-looking, brass-plated Telefunken and Marconi apparatus on the museum shelves of our Navy yards. Likewise, and for the same reasons, the American De Forest system was now forging ahead of all of its rivals on this side of the Atlantic. Marconi and Telefunken sets were found only on European vessels.

But gratifying as all this was to me at the time I was far more interested in a little wooden box with which Babcock and I were experimenting in the pent-house lab. at "42". Beneath its cover, to be dimly seen thru a small glass window, was a tiny cylindrical-shaped lamp, having a carbon filament surrounded by a platinum plate. No one but Bab and I knew the inner contents of that box, or how to connect it to the receiving circuits and to the "A" (storage) battery and the 22-volt "B" dry battery, housed in a separate box. Surreptitiously one night we stole from the lab into the nearby operating room, hooked up the six brass binding posts, connected the head-phones, and when Burchard had cleared a certain ship, instructed him to have that ship "send D's" for 10 minutes. Then the swift, nervous shift-over from the "electrolytic" to the mystery box.

I listened first, adjusted the rheostat knob on the cover. Then saying no word, I passed the phones over to Bab. A slow, sardonic grin crept over his grim visage. He nodded sagely. Then we passed the cans over to the puzzled Burch. "My God, Doc. hear those signals! What you got in that box?" That I did not disclose; but a few days later the mystery box was a definite part of the receiving equipment at 42 Broadway. The audion was born, and "the child doing fine."

Shortly therafter duplicate, wax-sealed boxes were taken to the Navy Bureau of Equipment, Washington. The Navy would buy anything <u>once</u> in those days! And thus I soon had

two audion detectors in use in naval stations. But for a brief time only. The navy ops. would insist on cutting out more and more resistance, to bring up those DX signals still louder, and out went the little lamps. They demanded replacements, faster than we could supply; and the Chief Clerk was adamant - and skeptical. "No more audions; use your old detectors." So the audion incubated for a year.

But in addition to that fine new 2 KW station on top of 42 Broadway, my penthouse lab, (birthplace of the audion) the rapidly-growing installations aship and ashore, that autumn of 1905 was made memorable by the completion of America's first 50 KW wireless station, "DF", at Manhattan Beach, Coney Island.

Back at the St. Louis World's Fair the preceding year, I had observed an electrician whose speed, strength of arm - and jaw, the neatness and dispatch of whose work had distinguished him among a host of hard workers. Harris was his name; "Driver" Harris, I nick-named him. He soon quit Westinghouse Electric, to rig antenna and power-lines for us at the 25 KW Jerusalem station up on Art Hill. Next came the East St. Louis station for Harris, and thence to Manhattan Beach, to the "daddy of them all." I had laid out that station shortly after our success at Key West, and I knew that Driver Harris, being as loyal to me as he was tough, hard-boiled and profane, would follow my instructions to the letter, be I in Key West or England. And thus it proved. When I reached New York from yellow-fevered Pensacola, Harris had "DF" nearly ready for the christening key; and every official and operator of the company his sworn enemy! He cussed 'em and defied 'em, and got whatever he wanted - "for Doc," "them's Doc's orders!" And so we got along fine.

And thus it was that, ahead of schedule, "Old DF" began to burn up the ether all around New York and eastern waters. Two wooden tower masts, 210 ft. tall, 250 ft. apart, the large station house located midway, on piles above a salt-water swamp, a perfect ground, a perfect location for over-seas work.

First crack out of this big box, Oct. 5 to Montreal was received in Chicago. Elated Harris worked harder than ever, as I drove him and "R. B.," our first operator there, to re-tune the station to longer wave-lengths, to attempt to melt the ice of that immense fan antennae, to replace it after the ice had brought her down. Thus on the night of December 19th A. C. Curtis, our then operator at the new Navy station at Colon, overhead "DF" speaking to Pensacola (Curtis' especial delight through the preceding terrific summer at Key West!). This latter feat so astounded the Navy cocked-hats, dear old Admiral Mauney presiding, that they gave out an official statement reading"...The distance between Colon and Manhattan Beach, the extreme range of the message, is 2150 miles. So extraordinary was this feat that

that the Bureau hesitated about making it public, and has only done so after receiving corroborative evidence from several points. This not only beats any previous record made by the Bureau but it beats the record of the first trans-Atlantic cable, which reached only 1660 miles, from the west coast of Ireland to Newfoundland! The Bureau is now prepared to receive from any distance (sic, and two more sics!) regardless of surprising features. At the same time the effort is constantly along the line of making, not unusual records, but of establishing a thoroughly reliable means of communication over a given and comparatively limited circuit."

Thus did the Navy confusedly claim credit for the efficiency of the new "DF" transmitter, whereat my company took no umbrage; rather rejoiced, for was not Colon also equipped with our "gear", and manned by our men? Which made it unanimous! But that quoted statement is highly interesting today, as showing what genuine feat it was 27 years ago to cover those now insignificant distances, using the long waves and damped wave-trains then employed.

During this period when the big boy, "old D. F" was scouring the north Atlantic for new records and down the Gulf to Galveston, one of the best of the recently erected wireless stations was that at Boston.

I have here such a complete technical description of the exact lay-out of a duplicate of this Manhattan Beach Station (although of one-half its power) that I think many of my readers, familiar only with modern tube transmitters, will be interested in learning of the queer "gear" which was then the last work in up-to-date wireless efficiency.

Quoting from Electrical World and Engineering, Sept. 16, 1905, "The American De Forest Wireless Telegraph Co. has recently placed in commission a new high powered station at South Boston, Mass., which has already proved to be of notable commercial value in the transmission of messages between coastwise steamships and the shore. The station is one of the company's chain extending between Havana and Portland, Me., and it is capable of transmitting and receiving in connection with both land and marine service.

It is located near the edge of Boston Harbor on M Street, between 8th and 9th streets, and is connected by telephone with the company's commercial office at 152 Devonshire Street, in the downtown district.

The transmitting and receiving instruments are installed in a small one-story frame building, the interior being divided into five rooms. Power is taken from the alternating current mains of the Edison Electric Illuminating Company. The circuit is

brought to a 20-kw reactance coil which control the main transformer, the latter raising the potential from 104 to 25,000 volts. The main transformer is of the oil insulated type and it is mounted upon porcelain insulators resting upon a wooden base that is set upon the concrete floor of the room close by the reactance coil. The transformer is rated at 25-kw; is supplied at a frequency of 60 cycles and was built by the American Transformer Co., of Newark, N. J. In the the transformer room is also a motor-generator set which supplies direct-current to part of the de Forest equipment. This set consists of a 20 hp., 104-volt, 60-cycle Holtzer-Cabor motor direct coupled to a 9-kw., 110-volt generator. On a shelf above the motor-generator set are six special Leyden Jars arranged to protect the machines from high-tension discharges. Two of the jars are connected to the motor leads, one being tapped into each wire, the other four jars being similarly connected to the general leads. The outer coatings of all the jars are grounded, as the jars are set upon a copper strip on the shelf which is connected to earth. Two General Electric magnet blow-out lighting arresters are also connected to the motor leads.

Adjoining the transformer room is the condenser room. This is about the same size, and the 25,000-volt circuit is brought to it through two glass plates set into the partition wall. There are two large condensers mounted here, each being made up of glass plate coated with tinfoil, the assembled unit being immersed in a non-metallic tank, in which is a heavy oil bath. Each tank is 5 -ft. long and 30-in wide. The spark gap case stands next to the condenser, and on top of this is a helix made of hollow copper wire used in adjusting the wave-lengths of the wireless signals sent out from the station. The spark-gap case, or "muffler" is designed for operation with sparks as long as 1-1/2 in, if desired; its interior is lined with asbestos to prevent the occurence of fire, and peep holes covered with glass are provided to enable the operation of the spark to be observed at will. In a station of this capacity the noise made by such a powerful spark discharge within the confines of a small room is almost deafening, and the importance of shielding the ears of the operators require careful construction at the muffler. In the South Boston station the muffler is supplied with a powerful air blast which is turned directly upon the spark discharge. The air supply is brought into the spark chamber by a porcelain insulated pipe leading to a blower driven by at 1-6-hp. 110 volts, direct current. This motor is also protected from high tension discharges by a half-dozen Leyden jars connected to its leads, and grounded on the outer coating. The motor is carried along the wall of the condenser room, and it is protected from the high-voltage by a coating of grounded tinfoil throughout its entire run.

The operating room adjoins the condenser room and in one corner is set up a slate switchboard which control all apparatus in the station. The table at which the operator works is equipped with a sending key, double-pole switch for sending or receiving connections, a syntonizer or tuning apparatus for adjusting the wavelength, and the de Forest electrolytic receiver. The latter operates two head telephone receivers through a local battery circuit. With the de Forest forty-five words a minute have been handled; atmospheric disturbances are said to be far less troublesome than with the coherer systems. Something beyond an ordinary thunderstorm is required to shut down the South Boston station.

From the condenser room the 25,000-volts circuit passes upwards through the ceiling to a pair of porcelain bushings extending through the ceiling. The wires then pass through the bushings to two high-tension insulators mounted on the roof, whence they are carried to the 15 antenna steel wires arranged in east and south fans supported by the mast. The mast is 208 ft. high, set in a concrete foundation and guyed by 16 cables, in each of which is at least one strain insulator. The mast was built in sections of four upright pieces each and the uprights and spacing pieces are strongly bolted together into a single substantial pole section at each point of junction. A horizontal spar, used in spacing the antenna wires, is attached to the top of the pole. It is 50 ft. long over-all. The receiving circuit is composed of steel antenna wires which are all brought together at an insulating bushing in the roof over the operating room, whence they pass to the instruments upon the table. Three men constitute the operating force, and the shifts are 8 hours in length each.

"The South Boston station has often communicated with Portland, Me., and it is expected at an early date regular commercial service will be inaugurated between Boston and New York. Messages are constantly being received from the captains of steamers passing along the New England coast and from passengers traveling upon these boats. An interesting example of the value of the service given by the company was furnished by the President's Yacht, Mayflower, when it was conveying the Russion peace envoys from Oyster Bay to Portsmouth, where "T. R." awaited them. The Government wireless operator on board this vessel was, at one time, unable to establish communication with any of the Government's own stations, and he accordingly requested the de Forest station at New Haven to handle an important despatch for one of the plenipotentiaries. Needless to say the message was taken with quickness and accuracy."

Operator Dart of the Boston station initiated the habit, later somewhat common, of setting fire to the top of his 208 ft. wooden tower. Not that it was Dart's intention or fault in any sense. Those old "formica" antenna insulators when damp and subject to say 50,000 volts of high frequency sometimes made excellent conductors. This was before the porcelain manufacturers made link or suitable strain insulators, but in this instance the mast caught fire twelve feet below the top, through the crossing of the guy wire and one of the strands of the big fan antenna,

which burned through and draped itself about the pine timber. Boston Fire Company No. 7 having run 500 feet of hose was able to squirt water to 150 ft. altitude only! In course of time the mast broke off at a bolted joint. Dart courageously climbed up to that point with a fire-extinguisher on his back and finished the smouldering job. Within an hour the transmitter was in full operation.

There was no Federal Radio Commission in those brave days; no regulation whatsoever, save the unwritten code of courtesy among wireless operators (of the same system)!

Our men considered the victories of Peace more worthy than those of War. In other words - "Never mind the Navy; get yours through first". And if a good old Yankee wireless jammed a Marconi lime-juicer - that was just too bad. And how! Those were the days when it became conclusively proven that a coherer and tape recorder, or e'en a Marconi magnetic-detector, were simply not in it when it came to reading thru interference, or static-compared to an electrolytic detector, a pair of headphones, and a quick-witted Yankee op.

Against such a combination "Sparks" was simply outclassed. And yet it required a long, long struggle before the Marconi company learned its lesson and fell for the crystal and phone combination of their American rivals.

And long before the big-wigs of London had capitulated many a limey Sparks was concealing about his person a small chunk of "coal," as the Dunwoodie carborundum was later called. Through these months the very air was electrically charged, literally and figuratively. The communications achieved with out equipment repeatedly thrilled the natives and the Navy. A 1905 N. Y. Herald Headline read "Wireless Work Astonishes Navy. Records made on sending Christmas Greeting much Better Than Had Been Expected. Florida Gets Maine's Reply. Guantanamo Talks with Washington, a Feat Regarded Heretofore as Impossible." A few weeks later Colon repeated this feat extending the new record to 2150 miles, astounding the newspapers once more.

Those early Navy operators deserve utmost credit for the progress American wireless was now achieving. To mention just a few - Scanlan, still with Capt. Hooper in "Communications" at Washington. Watts, Sirback, of the record-breaking gang at Key West. Marriotti, Eaton, Geagan, Martin, Cameron at the Washington Navy Yard; and pre-eminent at the Brooklyn Navy Yard was always good old George Davis, who stuck to his wireless work up through United Fruit, Tropical Wireless, and finally became a vice president of the R.C.A., Bless his memory!

The Ship's Wireless Newspaper then put in its first appearance; the Cunard Daily Bulletin, printed 98 per cent in London; The Atlantic Daily News on the Hamburg-American Line. We published the "Airogram".

But all naval men were not agreed as to the value of this wireless. To quote from the Boston Advertiser of January 18, 1908: "Naval men are growing more and more skeptical as to the value of the wireless system to the Department, unless the government can make of it a government monoply. Under the existing circumstances it is coming to be regarded as a farce. It is little more, at best, than an amusing plaything, and one which cost a pretty penny, to no good or useful end." Under what present cocked hats are the heads which once voiced that interesting opinion?

And here is another quotation of that period, from the Chicago Tribune, interesting indeed today when almost every city has its police radio-station and radio-equipped cars!

WIRELESS MESSAGE
SENT TO A MAN
IN AUTOMOBILE

DeForest Company's Experiment in Michigan Ave.
Is Successful; Will Try Moving
Machine Next

"An automobile equipped with a brass pole, from which dangled two wires, drew up in Michigan avenue yesterday afternoon, and at four o'clock received the following wireless telegraph message:

"William H. Oker, Automobile : How do you like your first wireless ride? The fire department, steamships, and railways ought to adopt the same method of communication!

"The message had been sent from the de Forest wireless telegraph office in the Railway Exchange Building.

"Later in the week experiments will be tried in receiving from an automobile running at full speed. 'All that is necessary for the success of this experiment," said Mr. White, 'is that a wire be trailed upon the ground. Hereafter, we hope it will be possible for business men, even while automobiling, to be kept in constant touch with LaSalle Street.'"

Realize that this first application of radio to an automobile occurred 29 years ago! The trailing ground lead was then deemed as indispensable, as was at first the trailing antenna in aviation communication. And today the trailing ground behind a rushing cop's car might prove a useful purpose at that!

But returning to navy wireless operators and operations, nothing in the early history of American wireless gave to that new development such an impetus as did the success of the first wireless installation on a U. S. cruiser, the old (then new) West Virginia.

President Theodore Roosevelt chose that fine speedy vessel for his trip north from the Gulf in October, 1905. And were our boys proud that the Bureau of Equipment had selected our wireless instruments for that job? The President boarded the cruiser at New Orleans, and northern stations began almost immediately to copy her message to the accompanying cruisers, the Maryland, Colorado and Pennsylvania.

Operator P. S. Geagan at Washington Navy Yard copied the first night out as follows. "West Virginia in good communication with Jupiter Inlet. Savannah and St. Augustine have heard no messages, but West Virginia requests Savannah to listen closely for them as they may have messages anytime. West Virginia also requests weather report from Savannah." As soon as the West Virginia got in touch with Key West the first message to be transmitted from Washington to the cruiser was a personal one from Mrs. Roosevelt to the President, congratulating him on his forty-seventh birthday.

All our stations along the coast now began to hear that sterling fine transmitter in the President's cruiser. It was extra good "copy" for all local newspapers. Said the N.Y. Sun:

"Cruiser West Virginia, at sea, via Savannah. October 28th. The weather is perfect, a moderate breeze blowing from northeast, and the sea smooth. The President is quartered in the Admiral's cabin and is enjoying the trip immensely. The ship is keeping up a uniform speed of 18 knots, and everything is running smoothly. This is the first time in the history of our navy when a squadron cruised in company at a speed of 18 knots and over.

"At 1:45 P.M. we picked up the Pennsylvania and Colorado off Key West and are now cruising in squadron. As we passed the warships each manned the rail and saluted the President's flag. It is the customary honor, and the President returned the salute from the Admiral's bridge. Tonight the President will dine with the wardroom officers, and according to the navy custom while at sea on Saturday night, will join in the toast, 'Sweethearts and Wives.'

"Cleveland, Ohio, Also Got the Cruiser

"General Manager Galbraith of the de Forest Wireless Company said yesterday that the wireless station at Cleveland, Ohio had advised him that they were in 'perfect communication' on Friday night with Savannah, Key West, St. Augustine, and the armored cruiser West Virginia in the Gulf of Mexico. Lee de Forest, vice president of the company, said that in cooperation with the Navy the company was making elaborate preparations to keep the West Virginia in touch with the shore throughout her trip. 'We have stations at New Orleans, Southwest Pass, Key West, Savannah, Cape Hatteras, Washington and Atlantic City, and the West Virginia is equipped with the apparatus. No possible precautions have been neglected to keep President Roosevelt in complete touch with the outside world. In this matter the Navy is, of course, cooperating with us, and the naval stations at Pensacola and St. Augustine will also aid in keeping communication with the West Virginia perfect throughout her trip.'

"The Governor of Ohio will make an effort tonight to communicate directly with the West Virginia, and if he cannot do so he will utilize the wireless station at Havana as a central and thus have a talk with the President."

And not only did the coast stations copy the West Virginia on that history making trip. Fort Leavenworth, where Major (later General) Geo. O. Squier and Capt. Wm. Mitchell were experimenting with novel receiving circuits, with kite aerial, copied copiously. Cleveland of course, was right on the job sending the receiving from the cruiser. Governor Herrick sent this to Roosevelt: "On behalf of the people of Ohio I send you greetings and sincerest congratulations on your escape from injury in steamship accident and hopefer your safe return. This is by American de Forest Wireless Telegraph." One of the early messages which I prize most highly reads: "Received at Nottingham, Ohio, October 29, 1905. Battleship West Virginia off Florida East Coast, to Governor Mytron T. Herrick: Hearty Thanks. I warmly reciprocate your good wishes. Theodore Roosevelt." Written in flowing hand of "Bu." - Bucher.

The N. Y. Times reads: "President's Wireless Test - In Constant Communication With Land Throughout His Voyage. Washington November First - President Roosevelt took great interest, during his voyage around from New Orleans to Norfolk in the workings of the wireless system of telegraphy. He sent numerous messages to Mrs. Roosevelt, to members of the Cabinet, and to various friends, and was fortunate enough to receive messages also from the White House.

And the N. Y. Herald added this bit of local color:

"Says New York Herald Wireless."

"The wireless operator on the roof of the tall building at No. 42 Broadway yesterday morning with nothing to do. Presently he said he heard a faint ticking and listened intently.

"'Hum!' he said after a few moments, 'It's the operator on the cruiser West Virginia talking to Savannah. We couldn't hear that if it weren't the quietest and the dryest kind of night.'

"The cruiser West Virginia, which is bringing the President North, was in the Gulf of Mexico at the time. Shortly afterward a message came from the wireless operator at Cleveland saying that he also had heard the West Virginia 'talking'.

"An extra operator has been sent to reinforce the regular navy man, and extra men have been sent to the de Forest stations along the coast.

"Dr. de Forest says that the President's vessel will never be so far out at sea that it will not be in easy communication with at least one of these stations. The only thing likely to destroy the connection is a heavy electrical storm, and then the disconnection would be only temporary."

At the finish of that historic first Presidential proof of wireless efficiency, Roosevelt's private Secretary Loeb, speaking of the unusual test that was made of the system said: "There was in fact, no time, from the start to our arrival in Hampton Roads, that the President was not in communication with the mainland. We had no difficulty whatever in picking up a station almost anywhere. The President sent several official messages to the various stations complementing them on the work that was done, and learned to rely on the correctness and promptness of wireless communication very much as we would in land telegraphy. The President was greatly interested, and studied the sending and receiving of messages carefully."

There is no doubt that the remarkable demonstrations of the efficiency and reliability of American wireless on this Rooseveltian cruise on the West Virginia definitely committed our navy to a fixed program of development of the new art which has ever since kept her foremost in the field of military communications.

Very much of the credit for the success of that demonstation is attributable to our fine civilian operator put on board the West Virginia for the voyage north from New Orleans, A. W. Dorchester. He trained the Navy operators day and night, and was tireless and sleepless in his determination to make the wireless on board worthy of the distinguished passenger who took so keen an interest in its every phase.

Here's a bit of ancient wireless history interesting to those readers who man the ships sailing to the Gulf ports.

It's taken from a Mobile paper, of Dec. 22, 1905.

"First Aerograms have been exchanged between Steamship St. George" enroute to Mobile and the Mobile office of the de Forest Wireless Telegraph Co. in the City Bank Bldg., when the new Mobile-Havana liner was located 152 miles off Ft. Morgan. Mr. Pillichody of the Tugboat Association, who is said not to have any faith in the Wireless System, had the operator of the Tugboat Association up all night at Fort Morgan, for the purpose of being the first if possible to report the approach of the Steamer. But while the Prince George was 35 miles off the

light, which is just off Fort Morgan, at 6:45 A.M. and still out of sight of the fort, the de Forest office here received the following wireless message: 'Steamship St. George at Sea. Dec. 22, 1905.

"'To Mobile, Ala.

"'Just stay there five minutes, will have business. Will dock about noon. We are 35 miles from light. Where are you located. Do you know how the Fitzsimmons - O'Brien fight came out? Captain says will be there 10 A.M. thinks.
(Signed) Heilig, Operator'"

Then this, from the Mallory Liner, San Jacinto:

Kniskern, Mobile:

Yes, hear you, but faint, change your tune. Nothing of S.S. St. George. Don't know her call.
(Signed) Conklin, Operator.
75 miles off Southwest Pass. L.A.

Then this one from New York (either 42 Broadway or D.F.) Kniskern, Mobile:

Prince George left New York Dec. 16th. Arrives Mobile sometime Friday or Saturday morning. His call is Cu.
(Signed) Herndon.

"The Prince George has been expected in Mobile since early yesterday but has not been sighted from this city yet. The de Forest operator remained at his instrument through the night in order to locate and get a report from the vessel, and the Fort Morgan operator of the private line between Mobile and the fort also remained on duty all night."

(As was to be expected, and despite the regrettable skepticism of Mr. Pillichody, the wireless beat the Wig-wag and telescope!) "Although the de Forest office here kept track of the Prince George from the time she left New York on the 16th inst. it did not locate and get word from her until early this morning. Each vessel equipped with wireless apparatus has a schedule and a call. The Prince George will arrange a schedule upon her arrival here. In view of the fact that a wireless operator receives messages from the ticker like a telephone girl receives calls for numbers a reporter asked Mr. Kniskern if he did not have to keep the instrument over his ears all the time on duty, and was consequently put to more trouble than the ordinary telegraph operator? He replied in the negative, giving his reason that the wireless offices on land have schedules with vessels having wireless apparatus and knew where they ought to be at certain times. When a wireless message is sent there

is a noisy flash from the instrument." Nevertheless, and notwithstanding operator Kniskern's optimism, the enthusiastic operators of those days grew callouses and became flat-eared from uninterrupted application of "the cans", (thereby frequently benefitting in appearance.)

At Christmas, 1905, dear old Admiral Manney of the Navy, who personally had taken an extraordinary interest in the early progress of Wireless, had resolved on a grandiose experiment, and it was splendidly carried out. His idea was to get in touch with all stations south and north from Washington as the radiating point, (Arlington was not yet built) - to broadcast Christmas greetings from the Navy and to receive responses from all stations possible, in the shortest possible time.

Portsmouth, N.H. was the first heard from, then came Boston, then Newport, next New Orleans, then St. Augustine, Beaufort, N.C., then Jupitor Inlet.

"Nearby stations, such as New York, Atlantic City, Hampton Rhodes, etc., were easy, and the messages came back all right about midnight." The record on that occasion was with Guantanamo: "Manney, Washington, Christmas Greeting - Rodgers."

This message gladdened my heart at least as much as Admiral Manney's; for I knew something of the awful Hell those brave operators, both civilian and navy, had undergone for twelve months down there in the stifling, stinking mangoe swamps, not at all aided or cheered by "Limpy Rodgers", to enable him from his comfortable old Cheesebox, "Amphritite," to flash his Xmas greetings to the Capital.

The newspaper clipping finishes:

"Admiral Manney thinks getting messages across the Atlantic not impossible in the future."

And just to fortify him in his prophecy, on Jan. 3, 1906 "D.F." at Manhattan Beach sent the first 2150 mile message to Curtis, or Dorchester, Civilian Operators at the newly completed Navy Station of Colon; almost the distance to the west coast of Ireland.

But not alone with the Navy did the idea of these fond Christmas greetings broadcast by Wireless originate. The St. Louis "Post-Dispatch" arranged with our 25 KW East St. Louis station to send out to all these listening early Christmas morning: "Peace on Earth, Good will towards Men."

The Archbishop of St. Louis, Most Rev. John J. Glennon, and the Rt. Rev. Daniel S. Tuttle, Bishop Episcopal Church Diocese of Missouri, were among its notable sponsors. The poetically-minded reporter of the Post-Dispatch waxed most eloquent over a full page of the Sunday Edition, richly and imaginatively illustrated.

"A World-Wide Christmas Greeting." "It is a message that will be sent forth in song from thousands of temples throughout the world. But from nowhere else over all the broad earth will it spring forth to be gathered in other lands from the very air, even as it was in the star-lit watches of the morning in Judea, 1900 years ago. It is to be sent out on the suggestion of the Sunday Post Dispatch from the de Forest Wireless telegraphy station in East St.Louis at sunrise Christmas morning.

"Peace on Earth, Good Will towards Men."

"A feeling almost of awe may well encompass the operator who puts on the wings of the ether on the birthday of the Christ that message which was given forth by the angel host. With no irreverent hand will he touch the key that sets that message in motion. He will be performing a miracle of modern science, doing a thing never done before, actually, intelligibly filling the air with the song of Christmastide.

"From his hands it will spread filling all the terrestrial atmosphere and will find its way almost instantaneously to the uttermost corners of the earth, to the islands of the sea, to and through the ships on the sea, over mountains, valleys, plains into the frozen north, through the tropics and across the equator, out on the western ocean, back over to the Judean land from whence it sprang at the dawn of Christendom;" And so on and on! [Unlimited faith in the potency and coverage of our East St. Louis station this imaginative writer possessed, verily. And yet it is to me, looking back over all the busy years of radio progress since this was written, noteworthy to find here, so feelingly expressed, the wondering and poetic appreciation of what has, long since he wrote, been actually accomplished by the Radio Broadcast, there foreshadowed.]

"The message that goes out from his little isolated temple of Science, by the East St. Louis tower, will itself spread and radiate and permeate the whole atmosphere, a paean of peace and praise and good-will sung by an invisible aerial host. It will absolutely and actually be a greeting to the furthest corners of the Earth."

It is a pity that now-a-days, because this "miracle of science" has become so trite and commonplace, scarcely a thought is given to the mystery and to the spiritual significance of the marvelous medium, with which we toil and earn our daily bread.

And that is the sad feature of science; that its wonder and its philosophical meanings are so quickly submerged in the dire tangles of an intricate technique, lost to our dulled perception.

The last of the five big Navy Wireless Stations which I had designed, that at San Juan, Porto Rico, was now also in commission. From his long siege at Pensacola, quarantined by the yellow fever scare, G. S. Iredell had been transferred, as a fitting reward, to complete and open that larger station.

On Nov. 18th, 1905 he copied the first complete wireless message ever received in Porto Rico from the mainland, altho during the three weeks following his transfer fragmentary messages had been heard from Brooklyn, Savannah, Pensacola, and Guantanamo. This one was addressed to the "The Eagle" - leading newspaper at Ponce.

"Key West, via San Juan. There were no new cases of yellow fever in Havana yesterday. There now remain under treatment five cases of yellow fever altogether. There are many suspects however, because physicians are reporting their dengue patients as suspicious."

"WE ARE CERTAINLY PROGRESSING." "FIRST WIRELESS FROM MAINLAND" - are the startling headlines with which "The Eagle" plumed itself, on that momentous occasion. Shortly after the New Year Iredell had the P.R. transmitter in successful operation with her four big sister stations of the Navy chain, and ready for the long-delayed Official Acceptance tests.-

Popular interest not only in Wireless but in electrical matters generally had now risen to such a level that for the first time in history Electrical Expositions were to be held, the first one at the old Madison Square Garden in New York. Our first "Wireless Booth", primitive precursor of all the gigantic Radio Expositions of World Fairs of today, seemed to attract more interest there than any other exhibit.

An electric automobile equipped for wireless transmitting and receiving was displayed. A "wireless Bulletin Service", posting news items and happenings aboard the various steamships equipped with de Forest wireless were continuously posted. As a "historic exhibit" even at that early date, we

displayed one of the weather-beaten sets which had earned such honors for wireless by its record-making presswork for the London-New York Times in reporting the Russo-Japanese war off Port Arthur, and brought home at last by Operators Brown and Athearn.

A complete new 1 kw. spark transmitter, gap unmuffled, drew mobs of gapers with its deafening staccato rattle. Rapidly New Yorkers became wireless-minded.

And then during the month following, on January 15th, 1906 to be exact, Chicago opened her first Electrical Exposition, at the Coliseum.

"THOUSANDS HEAR PRESIDENT'S WIRELESS MESSAGE OPENING BIG ELECTRICAL SHOW: 'To the Chicago Electrical Show: Congratulations and best wishes. Theodore Roosevelt.'

"Thousands of persons breathlessly silent on the floor of the Coliseum last night heard this message from President Theodore Roosevelt read from a balcony.

"Instantly the electric currents were turned on. Thousands of incandescent lights flashed, electric bells rang, electric whistles blew, and the band played the Star Spangled Banner, all marking the formal opening of the first Electrical show to be held in Chicago.

"The message was received by de Forest wireless telegraph. Every click of the big receiving machine made a marked impression upon the hundreds of persons crowded around the booth. (Evidently our operator "relayed" it through his spark-gap, as received by 'phone from the West Chicago wireless station.)

Looked Upon As Miracle

"The silence awaiting the coming of the aerogram was such as would attend the performance of a miracle.

"The aerogram reached the receiving station in the Coliseum at four mintes past 8 o'clock. It was copied on a typewriter and handed to Earnest Rietz, a messenger boy. True to tradition the little fellow was rather late in reaching his destination, although the crowded aisles were sufficient excuse. He reached the band balcony at 8:16. A bugle announced his arrival(!)

"Then followed the opening of the Show."

And now, nearly thirty years afterwards, another President Roosevelt in Washington speaks into a microphone; and not his telegram but his voice is heard, not by a few

thousands in the Chicago Coliseum, but by as many millions in their homes scattered over the broad face of the North American continent.

In 1904 the United States Signal Corps erected stations at Nome and St. Michaels on opposite sides of Norton Sound, Bering Sea, thereby connecting Nome with the long signal corps telegraph line which ended at St. Michaels.

These pioneer Army stations in the far North were a source of great satisfaction not only to the Signal Corps but to the American de Forest engineers who designed and constructed that apparatus. Capt. Wildman, U.S.A. had been put in charge of this entire job, and I venture to say that no wireless equipment was ever subjected to more rigorous severe, and uncompromising inspection and test than that Capt Wildman supervised. The apparatus was first assembled and tested out for many months between Fts. Wadsworth and Hancock, N.Y. before it was finally accepted for shipment to Alaska. Two Signal Corps operators were thoroughly trained and then entrusted with the tough job of installing and operating in Nome and St. Michaels. There for the first time it was found necessary to use a counterpose, of chicken netting, fastened on stakes above the frozen tundra; for actual conducting "ground" lay perhaps 75 feet beneath this perceptually frozen and non-conducting layer. Capt. Wildman whose wireless enthusiasm led him to immolate himself at Nome through the long dark winter, personally supervised this work.

Operator Seergant Applegate was his mainstay. So well were these first Alaska wireless stations manned and operated, so thoroughly had Capt. Wildman foreseen every possible contingency and provided every manner of replacement, that the service was maintained uninterruptedly for 18 months after its first initiation. Then occurred a brief suspension, sufficient to make all the white population of Alaska beyond the reach of the St. Michaels-Seattle cable realize how completely dependent they had become, for contact with the outside world, upon this still new miracle, "the wireless".

In the Spring of 1905 the American de Forest Wireless Telegraph Company established an office in the old Palace Hotel in San Francisco. For a transmitter, the old 60-cycle straight sap equipment was employed. The call of the station was "PH", after the Palace Hotel.

In 1906 the Navy erected its first Pacific Coast radio station on the Farallon Islands, and soon afterward built others at Mare Island, Yerba Buena, North Head, Tatoosh, and Bremerton. These were equipped with the then well known Massie Wireless Telegraph Company's apparatus. As there were

no radio laws in those days, the owner of a commercial station would choose a call of his own liking. It would invariably be a two-letter call, because at that time there were plenty of them to go around. Mare Island's call was TG, Yerba Buena's TI, and Farallon Islands TH. About this time the U.S.S. Chicago, equipped with similar apparatus, steamed out to sea for the purpose of conducting tests with the established government stations. This was the first Pacific Coast vessel to be equipped with radio.

During the great fire of 1906, both the "De Forest" and the "Pacific" companies' San Francisco stations were destroyed. The "Pacific" started immediately to rebuild, and the "De Forest" reincorporated under name of the Occidental and Oriental Wireless Company. The latter obtained a new station site on Russian Hill, San Francisco, on a lot owned by the School Department. Upon completion this station was sold to the then newly organized United Wireless Telegraph Company, which operated it for some time under the original call, PH. The station was subsequently moved to Hillcrest, Daly City, and from there, after the Marconi Company took over the interests of the company, to its present location at Bolinas, Cal., where it is now known as KPH and is owned by the Radio Corporation of America. Needless to say, there is no part of the original equipment at the present location, only the call letters. Timothy Furlong acted as first operator for both the Palace Hotel station and the United station on Russian Hill. J. O. Watkins relieved Mr. Furlong when he was assigned to the Standard Oil barge No. 3. Barge No. 3 was the first commercial vessel to be equipped on the coast. L. Malarin, until recently Pacific Coast sales manager for the Radio Corporation of America, was one of the early operators at the Russian Hill station.

Althe the earthquake and fire put old "P.H." on the Palace Hotel out of business before it could be of service during that frightful cataclysm, our station at San Diego arose to the occation, to first notify the U.S. warvessels in Pacific waters of what tragedy was transpiring at San Francisco. Witness this appreciative letter from Rear Admiral Goodrich:

United States Pacific Squadron, Flagship Chicago
San Francisco, Calif.

May 2, 1906

J. A. Stillman,
Am. De Forest Wireless Telegraph Co.
San Diego, Calif.

Dear Sir:

There is no doubt in the world that the promptness with which I was able to hear the news while at sea on the 18th of April of the disaster at San Francisco was due to the existence and activity of the wireless stations of which you are in charge.

I shall take pleasure in mentioning this circumstance in my report on the affair to the Navy Department.

Yours very truly,

C. F. Goodrich,
Rear Admiral U.S.N.
Commander in Chief,
Pacific Squadron

And while on this theme of pioneer wireless on the Pacific Coast I may as well jump ahead one year, to cite an additional interesting episode encounted by Bernard Linden, now Supervisor of Sixth U.S. Radio District, regarding a radio pioneer operator who first came to me for a job back in the days of the little glass penthouse wireless station on top of 17 State St., New York.

In February 1907, A.A. Isbell, one of my very first and trusted operators at 17 State St., New York, until a year or two ago Pacific Coast division manager of the Radio Corporation of America, a position now held by G. Harold Porter, equipped the then new steamship President, now named Dorothy Alexander, at Camden, N.J., with a three KW Massie set, in the receiver of which was used a Fessenden electrolytic detector. The transmitter was of the open spark-gap type with a conductively coupled antenna working on a wave-length of 900 meters. (The wave-length and power to be employed by a station in those pre-law days were optional with the owner of the station.) Mr. Isbell arrived on this vessel at San Francisco 49 days later, coming via the Straits of Magellan. This vessel was the first one of the merchant marine in the Pacific to have radio and Mr. Isbell was the first commercial marine radio operator. This vessel and the same operator had a similar honors in the same year

when the vessel entered the Bering Sea enroute to Nome. The station made some extraordinary records for those days. After leaving the Delaware Capes it kept in touch with the Brooklyn Navy Yard station for 2,000 miles; picked up the naval radio station at Point Loma when 1,000 miles south of that point, and when going to Nome constant communication was maintained with the naval radio station at North Head until the vessel passed through Unimak Pass. Quite naturally these achievements attracted a great deal of attention and much publicity was rightfully received. Incidentally, Bernard Linden was himself an operator on the S.S. President in the early days of radio.

But the most interesting commercial working of wireless on the Pacific Coast, prior to the later installations of the Federal Wireless Telegraph Company were through the stations already mentioned, at Catalina Island and on the mainland at San Pedro, covering a distance of some 22 miles. These two were a success from the start and, by enabling the publication of a daily newspaper in the village of Avalon, aroused more wide-spread interest in the future value of wireless for commercial ends than could a score of shore-to-ship stations.

The sustained success of this enterprise was, I believe, chiefly due to the enthusiasm and skill of our first Los Angeles operator, H. L. Bleakley, whose uncanny swiftness at the key, Robert Marriot had described to me in Denver in 1905, where I first met Bleakley in a crude shack at the base of that tall smelter chimney.

For further interesting details of later operations along the Pacific Coast I shall return in a subsequent chapter of my narrative.

During the year 1905 the success of our American wireless had become so well authenticated abroad - what with the 1904 work in the China Sea for the London Times, the earlier demonstrations for the G.P.O. across the Irish Channel, Holyhead to Howth, and now the increasing number of vessels reaching England equipped with the yankee apparatus - that a group of London financiers headed by Lord Armstrong was persuaded to attempt to introduce the system directly into Great Brittain.

Accordingly "Mac" Horton as chief operator, Harry Brown as his assistant and George Barbour, as erecting engineer, were exported, and domiciled in dreary London.

This situation appealed strongly to me as affording a possible opportunity for trying out the long-distance capabilities of 50 KW D.F. at Manhattan Beach. Consequently a nightly transmitting schedule covering some weeks in advance was mapped out, and intrusted for faithful fulfillment to the hands of "Driver" Harris. Then I set sail in February 1906 on the old "Lucania", once more for London.

It was decided at the last moment not to carry the Audion receiver with me, but to leave this with Babcock at 42 Broadway, for further research and possible improvement. I had abundant reason later on to regret this decision.

I arrived in London later in February. Horton was on hand to take me up to Oxford and Cambridge, not for a degree, but to inspect the first Yankee wireless telegraph stations on England's soil. We recalled vividly the tough times we had had together in the chill fall of 1903 at Holyhead, Wales, and in Howth, Dublin, when we first showed the Britishers a better way of sending dots and dashes than the old pump-handle key, and hammer interrupter-coil, and how to receive by ear instead of by eye, faith, and profanity. So now these new stations, already manned by his hand-picked and trained "limeys" resembled exactly those on our Atlantic seaboard, with alternating current transformers, American Morse key in primary, and with electrolytic detectors with head phone connected to the three-coil slide tuners.

But now my thoughts were not on England but the southwest coast of Ireland, the land nearest America, and where it was reasonable to expect reliable kite winds through all of the spring season. For some months prior to this trip I had been watching Prof. Alexander Graham Bell's interesting developments of his tetrahedral cell kite, down near what is now Langley Field in Washington. Heavy kites they were, tailless, but possessing astonishing stability and great lifting power. It had been then suggested that to use these Bell kites for holding aloft a long antenna wire might enable the receipt of wireless signals over great distances, through reasonable periods of schedule. Using "Blue Hill" kites Col. Squier at Ft. Leavenworth, Kansas, had been highly successful recently in pulling down our messages from the cruiser "West Virginia" during President Roosevelt's famous trip up the Atlantic coast. And Prof. Bell's kites should prove even better for this purpose.

I had therefore obtained from Col. Squier, who was ever eager to aid in any new experiment in wireless, a quantity of very strong light and flexible cable of tin coated steel, stranded about a small hemp core, which the Signal Corps had developed particularly for the purpose of a kite antenna.

I had also become well acquainted with Dr. Bell's kite expert, "Old Man McNeil," as we all called him. A fine rough specimen, he; Cape Breton Schotchman, with a clear and kindly eye, a tender heart, especially for those little spruce-lined silk-covered tetrahedral cells, which he only knew how to construct, cover and then tie together in light masses, and which could be built up as large as a house, if one desired a man-lifter. Surely with such a combination Squier's cable, Bell's tetrahedrals, and Old McNeil to construct and fly the kites it should be possible now to go to the S.W. tip of Ireland and expect to pull down some interesting signals from 50 kw. D.F. at Manhattan Beach. Consequently arrangement had been completed to borrow from Prof. Bell a crate full of cells, and McNeill, for a two months leave.

So now in London Horton and I assembled quietly a quantity of portable storage batteries, my new tuning coils, electrolytic detectors, plus a small hydrogen gas balloon and a zinc-acid gas generator (just in case the winds might fail us.) And with McNeil and his kites the caravan started for Glengarriff beside the Blue Bay of Bantry, Ireland. The time schedules set were early evening in New York, but well after midnight in Ireland. We found amid rough open farm fields by the Bay of Bantry a suitable small stone dwelling, abandoned but snug, with smooth white walls within. Late each afternoon Mac and I would go out in an Irish jaunting car to our flying field, and, if the rain would let up and the wind would spring up, we would, with McNeil's advice and help, struggle to get aloft the 5-foot-on-a-side tetrahedral kite, which usually he had that morning assembled from the battered wreck of the night before.

Those were dreary, tedious days before we at last found the combination we prayed for, no rain and a fair, steady wind. We had already been forced to try out the 5 ft. diameter hydrogen balloon, and after futile efforts had found its buoyancy quite below specifications and, leaky as it proved, quite inadequate to hold up even a hundred feet of our antenna cable. But occasionally we would get the kite aloft near sun-down, return to our hotel, to read deeply in Hume's "History of England" after dinner until 1 A.M., then again, if it was not raining, climb into our chilly jaunting car and poke along behind Patrick to the dark schoolmaster's house on the hill.

And there all too usually, an anxious pull on the kite string in the darkness would spell the disheartening news that the fickle wind had proven untrue, that the wire lay along the clods, that McNeils pride could be found next daylight wrecked among the stone-walls; and that faithful old Harris and his night op. at D.F. might at that moment be frantically signalling to Mars, but not to us!

But one night we came out with hopes high. The wind had kept a steady gale, the kite was tugging hard at its tether; we would certainly copy D.F. this night of our Lord! Mac Horton sharpened his pencils while I tuned for New York. Back and forth moved the three slide-tuners, backward and forward, in every possible permutation of combinations. The night was still, there was no static. I vowed to tune in New York or burst an ear drum. There was no interference, there was no static, there was no sound. It was too goddam still! Finally I went outside and pulled on the kite wire. Then I came back, and with his newly sharpened pencil Mac engraved on the wall:

"Four o'clock, April 1st, 1906.

At 2 A.M. the kite hit the grit; but the Doc was not wise, and tuned steadily for two hours."

If ever I revisit the emerald green glades of bonnie Glengarrif I intend to find again that little old stone hut of the Irish schoolmaster, to determine whether that historic entablature still immortalizes the unyielding optimism of two wireless pioneers!

And that final experience sufficed us for Glengarriff. Horton needs soon return to his English work. We could no longer flirt with th'inconstant wind. We would find a new spot nearer the bleak sea coast where winds from the broad reaches of the Atlantic could be depended on.

Gathering together the remnants of our personnel impedimenta, the four of us (Mrs. Horton was with us all this while) loaded on a two-horse dray, with Patrick to drive, set out over the highways to Cahermore, some thirty miles further west from Bantry.

We rode through Castletown where the best part of the British Channel Fleet lay anchored, 17 battleships and cruisers, with sundry destroyers. It was a great sight, that mighty armada of England, riding sheltered under the tall Martello-capped hills of Bear Island.

And on the road we dusted past some thousands of British tars, reeling back from the town from a pay-day, daylight debauch, all of them plastered, most of them drunk, many scarcely able to navigate. Jaunting cars designed for five held nine or ten stews, while other carts overflowed with jellied masses of doughty rumsoaked jackies. Red-eyed, Brittania ruled the cockeyed waves!

From Castletown we continued by a lonely, romantic road, over high and barren hills and by the steeps overlooking the Atlantic, ten miles to an isolated hamlet. It consisted

chiefly of a white-washed chapel and the long rambling string of stone houses constituting the domicile of "James Sullivan, Esq.," a typical good-hearted, gaelic-sputtering Irishman, who served in the double capacity of farmer and publican, and whose longitudinous building (once a coast-guards' station) afforded the only shelter for sojourners in all that region.

Hailing him I asked first if the wind blew much in this region. "Wind is it?" he blurted. "Sure we niver have even so much as a whisper of wind all th' year round. Today be the windiest day we see in many a month." Bitterly disappointed we prepared to drive on. Then Patrick explained to Sullivan, as one Irishman to another, that we were looking for a windy spot where we could fly our big kites all the time, day or night. "Ah, sure, it's wind ye be lookin' for," shouted Sullivan. "Lord bliss ye! we have nothin' but wind hereabouts all the time, be jezus! This day is the stillest day iver I've known hereabouts. Shure, an' it blows hard here, marnin', noon an' night, begorrah. Yez must stop over a while, an' I'll prove it to yez. Molly," calling out his buxom wife, "don't the wind blow hard here all the time, and yez can depend on't?"

We liked Molly's clean appearance. Furthermore we could understand her language, which we seldom could of Sullivan. Furthermore she had lived in Connecticut and could cook Yankee style.

So we voted to accept Sullivan's latter version of existing meteorological conditions thereabouts, and forthwith unlimbered our cramped limbs.

"We have the eastern extremity of his homestead all to ourselves. Below stairs is a stone-floored room where the kite reels and the wireless instruments are installed, and a small chamber which serves as parlor and dining saloon. It is quite comfortable. The great fire smokes like a ham house, but we have brought our own oil stove (for we travelled with utensils in wagons very like a gypsy caravan) and this warms us nicely through the long hours of our vigils. Above are two bedrooms with flees! The Hortons have one and "Old Man McNeil" and I occupy the other. Mrs. Sullivan, thanks to her ten years' residence in dear America, knows how to cook to the Republic's taste, and nowhere since I left New York have I enjoyed such meals.

"This is a wild open and deserted country. Back of us rise tall and barren dun hillsides checkered with numerous and straggling walls of stone or turf; here a pasture feeding a few sheep, there desolate stretches of crozier bracken or heather covered moors.

"From the edge of the sea rise black and ragged cliffs broken by sudden fjords and knife-like promontories where the green waters are forever roaring in white foam and have, in the ages past, cut frightful chasms and tunnelled yawning caverns, breathing out terror and mystery as the sullen waves flow in and out. The inhabitants tell with bated breath of one cave in particular, never yet explored, a narrow, sea-choked ending in some black vault of unknown vastness, the home of seals and great conger eels, and into whose fateful maw wreckage of inestimable value has for centuries been floating, and out of which not one task or test has ever been emerged.

"To enter and explore this black sea cellar of mystery is now, next to wireless aims, my consuming ambition - relic of those boyhood days of adventure when we two brothers burned with desire to discover some vast cavern among the red clay ditches of Alabama! And finally I did manage to explore this mysterious cavern, stripped to the skin and on board a long plank raft which McNeil and O'Sullivan in his skiff pushed with me on a deep into the entrance, whence I managed to make a right angle turn into another frightening cavern tunnel. I had not gone far into this before my little raft was upset and I fell into the cold black water. O'Sullivan was deeply concerned. "Kape cool, Doctor, kape cool," he yelled. Through chattering teeth I told him that I would "dam well keep cool," and climbed out and clambered into the skiff. That was the end of that expedition."

McNeil began forthwith to assemble all that was left of his tetrahedral kite cells into 2-1/2 kites. Our old stand-by which had staunchly withstood all of the crack-ups of Glengarriff, and which he had affectionately named "Mabie the Third", after Horton's wife, was still with us, although somewhat weather-worn and battered.

But now ensued uninterrupted bad luck. Either the first of O'Sullivan's statements regarding no wind, or his corrected version "strong winds all day and night" proved undeviatingly correct. Long calms were succeeded by lashing gales, usually with heavy rains. So that, morning after morning, we would find our kites torn to bits; and then McNeil would patiently cut out the broken cells and sew these together into a new kite. Thus it happened that he was the only member of our party who was kept busy during these last trying days at Cashermore, Ireland.

After a week of this inactivity and maddening delays, without one fair chance to get our antenna aloft and tune in for D.F., Horton was summoned back to London, leaving McNeil and me alone to battle on.

Then one night, April 11, 1906, just about a week after Mac and Mable had left us, we got the winds we were waiting for - steady and strong, from off the wide Atlantic. With blustering aid from the very windy O'Sullivan we got out our last remaining kite at 2 A.M. and sent her aloft without mishap. She went up 3000 ft. and I tuned in while McNeil was slowly unreeling cable. Here is my last bulletin on that occasion:

"Thursday, April 11th.

Static bad at 1000 ft. and above. At 4 to 4:05 A.M. static quieted greatly, nearly 2000 ft. wire up - single wire (we had sometimes used two wires to tether the big kites in strong gales).

Heard N.Y. sending. Quite faint, but readable; stopped at 4:05. Tuning on C F.c. (pancake coil) quite close at 2 div's A p.c. at 5-1/2, 1 V.C. in Antenna - all in 180°). Did not hear N.Y. with this V.C. out cut.

LdeF"

Had Horton been able to remain one week longer he would undoubtedly have been able to copy that night the first wireless <u>messages</u> ever transmitted across the Atlantic; certainly the first from West to East. The speed of D.F.'s sending was far too fast for my fist to follow. But his style of sending was strictly American, his spark-frequency was characteristically much higher than that of the British ships, to say nothing of the splashy "plop--plop" of Poldu. And I got his sign-off. The test therefore, while I cursed my luck that Mac could not have stayed on another week to actually copy the stuff, was equally as confincing as was the succession of triple-dots which Marconi pulled in from a kite string four years before. (By the way, did you ever wonder why, on that historic occasion, the Poldu operator was never instructed to intersperse his--- with a few words of English in continental morse? Just in case Marconi <u>should</u> succeed in picking up the letter S, you understand. The copied words would have been so much more interesting and convincing, you know!)

But I, not foreseeing the long wind delays and Horton's too early departure, erred in the other direction - messages and press only, and at 25 or 30 words per minute - and no simple succession of dots at all.

However all that is long ago over the dam and washed up-- washed out by a thousand 20-watt oscillating tube ham sets, on both sides of the Atlantic - and the Pacific and Antarctic ocean as well, with audion detectors and amplifiers, the latter not even conceived until a half year later.

But strange to relate, although I had tried in every way to keep quiet the news of my mission with kites to Ireland, I was greeted upon my return with old McNeil to Castletown two days later, enroute to Cork and England, with the following gem from his Majesty's G.P.O. officialdom:

"General Post Office, London
April 10, 1906

Dear Sir:

I am directed by the Postmaster General to say that he is informed that experiments in connection with the receipt of wireless telegraphic signals transmitted across the Atlantic have recently been carried out by you in the neighborhood of Glengarriff by means of kites or balloons.

I am to enquire whether the Postmaster General's information is correct, and if so under what authority the experiments in question have been conducted. I am at the same time to point out that operations of this nature, if carried out without the Postmaster General's permission, constitute a misdemeanour under the Wireless Telegraphy Act 1904.

I am to ask you to be good enough to let the Postmaster General have an early reply.

I am, Sir,
Your obedient servant,
Wm. Ardron."

I couldn't suppress a chuckle, I think how narrowly our little band had escaped Scotland Yard, as I penned my reply:

"Castletown, Ire.
April 12, 1906

Hon. Post Master General,
London

Dear Sir:

Replying to an enquiry received from Mr. Ardron today I beg to state that inasmuch as the object of the Wireless Telegraphy Act is, as I understand it, to prevent undue interference between various wireless stations, and as I have used no transmitter whatever I do not understand how I have acted in violation of said act.

The object of my experiments with kites and balloons was two fold:

(1) To determine how far kites could be relied upon on these coasts to maintain an antenna.

(2) At what altitude a single wire must be placed to receive messages from a powerful station in New York.

The object of these experiments having been accomplished they are now discontinued. (sic)

While I may be wrong in my ideas of equity and law, it strikes me as strange, to say the least, that objection could be urged to such experiments as I have carried out, with receiving apparatus alone.

I cannot understand why work of such harmless nature. and of such scientific interest and value should not be encouraged instead of frowned upon or prohibited by the officials of England.

Very respectfully,
Lee de Forest"

Was it possible, or even conceivable, that the alarm expressed by the G.P.O. over my kite-flying wireless tests was even remotely connected with those of December 1901?

Or was it prompted by apprehension of a coming war between Great Britain and the United States? In any event I never knew, for I heard nothing further from Mr. Ardron of G.P.O.

The mail at Castletown contained also the very welcome news from New York that the U.S. Navy had at last and finally accepted all five of our high power stations, Key West, Pensacola, Colon, Guantanamo, and Porto Rico.

Fully mindful from my own observations and experiences of what my plucky construction operators had undergone to bring these five pioneer big stations to final acceptance, I took the opportunity offered by the slow tug-boat trip back from Castletown to indite the following letter to all those lads. Perhaps its reproduction, even after all these years, may serve to encourage some faraway radio operator who today may be struggling under great handicaps to carry on, in face of difficulties and discouragement. Or some employer of such fine operator or engineer, to show them that their efforts to establish new lines of communication are properly appreciated, even if improperly recompensed:

"London
April 20th, 1906

Messrs. Butler, Iredell and Curtis,
Dorchester

Dear Sirs:

Upon the occasion of the final acceptance by the U.S. Navy of the five large stations of which you have been in charge, I wish to extent to you, on behalf of myself and of the American De Forest Wireless Telegraph Company, congratutions, hearty and sincere, and to felicitate you all upon your safe return to God's country.

Too often is it the case that while the faults and blunders of men receive good and severe criticism, the merits of their work, the vitality of their services pass unacknowledged, even if fully appreciated by their employers. I trust that this may never be the policy of our Company.

Our President, and all the officials of this Corporation have watched with intense pride the heroic efforts you boys have made, the great patience through long months of discouragement and difficulties which have necessarily preceded this success for which all have generally striven. I myself deeply appreciate the nature of your labours, your trials, the hardships you have undergone, for it has been my good fortune to have been with some of you at your posts, and shared in while directing your work.

This work, these experiments, these long-drawn out tests, carried on in the face of unpleasant and manifold difficulties have, I believe not only achieved the wireless success intended, but have been the means of developing character, a determination to bear and achieve like good soldiers, have ripened a friendship and a loyalty to one another and to a worthy cause, which constitutes in life elements of even greater value than commercial success.

We do not, we cannot forget the obstacles you have had to face and which you have bravely overcome.

For tedious months away from home in foreign lands, in climates scorching and unhealthy, deprived of all usual comforts of life, tormented night and day by insect pests, distressed but not baffled by static unknown to any other wireless workers, delayed month after month by breakdowns of Navy apparatus, continually called upon to make repairs, often without proper tools, facing skeptical criticism, some of you surrounded by hostility, open or concealed on the part of officials from whom we had every reason to expect cooperation and interest - yet you have stuck to your posts, have triumphed over one difficulty after another, have forced new secrets from Nature, and having by your tenacity, patience and skill accomplished your ends, you have won at last an acknowledgement of the success of the system from the entire Naval Department, and set a new standard in the art of Wireless Telegraphy.

In view of your services in this unexampled undertaking, we wish to express, although in inadequate words, some portion of praise you so well deserve, and to express our confidence that this Navy work is but a beginning of the greater things we are yet to accomplish together in wireless.

Very sincerely yours,
Lee de Forest"

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And so I had left Glengarriff and Cahermore and the southwest tip of Ireland, to hurry back to London. Patent and other matters in America were too important for me longer to continue that losing battle with the elements. I felt that I had at least done as much to demonstrate the feasibility of trans-Atlantic wireless telegraphy from West to East as had Marconi four years previously.

And I enjoyed this rough outdoor life. It did me much good. We tramped the fields and scaled the cliffs and the hills and visited the old Martello Tower over on lofty "Black Ball". "There I have lain through a sunlit afternoon, my thoughts hovering above the blue waters as idly, as aimlessly as the wheeling gulls which find no abiding place. Near us is the green thatching, the grey rocks and the slate walls of the Martello Tower, beyond the brown of the nearer hills, still further the drab of another mountain, and behind that the faint purple of the uttermost veiled, indefinite clouds. These varicolored hills, the violet tones of the horizon beyond, form the petals of the blue rose of the world, the water world dropped from the sky."

* * * * * * * * * * * * *

McNeil and I journeyed towards London through Cork and Killarney.

I had enjoyed this rough, outdoor life. We tramped the fields and
led the cliffs and visited the old Martello Tower over on lofty "Black Ball".
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nds. These varicolored hills, the violet tones of the horizon beyond, form the
ls of the blue rose of the world, the water world dropped from the sky.

I climbed tonight to the topmost rock of the hig est hill, climbed in the all-
rbing silence of the deserted land, in the soul-hushing silence of the moon.
re, on a throne of stone, I rested on a black throne of my own shadow, for the
n had lowered filmy draperies over every dim and sea-lined horizon, and every breath
the sea had fallen to sleep in the arms of the silent night.

Thus it was in April, '06, I returned to London with a half-success, called back to America by a crisis in the patent situation not at all assuring. I briefly visited Edinborough and Liverpool. At Sterling Castle I had a delightful day with Alexander Graham Bell, strolling through the old ruins and meandering across the tourney fields at its base. I briefly outlined to Prof. Bell what I had accomplished thus far in the field of wireless, and particularly what McNeil and I had experienced with the Bell tetrahedral kites in Ireland. He purchased there and gave to me a beautiful briar pipe engraved with "Sterling", as a souvenir of the occasion and of our meeting there, a trophy which I have cherished for many years.

Before I had sailed for England I had left explicit instructions with Babcock and others that they were to have manufactured, and equip as fast as possible all receiving stations with the Audion detector, to be prepared in case the patent suit, which was then rapidly coming to a head, should result in an injunction which should embarrass our operations. Instead of doing this however (happily for me as it later proved), the Company's Directors at 42 Broadway decided to substitute the Dunwoody crystal detector, a rectifier, the discovery of General Dunwoody, former Chief Signal Corps Officer and now Vice-President of the De Forest Wireless. To my astonishment I now learned that White and Wilson held me personally responsible for the unpleasant situation brought about by the injunction, although I had been assured by our patent attorneys, Philip Farnsworth and others, that I could make the proposed trip with perfect safety, that no injunction would be entered, and that if it were they could take care of the situation with my Audion detector.

June 26, '06: "My old Sheff class of '96 met again at Yale for its Decennial. The reunion was all that could be desired. There was now after ten years far more of the real Yale spirit of fellowship and democracy among our boys than every existed in college days, or at any previous reunion. President Hadley addressed us as the 'Wireless Class', and I was 'put up' amid yells! In these ten years since that sad, joyous commencement of mine I have done what I could, although not all I had planned or hoped. It was sweet to feel the hearty handshakes, the frank words of appreciation and pride from classmates willing to honor me for what success I have achieved.

"July 2nd, another reunion at Hermon's 25th Anniversary; again with old Max Stires and many of the good souls of '93. How ancient seem the days when last I trudged the sandy road among these slender pines, climbed the flights of Crosley Hall, sat down to the homely fare in the Prep School dining hall! Never before, it seemed, had I realized the beauty of that panorama of hill and river, woodland and verdant farms stretching down the picturesque valley of the Connecticut. Many of the old faces again appeared, mostly of the old teachers whom I loved and who are now proud of me. Especially happy were Prof. Dickerson and I to meet once more."

And now during the Summer of 1906 I found to my indignation and dismay a very definite change in attitude toward myself and my contributions to the Company and the art of wireless on the part of White, Wilson and their stock selling parasites, including also Philip (Judas) Farnsworth, patent attorney for the Company. It appeared that in their reckless sale of stock (their own as well as the Company's) the scoundrelly promotors had actually oversold the stock remaining in the Company's treasury; that for some time previously the treasury was bankrupt and that following an old stock promotor's trick of that day, White and Wilson had connived to organize a new Corporation called United Wireless Telegraph Company, had conspired to transfer to it the assets of the American De Forest Wireless Telegraph Company, leaving all its debts in the empty shell of the old Company for the benefit of its creditors.

It was flamboyantly announced in the press and in paid advertisements (full page advertisements) that a consolidation had been or was actually in process of being effected with the American Marconi Company, a statement immediately branded by their officials as being one hundred per cent false.

When I learned of this situation I promptly resigned, offered to turn back into the treasury of the American De Forest Company all of my stock, amounting to some 20% of the entire capitalization, and in exchange demanded merely all rights to any pending Audion and Aerophone patents, $1,000 in cash and a general release and quit-claim. Saurian-eyed C. C. Wilson greedily grabbed at its quixotic offer on my outraged part, and Farnsworth, (whom I had formerly regarded as one of my best friends) advised the Company to accept my proposition, stating that the patent applications in question were of no value, that my contributions had been negligible from the start of the enterprise!

In so doing Farnsworth, quite unwittingly, was doing me a very great favor, as subsequent results proved. But his idea was to see me walk the plank, jettisoned from their newly disguised, piratical craft.

"Honest Abe" White (who now has again changed his name to "Abraham Lincoln White") had just pulled off a coup in Union Pacific stock, with his profits made a fair sized payment on McCall's huge mansion, "Shadow Lawn" at Long Branch, New Jersey, and thither retired with all the unction and high-hat of the nouveau riche, whose manner his Jewish soul (?) now so greedily courted. (I now, for the first time, learned that his real name was Schwartz - But he had turned his back and his name on his Texas family, the better to mingle with the Russell Sage and Morgan and Rockefeller tribes he so yearned to ape).

So while White revelled in gigantic sham at "Shadow Lawn" (where he ultimately cut out and hocked the McCall silver chandeliers and doorknobs during his subsequent submergence - before he for the first time (?) landed in jail) -- I found myself once again walking the streets of New York, and penniless, as I had been five years before. But this time with experience, confidence, an international reputation in Wireless--and some certain pending patent rights - which I had not when I first came to the Metropolis five years previously.

August, 1906: "Alas for the early youth; justice wears an iron mask. Fortunately for me I can no longer feel, nor realize, nor think. Fortunate indeed that I am brave enough to hope."

Even before I was booted out of the Company I began to move my Audion equipment up a little laboratory on the top floor of the Parker Building, 19th Street and Fourth Avenue. My former laboratory, in the attic of 42 Broadway, near the sending station, was too dark and crowded and too often visited by operators and those sent up from the Office downstairs to interview me.

In this little laboratory in the Parker Building momentous history was destined to be made, and in its confines I derived greatest comfort, during the revelation of the various villanies which were under way down at 42 Broadway.

Some time previously I had ordered a 5,000 cycle generator, which I now purchased from the Company for $150. It had been my earlier idea to generate therewith a very high frequency spark, higher than the most essential frequencies in voice telephony, and to control or modulate the high frequency energy from this generator, or from the spark gap energized thereby, by means of a microphone located, either in the field of the generator, or directly in the ground connection of the radiating system.

But I never used this machine, as I had not then the means for purchasing a motor suitable for driving same; and more especially because about that time my friend D. McFarlane Moore, on whom I had called in his Jersey City laboratory, had informed me that it was not necessary to use the Poulsen arc-in-hydrogen, which was covered by a broad patent, in order to obtain undamped waves suitable for use in wireless telephony. Moore pointed out that Nikola Tesla in his monumental volume had clearly described the use of a direct-current arc burning in the flame of an alcohol fed lamp. Moreover about that same time I had read in some scientific journal in the library that an arc surrounded by an atmosphere of hydrogen had been used previously to Poulsen by P. M. Berthelot of France. It was quite clear, therefore, that I could expect to generate undamped waves from the electric arc without infringing the Poulsen patent.

For the last two or three years coincident to my developing of the Audion from the bunsen gas flame I had become dominated

more and more by the idea that the next big development in wireless communication would be the telephone; and I was resolved more and more to turn my attention to that engaging problem. So it came about that in the Fall of 1906 two basic enterprises formulated in my mind, one to further pursue the experimental development of the Audion detector, the investigation of its unknown and ever expanding possibilities, and second the development of the wireless telephone transmitter.

One motive for this latter course, as humorously related, was that it would be easier for me to develop a radio telephone system than to continue my education for a speedy telegraph operator!

The thousand dollars which Col. Wilson had given me had been unceremoniously cut in two by the generous magnanimity of the lawyer whom Babcock had recommended to me, whom I employed to finish the negotiations with Wilson, and to draw up the necessary papers in correct legal form. C. C. Higgins was the name of this outstanding gentleman. When he received Wilson's check he blandly asked me how much of this he should keep. Without giving me a chance to reply he said, "I shall take half of it, and if you don't like that I shall take it all." So I decided to take it, and I started on my wireless telephone work financed by the huge sum of $500, out of which I owed the De Forest Company for that high frequency generator!

But I had learned long ago not to let little things like this discourage me from great enterprise.

About this time I was approached by a Mrs. Hogan, who was very desirous that her son, John V. L. Hogan, might be permitted to work in my little laboratory, as she intended later to send him to Sheffield Scientific School, and wished him to have some introduction to the mysteries of wireless before he matriculated. She showed the greatest interest and sympathy with me in the troubles I was then undergoing, and suggested that her husband might be instrumental in raising sufficient funds to finance the new De Forest Radio-Telephone Company, which I already contemplated organizing. This done, Mr. Hogan contributed a few hundred dollars to the empty treasury, and John Hogan started in as my first laboratory assistant. He was already endowed with a rich bass voice suitable for broadcasting!

Babcock was very loyal, and frequently visited me at the Parker Building to give me the benefit of his suggestions and encouragement; and the low-down on what was going on down at 42 Broadwey - which was very low-down! I was enabled therefore, late in 1906, to design and construct my first crude arc transmitter. I recall that it was the last day of that year that Hogan was able to pick up in the Audion and telephone receiver across the room the first words spoken into a microphone connected to my arc transmitter, which was then fed from a 220 volt direct current source.

September 30, '06, after my resignation from the Company:

"I will never again be connected with the metamorphosed Schwartz. If ever was a good clean, promising industrial proposition inflated, misconceived, mismanaged, misapplied, prostituted, sandbagged and then deserted - it is this Wireless System with which he undertook to dazzle the galleries, enrich himself and have a novel and thrilling good time generally!

"All his effusive and condescending conduct in times past, when he made me a mendicant member of his family while he hampered my powers and prevented me from my real work, avails very little with me as against the infinite, irremediable damage which his imbecile mismanagement and Hooleyian policies have wrought to the enterprise built up largely on my brains and to the company which bore my name.

"Far better would it be had a man been found less hypnotic, less gifted in impulsive and careless 'generosity', with ability to raise only one third of these squandered funds - a man nevertheless endowed with at least a modicum of system, a balanced man with a fixed policy and plan; one of sound, level headed, conservative business sense; a man who regarded first the real welfare of the Company, (not of his stock agent), the earning possibilities of the enterprise, who could direct and limit expenditures wisely; see to the building up of a market and a laboratory imperative for the need of that market; and Director who calls Directors' meetings-not single-handed and alone dictated however the peoples' savings should be flung away; a President who realized the need of assets instead of spread-eagle advertisement of stock; and who would take out patents instead of stock profits, pay for indispensable legal services instead of extravagant office rent, and radio stations scattered broadcast for the enrichment of himself and greedy agents.

"My brains and knowledge were assets to the Company as well as to myself. Instead of allowing me adequate facilities and funds to conceive, develop and protect ideas, he has made of me these years an office boy, a traveler about the country to meet people, to talk glowing prospects, to build and operate impossible stations, so that his stock agents might reap large commissions while he stole the residue.

"In short, in any plan, had business sense and earning prospects to argue in its behalf that plan was abandoned or retrenched and killed; if any idea was chimerical, ill-timed or ill-advised, spectacular, costly, unfair to me, to the enterprise and the stockholders, that idea, if glittering and novel, appealed to advertisement and Jewish love of display, was breathlessly followed - until its cost became burdensome or another dazzler appeared.

"I am done with White. While the company floats I will work for it, but I will search for another man of means and honest common sense who can clearly finance my further inventions; that I be not always the mendicant, the 'tramp of fortune', which White has delighted to make of me.

November 29, '06:

"Dear Mr. H-------

Replying to your favor of the 20th, I do not know much about the 'United Wireless Telegraph Company', but I know sufficient to calmly and truthfully state that it is just one more (and let us pray God the last) link in the shameful chain of exploitation, expansion, watering and milking, stock-jobbing, defaulting and swindling operations with which the decent, honorable and humanitarian art of Wireless Telegraphy has been scourged from its very beginning.

A more shameless, bold-faced imposition has never been perpetrated upon a much believing and long-suffering public.

Consider the present condition of the poor remnant which White still keeps afloat. Look at the pitiful wreck of the factory at Jersey City, the worthless junk pile that represents thousands of confided dollars, at Atlanta's $5,000 station sold on the Court House steps for a paltry $150 attachment, the farce at Columbus, the lone mass at Geneva, the Sheriff's notices at St. Louis, etc. Then read White's ads and the curb's laundered quotations, glance at his worthy list of 'Directors' and 'Officers', office boys, insensitive operators. Even the 'figureheads' whose names might carry weight to the uninitiated, have already deserted his flimsy, piratical, phantom craft almost before it launches.

You know the actual possibilities and capabilities of Wireless, and you know White too well to need further protestations from me. You know then what this United Wireless, of already stinking memory, can be. Of course I have now resigned from the Vice-Presidency and the Directorate of the now comatose and moribund American De Forest Wireless Telegraph Company, and am considering what steps I can take to prevent the further prostitution of my name in this wretched stock swindle.

If ever man was deceived in his fellow man, in the ultimate soundness of heart, the earnestness of mind and honesty of purpose of one's co-worker, then I have been in Abraham White. Once I held him dear as a brother; and it is not his brutal heart and treatment of me personally that has convicted him in my eyes, it is the now all too evident intention to betray this child of my efforts and my brains and

good years into the clutches of stock pirates. It now seems clear that through it all but one underlying, unswerving motive ran, hidden by vascillating lack of purpose, unpulsive extravagances, unsound judgment and criminal mismanagement - the silent, disguised amassing of a private fortune from the proceeds of the confiding, of the poor and the provident.

These people, thousands of them throughout the land, women and laborers, men of small means, believed in me, had confidence in my work, the results of which spoke for themselves. They shared my faith in the future of wireless and in the sagacity and honor of the one to whom I had entrusted my future. If rightly fostered, conservatively developed, thriftily directed, Wireless in this country would today stand on a firm basis with a remunerative future absolutely assured. But Abraham White has betrayed me, has hampered my abilities and nullified my work, and heedless of advice or control squandered the hundreds of thousands which were given to him by trusting people.

Now it is vanished, irretrievably lost. Because of its wreck, my name is one of ridicule and opprobrium. He has wasted years of my life, and the public's savings. All are alike losers, save White and the small coterie of stock agents who, craftier, conscienceless, and farther seeing than the rest, have grown opulent, while we others toiled and gave of the best we had.

I have been with cruel thieves who made me unwittingly their chief accomplice. But in the end they must, if there is justice on earth, sink with the craft they have so meanly settled. (Prophetic words: Four years after this was written several of the leaders of this gang were sent to the Atlanta penitentiary. Crafty White, by God knows what chicanery, managed to escape his measure of justice.) As for myself I ask merely the chance to begin again with a free hand in a field not free, but now crowded, to enter with new, honorable, and genuine capital, to develop my ideas, to follow my bent, to vindicate myself.

Many other, (someday to be proven most valuable) ideas and inventions will justify the faith hitherto reposed in me. Despite the scant support, the pitiful laboratory facilities, the wretched patent and legal assistance I have met, I have made good. Witness the history of my real successes. And now with a rational and sufficient backing by men who desire results--not robbery--I shall quickly stand before the world as come into my own."

First of all my achievements today stands the Audion, child of my earliest experiments, conceived six years ago in the poverty and inexperience of a faithful beginning. Given sound and intelligent legal advice, with a laboratory and an opportunity to stay there, and this marvel of sensitiveness and efficiency would doubtless have stood as it does today three years ago.

The company would have escaped most damaging litigation. But - quo bene? Just that much more prestige and income from which White will filch his private dividends. The Company with him at helm faced ultimate wreck, whatever patents and perfection of system it might posess.

But you, little Audion, have been a comforting companion to me in all the troubles of the months that are passed. Through all their dark hours your light has alone gleamed dazzlingly bright in my eyes, my ears have harkened to your fluttering whisper amid the discordant noises of these crashing times.

On you alone, little Audion, have I been allowed to concentrate, since those months of desponding study in Chicago upon the electrolytic responder. And right well have you rewarded my thought and my study. Scarcely a step that was not in advance - each change was an improvement.

Until tonight you rest on the table before me, excelling all devices which man has achieved in centuries, cognizant of the infinetesimal forces I have built for you to detect.

Yet, Audion, you are very old, older than this earth, as old as the sun. Your incandescent gases have for countless eons quivered in response to the electric waves which have been born in that awful photosphere, or traversed with their light the infinite distances from other stars."

"January 1, 1907: Two hours of the New Year have already passed. The night without is still and calm, mild in the silver of the southern moon.

"A New Year, a new Era, a new Hope has dawned upon my life.

"The world in the years past has dealt hardly with me, and I have seen hopes fail and friends betray.

"Courage only and faith in a final happiness has remained unchanged, the unaltered star towards which the world ever points its pole.

"It is a new thing for me, as new as this New Year (although like another year, long gone) to feel the awakening of love. It is a sweet, a solemn thought to find that at last, at last, the long search is ended.

"I sought through the world, seeking peace and found none --- watching patiently, hoping postponing -- despairing at times of the quest's end. Now Fate, mocking at the wild plans of men, has brought Her to my door!"

Let this quotation introduce to my life's history the second of my loves, Nora Stanton Blatch. She, with her Mother, Harriet Stanton Blatch, occupied the apartment directly adjoining mine. Propinquity had brought acquaintance. Through the thin separating wall I had often listened to her magnificent playing of the piano in her Mother's apartment. I found her to be a charming young lady, a recent graduate from Cornell University, their only alumna graduating as a Civil Engineer. She, quite naturally, became very much interested in my work. She and her Mother expressed great sympathy with the way I had been outcast from the Company which I had founded.

They had read of, and admired, what I had achieved in Wireless; and were enthused over the plans, as I outlined them, for the development of the Wireless Telephone, as it was then called, and particularly with my ideas of "broadcasting" from some central point in New York music which could be heard by thousands of listeners all over the City; even if, as was then apparent, the range of the new instrumentality should prove to be greatly limited as compared with the ranges already attained by the Wireless Telegraph.

The new year and my new work had not advanced very far before Nora Blatch and I became tacitly engaged. But it was not until a year thereafter that we were married. My diary of that year is filled with excerpts copied from love letters which I had written to her. There were nightly visits back and forth between the two apartments. During part of this period my Mother came down from New Haven to spend a few weeks with me, and there was very happy inter-communion between the four of us.

Nora became extremely interested in my studies. She was then working in the New York City Engineer's office, in connection with the City's new aqueduct project. At her own suggestion she elected to give up this work and to take up a course of mathematics under Prof. Pupin at Columbia University, so that she could better understand my work and become a valuable assistant to me. (That was the first grave mistake which we made.)

February 28th 1907: "Radio Telephony and Teleharmony - new, epoch marking, crowding one upon the other so rapidly, and with such a bewildering complexity of possibility that my mind cannot realize with what wonders I am toiling.

"There is Music, dearest of the soul's pleasures, created in largesse, broadcast like some merchandise, owned and distributed by a new art, unknown until yesterday.

March 5, 1907: "My present task, happy one, is to distribute sweet melody broadcast over the City and Sea; that in time even the mariner far out across the silent waves may hear the music of his homeland, sung from unseen sources.

"But the sweetest music of all I hold for myself - That no wireless transmitter shall scatter from me - the Audion of which you sang I have tuned to that song, and it alone; and it does ever echo to my listening heart a sweeter etheric melody than antenna wire are harped to."

(These last two quotations, copied from my love letters, are clear proof that even at that early date I had a very clear comprehension of what I was trying to accomplish with the new radio-telephone, to Broadcast its message and its melody over wide areas, for unnumbered listeners. Of course, I cannot claim that I originated the term "broadcast", but I honestly think that I was the first one to apply so descriptive a term to this new art which I was then beginning to create, and which was destined ultimately to spread over the entire civilized world.)

In this respect I clearly saw the fundamental difference between radio and wire telephony. The inherent differences in nature and application were to me so self apparent that the evident inability of the many of my classmates, to whom I went soliciting financial aid in my new enterprise, was absolutely incomprehensible. When to such I explained my patent situation, and my ideas of building up a new enterprise differing wholly from the old wireless telegraph art and from the wire telephone, yet which possessed many unquestioned possibilities of great earning power, I was usually met with this question, "Lee, do you mean to say that if I had a radio telephone in my office I could talk to my home and that by tuning something I could either to Jack McCullough or Bill Pouch?"

When I explained that at most only a hundred or so messages could be carried on simultaneously over New York without interference, and that the communication would not be secret, the listener's face would lengthen, or a cynical or pitying smile would spread over his features. And then he would say, "Well, then of what possible use can your "radio telephone" be? It can't compete with the wire 'phone and it can't cover the distances, you say, that the wireless telephone can cover. Then what the hell use is it anyway, Lee?" And so I would go on to my next prospect! All in all I raised less than $400 from members of my class - and this simply as loans, granted out of commiseration, and to be rid of my nonsense.

It was all terribly discouraging, almost as discouraging as the reception I had received in 1901 when seeking to explain the possibilities of the Wireless Telegraph to the smart, brainy financiers downtown.

So again I was strapped, hampered, hog-tied, scarcely enabled to move forward in any direction. Again I was forced to create something from nothing, bricks without straw, lift myself by my boot straps; and again start on a proverbial shoestring. The faith which Nora Blatch, her Mother, and a few friends had in me - and above all the glowing love in my heart - were my sustaining comforts. These alone enabled me to plod ahead, to build up a second fortune, to create yet another New World.

The reference which I have just quoted in one of my letters to "Telharmony" indicates that it was at this time, March or February, 1907, that I had made efforts to interest the Cahill brothers, creators of the "Telharmonium", to allow me to demonstrate the possibilities of distributing their fine new electrically generated music throughout the New York City area, by means of my radio telephone system.

And so I wrote, "March 7th. Tonight there is joy and contentment pulling at my heart strings, for there is within me consciousness of a day, and days, well spent, of earnest effort, rewarded with a goodly measure of success. The day of ultimate triumph and happiness seems nearer by many leagues. And its promised joy as well as the satisfaction of the day's triumph is far brighter and more genuine because of your love for me, which hallows and intensifies all pleasures, all rewards."

"Were it not for the bright light which this wondrous girl throws ever on my soul, I fear to think of my present condition - I might well be on the verge of madness these many months.

"Not since 1901 have I known such a winter as this - never ending - ever over-clouded with storm and gloom. No sooner am I free of one dread, or rid of one enemy, or clear of the blight of one error and mistake, than another horrid shape usurps its place. White, then Wilson, then Higgins - ever reappearing poverty, debt constantly upon me - the supreme difficulty to get started anew and aright - patent complications and constant drain and continual strain of expense - to create again something from nothing, or with nothing - to organize a new Company, to make a demonstration, meet rent, secure loans, file patents, emerge from one difficulty to another - one foot always sinking into the mire while I struggle to release the other! Oh, when will it all end, and end forever? When can I be myself and work as I would, and can, and ought; when will this world allow me to earn my life in the fullness of my life,

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Inset after first line of Tyne's page 112

"Through it all and over all is Her love and her Mother's love, in confi-dence and aid. SAh, I am blessed indeed by Fortune that among all this unusual load and battle, and hate of men, this most unusual propinquit and chance has given me also this Harbor of Refuge"

"All the hideous shapes of Man, with whom I am battling, all the fears and difficulties take upon themselves the vague presence and voice of the Boyg, and like the Boyg they shall repeat:
"He was too strong for me; there were women behind him". "

Insert after line 3 of Tyne's page 112

" Last time I had heard your voice it was by the way which for years I have been ~~wing~~, the invisible, inaudible path thru the ether. Yours, oh my Sweetheart, was the first woman's voice ever to come to my ears by the newest and most wonder-ful channel, as was most sweet and fitting. And its etheric echo will go on forever ~~ging~~ thru the chambers of my heart, as its etheric impulse is now speeding into the infinite distances of space, into the uttermost dark forever.

"Your voice, my Nora, was the first woman's voice , first ofour world's angels, which was translated into the impulsesm of the ether to be wafted beyond the confines of this earth's atmosphere, and, free as your soul, mingle with the voice of spirit creatures in other worlds! In ages hereafter, when the great "Book of the Universe' is written, spelled in stardust upon the sky blue pages of ~~Etkex~~-Eternity, therein will be recorded that the first voice of those angels of the 'Sunlit Star' ever heard by the apirit listeners ~~xf~~ in Aiden was one Nora, sweetest voice of all her sisters', speaking in accents whose tone expressed what their words dared not convey, a heart love for the Mortal who first taught them how to talk on moonbeams. "

its possibilities, its deserts?

March 29, 1907: "Yesterday she spoke to me on my radio telephone.

The foregoing extravagance reminds me that on that occasion I had brought my Sweetheart down to the Parker Building Laboratory to speak into the microphone, while I myself went to the offices on the 10th floor of the Metropolitan Life Building of my friend, Miller Rees Hutchison, whither I had previously carried the receiver, and with whom I had for some time past been conducting one-way radio telephone experiments. Hutchison had always shown the keenest interest in my work, and gladly cooperated.

During my first tests, long before the Brooklyn Navy Yard picked me up, I would call him by telephone to listen in the Audion receiver, and to signal out his window with a towel as soon as he should hear my voice. The distance between the two buildings was less than a quarter of a mile, so that there was no difficulty in obtaining his wig-wag confirmation.

On the occasion I have mentioned Hutchison and I both heard Nora's voice. It came in very clearly - sweetly.

During the early months of experiment Peter Cooper Hewitt in his laboratory in Madison Square Garden Tower was also a frequent listener-in. On one occasion Hewitt placed his telephone microphone in contact with one of his wireless receiver headphones, and I was thereby enabled to hear a reproduction of the phonograph music which I was playing at that time. That was indeed a unique thrill.

Miller Hutchison was not slow in notifying the newspapers as to what I was undertaking to accomplish. At the Editor's request I prepared a description of my work and what I proposed to do, for the New York Sunday World, April 7, 1907. From this I quote as follows:

"Now comes the eternal question of the utilitarian: 'What's the use?' The most pertinent question, by the way, ever asked. What is the use of erecting a wire and speeding a spirit whisper, of a metal noose and lassooing a ghostly voice, or of atuning a new Aeolian harp and having it respond, not to the lawless songs of the wind but to the rhapsodies of the master musicians played in some distant auditorium? * * * The ether waves represent the sound vibrations may have passed over miles of city or waste of sea, through the walls of hundreds of buildings, or over the roofs of tallest towers. Nothing will retard or obstruct them, and those who stand between are all unaware of the silent voices or spirit music

which may be passing them on every side. They are dumb to all save him who listens who has the proper 'responder' directly tuned to the electric wave. He alone hears the etheric 'call of the wild', and when it speaks to him in the well known accents of distant friends, or when music from silent spirits coming in from nowhere sings to him the strains of some well loved earthly melody his wonder grows, and he thrills at the wierdness of it all."

Quoting from the New York Tribune, May 15, '07: "There is music in the air about the roof of the Hotel Normandy these days. A good deal of it is being collected by Dr. Lee de Forest's wireless telephone, ready for distribution to possible purchasers. Dr. de Forest's experiments are being carried on in conjunction with the distribution of music at Telharmonic Hall. Up to yesterday anybody wanting to get music through arc lights or over the telephone had to have his house or office wired. Now even those who go down to the sea in ships can carry a wireless telephone apparatus, and when they tire of listening to the waves may switch on 'Rocked in the Cradle of the Deep' and other popular nautical ditties.

"The power used to transmit the music from the sending apparatus on Telharmonic Hall to the Hotel Normandy was the same used to light an incandescent lamp. Dr. de Forest thought that this would not transmit the music more than a mile at most but was astonished on Tuesday night when E. S. Davis, Chief of the United States Wireless Staff at the Navy Yard telephoned Telharmonic Hall that the strains of 'William Tell' were being mixed up with Naval orders at the Navy Yard five miles away. Yesterday when Dr. de Forest was demonstrating the telephone apparatus messages from an incoming steamer were intercepted and heard distinctly."

But the above was not the first time when the Brooklyn Navy Yard had heard my radio phone.

To the best of my recollection it was during one of the tests in April when I was putting a part of an old speech and some phonograph music on the air that George Davis, Chief Electrician of the Brooklyn Navy Yard, was called in by one of his operators at the Wireless Station to listen to the speech and music coming in through the earphones. The operator was of the opinion that he had had a little too much beer at the corner and wished to have himself reassured. Davis came in, donned a pair of phones, began to think that maybe he was reaching his dotage a little early. But the thing was a fact, four or five of the operators attested to it. His hearing could not be deceiving him. Then he remembered de Forest. De Forest, he thought, was the only man in town who could be doing such an unheard of thing. Going on this hunch he went to the telephone and called my studio. "Doc, Am I drunk or crazy, or are you sending out some talk and music over that

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Insert at bottom of Tyne page 113

That man who first heard the "music", and called George Davis to don the headfones, was Steve Wallis, now (1946) a director of the Veteran Wireless Operators' Association. GHC

wireless of yours?" he asked me. I laughed and told him that I had a wireless telephone working and asked him how he liked it.

I understand that Davis, immediately seeing the possibilities of the thing, sat down and wrote a report of the whole incident, together with a description of the apparatus used, to the Navy Department at Washington.

I have neglected to state that upon my return to New York from England in April 1906 one of my first calls took me to our New Haven wireless station where certain necessary repairs or alterations to the newly installed transmitter were necessary. These done, I seized the opportunity to carry out certain tests I had long had in mind concerning the directive effects which might be obtained using a very low horizontal receiving antenna. Taking Frank Butler with me, who had recently emerged from the torments of Guantanamo, Cuba, I tied one end of a 50-foot length of antenna wire to a 6-foot pole set in the middle of a large vacant lot about 5 miles from the transmitter. I listened in the receiver telephones located at the pole while Butler, holding taut the other end slowly described a circle. The results were astounding, but exactly what I had hoped to find. The direction in which the transmitter lay from the pole could be very closely determined.

I next lay the wire directly upon the dry grass and sand of the lot, and again Butler described with it a circular path. Again were the signals received, ever stronger than before, so long as the wire extended in a line with the transmitter, but none when lying at right angles thereto. The theory of "grounded waves" was beautifully substantiated, and the practical value of the low-lying horizontal wire as a direction finder here again convincingly demonstrated.

Following this work, on June 20, 1906, I filed my patent application covering broadly the horizontal antenna for sending and receiving - which issued later as Pat. No. 1,101,535. A sample broad claim reads:

> "In a system of wireless telegraphy a substantially horizontal receiving antenna and a transmitting antenna, said receiving antenna being substantially in the vertical plane passing through said transmitting antenna."

The patent also describes and claims the horizontal transmitting antenna in the same plane as the receiving, and having "its generator end nearer to the receiver than its tail end." The patent also clearly illustrates how to utilize the track-side telegraph wires as a wave chute between the transmitter

and receiver, using the rails as earth connection. I consider this as having been a basic patent disclosing a method of utmost commercial practicability, one subsequently used by most of the transoceanic long wave telegraph transmitters.

The New York American of Sunday, June 2, 1907, records:

"The first wireless telephone system in the world is now being installed in the Hoboken Station of the Delaware-Lackawan Western Railroad. Following the success of the experiments, Dr. Lee de Forest, the inventor, expects that tugs, ferry boats, and ocean going craft of all kinds will be equipped with this latest device. He is also planning to furnish all lighthouses and life-saving stations with his invention, which will do away with the elaborate system of code flags.

"Already a conversation has been carried on between Dr. de Forest in his Park Avenue Building laboratory and the Sandy Hook Signal Station, a distance of 20 miles.

The May 1907 issue of the "Talking Machine World" states that my voice from the Parker Building Antenna was heard aboard the S. S. Bermudian in the Narrows, a distance of 12 miles. Under a headline, "Talk Across Atlantic" appears the following:

"I consider wireless telephony more valuable as a commercial proposition than wireless telegraphy, says Dr. de Forest. Although the distance between the first stations on opposite sides of the Hudson is only two miles I believe it would be possible even now to talk with Sandy Hook. Before the end of the year we will be able to talk fifty miles, in five years time 500 miles, and in ten or fifteen years across the Atlantic."

(As a matter of fact, this latter prediction was made good in less than nine years. Nevertheless, on the strength of this statement, six years later the Federal District Attorney did his very best to convince the jury that I should be sent to Atlanta penitentiary!)

"In the transmitter," said Dr. de Forest, "I employ an ordinary carbon microphone such as is on every telephone in the city, and connected with the wires which conduct the electric current from the transmitter and antenna wires to earth. Thus every change in resistance between the carbon granules affects the strength of the high frequency currents going into the earth, and in this way also the strength of the electric waves is radiated outwardly from the antenna wires.

"The inventor has in mind one use for wireless telephony in New York that will appeal to music lovers. With the permission of the management of an opera house he could carry on opera performance up through the roof, he said, and send it hot off the griddle to people with wireless receivers in their homes. In this way the people could hear all the operas for the trifling expense of $2.00 a month, but Dr. de Forest hasn't mentioned this to Coaried nor Hammerstein as yet."

As I have above intimated, the financing of my new departure in wireless signalling was beset with all the difficulties which might have been expected. The big guns down in Wall Street were just as skeptical as they had been six years previously regarding wireless telegraphy. Again it proved necessary to look to the public for our financial support. The original De Forest Radio Telephone Company had been transformed into a larger organization, entitled the Radio Telephone Company. Two recent friends of mine, James Dunlap Smith and J. J. Thompkins, who had been remarkably successful as stock salesmen for the American De Forest Wireless Telegraph Company had, simultaneously with myself, divorced themselves from the White-Wilson organization, with whose methods they expressed extreme dissatisfaction and suspicion.

With the aid of my good friend, Capt. Samuel Darby, he who took out my first patent application away back in Chicago, and who was now practicing in New York - as honorable and sincere friend as a man ever had - I succeeded in interesting these two men in the possibilities ahead in radio telephone development. They inspected closely my demonstrations, and finally dicided to put their shoulders to the wheel in an earnest effort to raise the finances for the new Company.

But these men found it desperately hard to raise capital during the early months of 1907, the days of the so-called 'Roosevelt panic', when long queues of frightened depositors were lined up in front of some leading banks in New York City. Those were certainly anything but "boom" days, and the going was anything but easy for those who were trying to launch this new thing, the Radio Telephone, on mundane shoresand on etheric oceans. However sufficient funds were made available so that I could continue after a fasion my developmental work in the laboratory.

About this time my old Worlds' Fair operator, Frank Butler, who in the spring of 1905 had been released from the torments of Guantanamo and came to New York, bringing with him his good friend and buddy, Roscoe Kent, who had also been discharged from that hell hole, his enlistment in the United States Navy having recently expired. These two boys,

therefore, in addition to John Hogan, swelled my laboratory staff, and are living witnesses of the rather rapid initial development of the three-electrode audion detector and amplifier in that tiny laboratory.

About that time I was visited by a magician, Carl Anderson by name, who was interested in staging a little mind reading act wherein he, passing among the audience and asking questions or receiving answers, might be enabled to transmit what was said, in sotto voce or whisper, by means of a small microphone concealed in his clothing, and wires extending down his trouser legs to spikes in the soles of his shoes. Beneath the aisle carpet were to be laid two sets of copper strips, the ends of which would be connected through a battery to a headphone concealed under the hair of his accomplice, a lady standing, or seated, upon the stage. All his attempts to accomplish this had been futile, due to the extremely weak signals received. He realized that a telephone amplifier would be necessary between the microphone and the receiver. He laid his problem before me.

I reasoned then that since the Audion was a very sensitive wireless telephone detector it might also be adapted to serve as a wire telephone amplifier, or repeater. I made some experiments at that time along these lines, and the results, although not very satisfactory to Prof. Anderson, convinced me that the little Audion was actually a telephone repeater as well as a detector of radio signals. So it was this visit of Anderson to my laboratory which prompted me to prepare the patent application which finally issued as Patent #841387, filed October 25, 1906 and issued January 15, 1907. This was my first Audion amplifier, or relay, patent, and the first showing the control electrode inside the tube - not in the form of a grid but of a plate parallel to the anode plate, and located on the opposite side of the filament.

This patent and its companion, #879532 filed January 29, 1907, the "grid-audion" patent, have indisputably proved themselves to be among the most valuable patents ever issued by the United States Patent Office.

These two patents, and all the others which I filed after my discovery of the perfidy of Phillip Farnsworth, were filed by my good friend, George K. Woodworth of Boston, a very competent patent attorney to whom I had been introduced by my friend and fellow pioneer wireless inventor and worker, John Stone Stone, whom I had first met at the World Electrical Congress in St. Louis, in 1904, before which both Stone and myself had presented papers on the subject of wireless telegraphy.

John Stone Stone, who is today living in San Diego, California, possesses unquestionably the keenest mathematical mind in America, or in the world for that matter, which has devoted itself chiefly to the problems and analysis involved in comprehensive fields of radio signalling.

In the spring of 1907, however, when Capt. Darby became one of the Directors of the Radio Telephone Company, I employed him exclusively as my patent attorney. It was now clear to Capt. Darby and the promoters that I was building up a really strong patent position, one well justifying their efforts to finance the Radio Telephone Company.

As I recall it, one of the first jobs to which Frank Butler applied himself after quitting the American De Forest Wireless Telegraph Co. and coming again with me, was the installations on board the Lackawanna Ferry Boats in May, 1907. The skipper of the "Bergen" received the surprise of his life when three men boarded his vessel, walked straight up the companion way leading to the wheel house deck and did not stop even there. They went so far as to traverse his own sacred domain. They went directly into the fore wheel-house without knocking. Once inside they dumped the bags, which looked suspiciously like plumber's kits, on the floor and unceremoniously turned about and went below for another load. Now Hell itself has no fury like that of the Ferry Skipper whose dignity has been violated; so when my assistants and I returned with the remainder of our apparatus to install the first floating radio telephone station, that skipper treated us to some choice deep-sea language, ending with a well merited lesson in sea etiquette.

It was not long, however, before we had installed the small generator in the engine room, belted it to the boat's generator engine, and run the wires to the cabin. The antenna was strung between the flag poles atop the ferry boat, and the transmitter was put into operation. The Lackawanna had permitted us also to install a land station at the Hoboken terminal of the ferry and another at 23rd Street, Manhattan. These stations were put into operation, an operator installed on the ferry, and newspaper men invited to look over the works.

Telephonic communication was easy. The ferry station was of ample power, and the land stations were fairly pouring current into their antennae. The following Sunday the papers came out with front page spreads telling of the latest great advance in Science, the Radio Telephone! Incidentally, the skipper's feelings were assuaged when he saw the papers, carring his own photograph in spiffy uniform enjoying the place befitting a staunch sailor man.

Such exciting work, or stunts, as are here described filled our busy weeks into the summer of 1907.

To follow immediately page 118 of Tyne series.

Look back to Page 56A for earlier glimpses into de Forest's real self.

May 24. "You will your vacation and change of scene next month. Mine may come in the Fall. Some day it must come, and then you can, and must, teach me to enjot it, how to be something besides an automaton and a worker. I want to be a human being firstm, a genius next.

Music, Poetry, Romance, --ah, there is time in the world and place in the life for all of this. One must make and take time, before the wars are deafened, and the heart chords cease their throbbing.

Will you bring these things back to me, Sweetheart? I want them; I need them. Life is but once, and life is Life, ---with love!

May 31 1907. I have seen all cycles, bright and clouded, calm, stormy and overcast. One thing only is constant in life, my life--battle, struggle, ambition, work!

Freinds come and pass, fortune smiles and fades. Even ~~the~~ (this probably means 'ever' GHC) the heart beats. It is harmonic motion, crest and node. Also time is measured by a rhythmic motion. Lights on river gleam and wane, ripples ebb and flow, as do tides. There is an under-current, forever flowing to the sea.

Nights are silent; then full of voices; music sobs into quietude, then its echoes fade away.

Tasks change, today this, tomorrow that. The toiler is the same, unaltered, seeking to do well today's work, such as it brings. The moods alter with the task, and the need, and the unfathomed laws. The Morrow always enters by night, and it is shrouded in the unknown.

Patience and work! Rest and change must come.

July 2. She has played exceptionally beautiful musicks for me, today, with exquisite expression.

Music's chords are in truth the thrmads of which lovers ~~m~~ weave the fiarest fabrics of fancy; and if the warp of heart strings and the violin be interwoven with the woof of heart strings, then indeed may a tapestry be woven all of beauty and golden figures.

See page 118B et seq.

Early in July one of our agents in Ohio had interested Commodore W. R. Huntington of Elyria in the project of equipping his yacht, "Thelma", with our radio telephone for the purpose of reporting the Regatta of the Interlakes Association during the week of July 15-20. The Thelma was the first craft in the world to be fully equipped with the radio telephone. Frank Butler and I went on to Put-In-Bay to install the equipment on board the Thelma and on the dock. During the races the Thelma followed the competing yachts around the course and full and graphic accounts were telephoned to the shore stations exactly as the event occurred. "It was astonishing to note the clearness and fidelity of the reproduction," states the London Electrician of August 23, 1907, in reporting the event. The scratching of the gramaphone needle over the disc after the record had been played through, even the tapping on the mouthpiece of the transmitter with a pencil, was distinctly heard at a distance of three miles from shore. The greatest distance at which the reports from the yacht were heard and recorded was four miles, which was considered remarkable in view of the low height of the Thelma's spars and the power of the transmitter on board.

Her equipment comprised a 220 volt generator, and for receiving apparatus an audion detector and pancake form of synchronizer or tuner. Her aerial wires led through the roof of the wheel house to the small cross arm on top of the foremast, thence to a similar arm on the mainmast. Earth connection was at first made to the propellar shaft with twin screws, but as this was found insufficient more area was added by fastening two sheets of zinc to the yacht's hull at the bow. On shore 110 volt direct current was available, and this was transformed into 220 volts by a motor generator. This was the voltage which we applied to our little arc.

As illustrating in part the advantage of expedition of business of the radio telephone over the wireless telegraph, it was found that three of four times the number of words could be transmitted in a given period of time. The following is a fair sample of the service rendered by the installation on the Thelma-

"I will tell you when the first boat crosses the line---first boat is about crossing the line, 9:59. "Spray" crossed the line at 9:59." Later - "Second boat just crossed, 10:07-1/2. Cleveland finished second. What shall I put you down for in the second race? Hello, Frank, we will be back in about two hours. Osekita just crossed the line. You spell it, I can't Time, 10:08-1/2."

At the finish of the Ragatta the telephone apparatus of the Thelma and the Put In Bay shore station were shipped to Toledo, where it was installed permanently on the roofs of two skyscrapers for further tests. It was the intention to remove one of these sets later and put it on a Lake vessel.

5 The Great Lakes, it was considered, offered the most promising field for the first general application of this new invention to the needs of a merchant marine, and it was the intention of the company to at once enter this promising field.

Insert after Type page 120

Toledo, Ohio, July 22, 1907.

" It is hard for me to put aught but Romance and Poetry and Beauty into my letters; so full of that love is my heart. The commonplaces, the petty happenings of my daily life pass from consciousness as soon as I begin to write to you.

I feel the Angel presence, and my letter becomes almost a prayer, a hymn of praise.

Lines of your sweet letters set all my romantic heart a-throbbing, as today when you wrote 'Your little girl is tired with fruitless hunting. Come back early, dear one, for I want you, oh so much. Eleanore'

Darling, I will come to you. Wednesday night I shall clasp you to my arms. Oh happy, happy youth.

July 22. Your little hands are soft and tender! They touch not my hands but my heart. Their fingers are dearer to me than my own, for they have found the strings of melody of my soul's joy and play a music which no other power on earth could ever awaken.

I wish I were an immortal poet, to say some few words, in a lifetime of trying, which should be fit tribute to you, Nora, my Eleanora. "

(So wrote in his diary, for all to read, Lee, the Exhibitionist! GHC)

I feel drowning beneath the great sea of sleep and weariness tonight. Good night, dear Wife-to-be.

Nora is her dear name. Named by her mother for the heroine of Ibsen's drama, for to her she was to typify the new woman--noble and self-knowing, independent, yet all-womanly, never the 'Doll' of the 'Doll's House'. And thus she had been trained. Born in England, the only living child of Harriet Stanton Blatch, and favorite grand-daughter of the noble and famed American woman, Elizabeth Cady Stanton, educated in New York and then at Cornell, graduating the only woman civil engineer, a wonderful mind, clear and just as so well balanced. Tall, well built, healthful and robust, athletic, fond of the out-of-doors, loving nature with a passionate love.

Musical, playing her piano with a skill and a heart which I have never known combined; ambitious, studious, energetic, hand working, broad minded, free thinking, liberal, yet most certain of herself and her principles- sweet and tender and womanly. Oh, such a paragon of all that is to be loved and admired. She is handsome, her eyes of the most wondrous blue, her cheeks a garden of roses, English roses. Nose slightly aquiline; indicative of the high born and fine breeding, a mouth where reposes the sweetest of smiles, red lips parting to disclose teeth faultless in shape and of flawless beauty.

This is a hurried picture of my Eleanora, but she has other pet names already bequeathed:- Leonora, for we both love Poe and often thru moonlit walks recite his mystical lines; Noraine, and Princess, and the little Koko, when she dons her kimona and pink slippers. And there are other names, known to ourselves alone--not to be written.

Many extracts from my letters to her I have copied into my 1907 diary. They form indeed the only diary of my life this year. And fittingly so, for she is all of my life worth recording, and in my words to her I have a truer biography of my real self than I could ever write.

The struggles, the inventions, the machinations of enemies, and the law-the formation of the new companies and the founding of my second fortune-what are they all beside the Real Fact of my life--the truth and the fortune and the happiness of life which I have achieved in this girl's love for me?

I could ever write.

So enthused was I now over the possibilities of radio telephone, based chiefly upon the success which we had had in Lake Erie, that I stopped off at Elyria, Ohio, to call upon my old friend of the Western Electric days, W. W. Dean, then president of the Dean Telephone Company, manufacturing independent telephone equipment; with the thought that I might get his company interested in the manufacturing of radio telephone equipment for us. For I foresaw that the time was not far distant when there might be a great demand for such equipment, better made and in larger quantities than our own organization could expect to produce.

Dean was exceedingly interested in what I told him, and showed great pride in the fact that his young laboratory assistant of seven years ago had achieved so much in the development of the new art of wireless signalling. However he was very skeptical as to the future of the wireless telephone, of its public acceptance. He pointed to the not too large office in which we sat and said, "You could put in this room, de Forest, all the radio telephone apparatus that the country would ever need!" We parted best of friends, but I decided there was no hope of interesting the Dean Telephone Company in radio at that time.

The radio telephone work which we had been doing during the spring and summer, and especially that at Put-In-Bay, had been closely watched by the U.S.Naval officers in Washington, notably Admiral Evans' staff. Lieutenant Commander Cleland Davis suggested to Asst. Secretary of the Navy Newberry that a trial installation be made upon two battleships about to engage in battle practice off Cape Cod, to determine its possible usefulness for the officers in command of war vessels.

The following item appeared in the New York Herald for Saturday, September 8th, 1907:

"Wireless telephones are to be installed on the battleships Connecticut and Virginia of the North Atlantic Fleet, and before the warship armada sails for the Pacific the entire Fleet will be equipped."

"This is attracting great attention, and a departure almost as important as installation of wireless telegraphy on American ships. It is expected that the captains of the Fleet, during their voyage, will be able to converse with one another as readily at a distance of between 5 and 10 miles as from one bureau of the Navy Department to Another."

The equipment was put on board the battleships in the Brooklyn Navy Yard, and final tests were made on the eve of the ships' departure for New England waters. It was on that occasion that the first human voice actually sang into the radio telephone transmitter. A newspaper correspondent, Miss Annabelle Lee, who had interviewed me on several occasions regarding my progress and plans for wireless telephony, brought to my Park Building Laboratory on that occasion a handsome contralto singer by the name of Van Boos. The song that she had selected for this occasion was "I Love You Truly". It was heard by Smith, and one or two other operators of the Navy Yard. The next day Roscoe Kent and I followed by way of Fall River and Provincetown.

Notable were the nine days I spent on the flagship Connecticut, the weird experiences amid the roar of guns, the lovely nights of vast sea and tremendous moon as I slept in my airy nest on the forward bridge, the pleasant fellowship with the junior officers of the Fleet, the tension I was forever under during the tests of the radio 'phone between those two vessels. Kent, on the Virginia, and I obtained highly satisfactory telephone communication.

Those tests are best recorded by the following dispatch appearing in the New York Telegram for August 31, 1907:

"Washington, D. C. Arrangements for the coming cruise of Rear Admiral Robley D. Evans' Atlantic Fleet of 16 battleships to the Pacific are now under way in all bureaus of the Navy Department. Acting Secretary of the Navy Newberry has ordered that all the vessels be equipped with wireless telephone instruments.

"All of the 16 battleships, beside the six torpedo boat destroyers, are to be equipped with two sets of wireless telephones, unless the installment of the first instrument shows unsatisfactory results. The wireless telephone apparatus will be distinct from the wireless telegraphic equipment on the ships. Details of the invention are kept secret by the Navy Department because of an unwillingness to inform foreign powers of their nature."

During the test between the Connecticut and the Virginia speech records of 22 miles were recorded. Admiral Evans came on board the Connecticut, and showed such a keen interest in the telephone installations, and was so impressed by the success of our tests, that he issued peremptory orders that his 16 battleships, the six destroyers and two auxiliary vessels should all be equipped with the radio phone before they left on the world-circling cruise. But before these contracts were finally awarded further tests on board the U.S.S. Virginia were made down at Norfolk Navy Yard.

"Another illustration of the working of wireless telephone

apparatus is stated to have been given recently with the U.S. battleship Kentucky, which went aground while rounding Lambert's Point. The battleship Virginia, on which the wireless telephone had been installed, was lying near the wireless telephone station at the Norfolk Navy Yard, about five miles from the spot where the Kentucky grounded. An attempt to send a wireless telegram from the Navy Yard to the Kentucky was unsuccessful, but the Virginia received it, and the operator, finding that the Kentucky was unable to read it, tried to telephone and the operator on the Kentucky picked up the message and ticked his answer back to the wireless telegraph sender."

This latter incident occurred, however, when the battleships had been pretty well equipped, and shortly before their departure.

The Navy gave us an almost impossibly short time in which to manufacture and install this apparatus. Never had my laboratory forces worked so feverishly, day and night, without respite, almost without sleep, to meet the tough requirements. When the last equipment was finally crated several of the laboratory staff accompanied me to Hampton Rhodes to make the installation.

The six torpedo destroyers were to sail first, so all hands concentrated on that squadron, the Whipple, Truxton, Laurence Hull, Hopkins, and Stuart. There was no time whatever after the installations to properly instruct the operators who were to handle the apparatus. In fact, some of our men were carried down the bay, put in the last lick en route, and were returned to headquarters by Navy tenders. It was inevitable that the operation of these hurriedly installed radio phones put in the hands of green and uninstructed men should have given very poor results.

With the battleships we had a little more time. But here for some strange reason the Navy authorities had decided to install this delicate apparatus out of doors, up on the bridges where it would be exposed to the vagaries of the tempest and drenched with salt spray. This announcement was disheartening to me. I well realized what it meant; but there was no appeal. A hurried call went out to carpenters to manufacture the necessary cabinets for housing the apparatus on each ship's bridge.

And here again little or no time was offered for instructing the operators in proper manipulation of the new apparatus. The results obtained therefore were what could have been foreseen. Those ships where the apparatus was in charge of well trained and intelligent, cooperative operators, gave a good account of themselves during the trip. On other ships the installations were practically useless.

In all there were 27 sets of instruments shipped in Norfolk. The cost of this equipment, outside of the expense of installation, was more than $35,000. The installations on board the Connecticut and Virginia gave a particularly good account of themselves, for the reason that more time had been given for their careful installation; and the Navy operators on board had been thoroughly trained. During that last week in Hampton Rhodes waters Roscoe Kent and I had talked from the deck of the battleship Virginia at the Norfolk Navy Yard to the incoming steamer Hamilton of the old Dominion Line when the latter was six miles out the Cape, a distance of 22 miles by airline. The operator on the Hamilton heard distinctly what I said to him.

From the New York Globe, December 3, 07: "In the early days of wireless telegraphy Dr. de Forest was in the forefront, showing its practical use in the reporting of a contest for the American cup between the Shamrock and the Columbia; and his enthusiasm of those days is fully matched, if not exceeded, by his enthusiasm of today, when he has accomplished something more marvelous, and most extraordinary in its simplicity.

"Day and night the de Forest men are at work to carry out the contract with the Government and get properly installed the little mahogany boxes -- with strange keys and handles and wavy connecting strings and little cylinders on top on board the 26 other vessels, as they are already on the flagship Connecticut and the Virginia. Over at the Navy Yard in Brooklyn are the Alabama, the Louisiana, the Ohio, and the Missouri beside the already equipped pair, and up at Boston are other battleships, while at Newport News half a dozen torpedo boat destroyers are being fitted out with wireless telephone equipment.

"Strange to relate, and it may be a point for the prohibitionists, alcohol will play a part in these wireless talks; for little alcohol lamps are important factors in the oscillator which is the transmitting agency.

Evans is Enthusiastic

"Rear Admiral Evans is a very busy man, but he found time to talk with enthusiasm of the innovation. Said he, 'If there is one thing more than another in the Fleet of which I am proud it is the wireless telephone. There you have a triumph of the arts of peace playing a part with the instruments of war. One can hardly realize such a thing as a wireless telephone. Just imagine it. I can talk to any officer of the Fleet over wastes of water the same as though he were in the cabin with me. It's wonderful, and its full usefulness is yet to be determined. What can we do with it in the rush and scurry and noise of battle? Will it be effective for issuing orders? It is certainly all right in piping times of peace, and I look for its future development. It will be very pleasant for me to be able at any time to call up any man during our long voyage and say 'hello' to him. If we could only talk back to New York wouldn't it be great!. But that, I suppose, is one of the possibilities of

the future. We have given up saying 'impossible'. We are certainly the first in the field.'

"Dr. de Forest, who spends his time nowadays flitting between New York and Newport News, where he is devoting his attention to the equipment of the destroyers, said in talking of his achievement, "Wireless telephony is an accomplished fact. It has come to stay. I have met with wonderful success, and when the Fleet sails every vessel will carry the wireless telephone apparatus, with the chart room of the Connecticut as the central exchange. All the commanders will be in direct vocal connection with the Admiral and each other.

"The sailing of the Fleet and the flotilla of destroyers will mark a new era in maritime communications and is just ground for pride to every American that the United States Navy is the first to adopt and demonstrate this new method, and on such a comprehensive scale."

The Cleveland Plain Dealer, December 15, '07, in a telegraphed interview with me said: "The great and almost universal appreciation of music reproduced by the gramaphone, tele-harmonium, and other devices, suggests that radio telephony may also have great utility in the distribution of music from a central station, such as an opera house. By installing a wireless telephone station on the roof the music of the singers and orchestra would be supplied to all subscribers who had aerial wires on or near their home. Transmission stations for such music would be tuned for an entirely different wave length than that used for any other form of wave telegraph or telephone transmission, and it is believed that by using four different forms of waves as many classes of music could be sent out as were desired by the different subscribers."

"Wireless telephone is the invention of Dr. Lee de Forest. When one considers what it is able to do it seems a very simple contrivance."

The above quotation is another clear revelation of the fact that in 1907 I had perfectly concise ideas as to the possibility and unique value of radio as a means for broadcasting music to the home.

From the Virginia "Pilot" Sunday, December 15, 1907: "It was a year ago in New York when Dr. de Forest began his experiments with the wireless telephone. We worked for a month

and couldn't even talk across the table. Then one night he was able to talk a city block and things, as he expressed it, looked brighter. By March the inventor was sending music through the atmosphere from his laboratory in Fourth Avenue to the Times Building a mile and a half away." -- Truly the work which he has accomplished during the past year might well be characterized as remarkable.

"The first time in the United States that talking on shipboard was done without the use of wires was in August of last year in Put-In-Bay, Ohio, where from the decks of a vessel the yacht races were reported to shore eight miles away. Along towards September the inventor began experimenting aboard the battleship Connecticut off Cape Cod, and successful talking without wires was carried on between that vessel and the Kentucky ten miles off. Then it was that the inventor came down to Hampton Rhodes for some experiments, and these were successful. They resulted in Dr. de Forest's landing from the United States Government a contract for $37,000 for the phones that went aboard the torpedo boats. When Dr. de Forest and his two assistants arrived at the Navy Yard they expected that the masts and dynamos would be in place, but nothing was ready. In six days the inventor and his assistants had all the vessels equipped.

"In the use of the wireless phones the dynamos of the various vessels are used to generate the current, and the parts of the instrument are intricate and not easily understood by the average layman. It was a tremendous mental task for the inventor to perfect the instruments, and they are considered as among the most valuable contrivances to be given to the world in recent years."

St. Louis, Missouri, Republican, December 10th: "Wireless telephone messages exchanged 13 miles by ship to Washington, December 9th on the way out Norfolk on their cruise to the Pacific, an opportunity was given to the vessels of the torpedo boat destroyer flotilla to demonstrate the usefulness of the wireless telephone with which they are equipped. Messages subsequently verified were exchanged for more than 13 miles. All of the 16 battleships about to sail will have wireless telephones."

Norfolk, Virginia, Pilot, December 18th:

"Wireless Telephone Talks with Fleet"

"Dr. de Forest's wireless telephones installed on board some of the vessels of Rear Admiral's big Pacific bound Fleet worked admirably as the ships moved out of Hampton Rhodes

and into the open seaway off the Coast on Monday morning. After the Fleet had got outside and laid its course straight for the port of Trinidad it engaged in conversation with the wireless station in the Yard, talking distinctly with the station. These experiments were continued for a long time, the operators on board the flagship Connecticut conversing with the Navy Yard here, many miles distant on an air line."

Savannah, Georgia, December 18th: "The Savannah de Forest Wireless station this afternoon was in communication with the flagship Connecticut, the Georgia, and the Minnesota of the battleship fleet. The messages showed that the wireless telephones are being used on the trip and are proving successful. The ships in the squadron carry on conversations and receive orders for formation by wireless telephone. At eight o'clock this evening the Fleet was reported as in communication with the wireless station at San Juan, another de Forest installation."

In order to give the operators of the Fleet some further instruction in the manipulation of the wireless phone on their voyage South it was decided at the last minute to put Roscoe Kent on board the flagship, to go with the Fleet and carry on a radio school at sea, as far as the Island of Trinidad. Naturally he had little opportunity to do much instructing of operators on other ships until he reached that port. Their stay there was short. Kent, completely overworked, then went to the hospital; and it was many months after when he, a pathetic wreck of what the boy was when he sailed, again returned to New York.

Immediately the Fleet was out of sight from the Norfolk Cape, I turned my attention to the installation of two radio telephones to be installed, one at Fort Monroe and the other on the mine planter tug Ringgold, installations which had been ordered by the United States Signal Corps. The tug Ringgold towed the targets in practice, and it was the purpose of the Signal Corps to report immediately the results of the shots observed on the Ringgold during target practice. These installations also, the first radio telephones purchased by the United States Army, met all test requirements; and another success was chalked up on our blackboard.

An entry in my diary dated February 13, '08 gives a brief resumé of all that transpired since I last wrote therein:

"The letters tell of my nine days on the flagship, the weird experiences amid the roar of guns, the lovely nights of vast sea and wondrous moon, as I slept in my airy nest on the forward bridge.

"The pleasant fellowship with the genial officers of the Fleet, the tension I was forever under during the tests of the telephone — these are half remembered.

"Then the trip to Norfolk -- more tests on the Virginia, the success there hard won, a great contract resulting which assured success to my enterprise (if I could fulfill, in the brief weeks allowed before the Fleet's departure). Ah, those days and nights, week in and week out, while 26 sets were building and testing! Life was hard and relentless through those weeks. Love had little leave to thrive during the race with time to equip the fleet at Hampton Rhodes, (Forget not that week of strain upon the torpedo flotilla). My impaired capital and strength and courage were drained to the last degree. Small wonder if the letters between my Love and me were not of the old type always. But love triumphed, and when at last on December 18th I almost staggered from the train at Jersey City the Dear One was there to greet me, almost too weary to realize the good fortune I had won.

"Then came a happy Christmas, Mother and Charles here with me, and the other family nearer than ever before.

"Still tedious days of anxiety and waiting. The fortnight in Chicago during which absence I received the cheerful news that the Parker Building had been destroyed by fire, that the irreplacable, invaluable samples of my early Audion tubes, outlining all its development since 1905, had been destroyed. I returned to New York to find that a temporary laboratory had been again set up in a loft on 14th Street, where my chief assistant, Leon Thomas, was doing his best to gather up a few remnants and organize the continuation of my work.

"Strange to say, the final consent to our marriage was won only after a bitter struggle, heart wrenching. The long, trying months of hard work and doubtful future had told on Nora, and doubts assailed her, hard and fast, as she sought in vain through her weary heart for the old joy, the old belief.

"I knew it was a crisis, that longer delay meant final separation, and I strove with agony of heart to force Fate to at last grant something more than hope and postponement. She and her Mother yielded at last, and the happy day was fixed. On February 14th we were united by a Justice of the Peace at Greenwich, Connecticut. Following the wedding reception in my apartment, at which my Wife (Ah, that word has meaning now!) was radiantly beautiful in a soft, pale gown of blue, we ran away to a down-town hotel. Next morning in a cold, drear rain we embarked upon the Carmania, for Liverpool.

From Liverpool and London we went almost directly to Paris. The extraordinary amount of publicity which had appeared in the American newspapers, as a result of the equipment of Admiral Evans' around-the-world Fleet with the radio telephone, aroused great interest in Europe. There had been some correspondence with the French military officials in Paris, and Nora's Uncle Theodore Stanton, who dwelt in Paris and who was a rather close friend of the then French Minister of War, General Piquart, had obtained permission for us to make a demonstration of the new radio telephone at the Eiffel Tower military station.

Considerable delay ensued before the apparatus, which was shipped from New York simultaneously with our departure, was passed through the French Customs, and finally installed in a little wooden shack about two hundred feet from the southeast corner of the Eiffel Tower, where Col. Ferrié, Chief of Radio for the French Government, an eminent scientist keenly interested in what I was attempting to accomplish, cordially extended to us every facility within his power.

At that time he was conducting most of his radio experiments and tests using an antenna which ran up only to the first platform of the tower, about 125 feet elevation. The main, long antenna from the top of the Tower was brought down to an entirely different station from the one where we installed our apparatus. Throughout all this work the young French officers were happy to render Nora and myself every possible assistance. Tests were to be carried on between the Eiffel Tower station and Mont Valerien, and later to Villejuif.

The Paris newspapers took the keenest interest in our work, recounting in great detail the installations I had made on Admiral Evans' battleship fleet, and followed carefully the results of our tests. In looking through the files of the French papers of that time now in my scrap book, the enthusiastic wonder which the French editors then displayed over the work which I had accomplished with this new instrumentality in America seems, in light of today's development in radio, absolutely astonishing. After a detailed description of the apparatus and its accomplishments, one editor exclaimed: "Thus is, in general, outlined the marvelous invention which comes to us from America, where it is no longer an experiment, but where it is actually applied and gives complete satisfaction. According to one Revue, actually with the delicacies of Chatelet, a holy personage, belittling with celestial superiority the human, says, "You, you have the wireless telegraph! We others in Paradise, we have the wireless telephone, and I here can converse with St. Peter. Thanks to M. de Forest, who is moreover of French origin, the earth has hence forth nothing to envy of Paradise - at least from this point of view!"

The New York Herald (Paris), under date of April 1st, states, "Telephone messages were yesterday for the first time sent without wires to a distance of 60 kilometres from Paris. The experiments, which were most successful, were conducted by Dr. Lee de Forest, the American inventor of wireless telegraphy and telephony.

"Dr. de Forest has been in Paris for the last two weeks making experiments for the French Government with the wireless telephone. These experiments were repeated yesterday afternoon at the Eiffel Tower in the presence of a body of French officers representing the Army and Navy. There were two Admirals among the latter. Very successful results were attained by Dr. de Forest in his experiments in telephoning from the Eiffel Tower to the wireless stations at Villejuif, some seven miles distant. On Monday night and last night from nine to ten Dr. de Forest made long distance telephone experiments using only short antennae such as are employed on shipboard, in order to show the utility of his system for naval purposes. The longest distance covered in this manner was 60 kilometres, communication being made with the Government wireless station at Melun. Later experiments will be made with the long antenna of the Eiffel Tower. Yesterday's experiments gave very satisfactory results. They believe however that other stations than those reported have heard the messages, and reports are awaited from them.

"Eventually, they say, we expect to equip every ship afloat with the wireless telephone. We are constantly increasing our range, and within a year we shall be able to guarantee fifty miles, which is sufficient for all ordinary work at sea.

Wireless telephony will be used in test reporting, in asking for tugs, and in case of danger calling for assistance, where rockets and flares are now used, but which are invisible in time of fog. When all light-houses and life-saving stations are equipped with these radio 'phones there will be no need of the old method."

The Paris Journal of the same date states: "A very distinguished American engineer has come to France with a transmitting and receiving apparatus for telephoning without wires. The first has been adapted to the radio telegraphic installation at the Eiffel Tower, the second is at Villejuif under the superintendence of Mme. de Forest, who assists her husband in his experiments.

"These have been satisfactorily completed. M. de Forest hopes to convince the French Government of the excellence of his apparatus and that, following the example of the United States, France will install this apparatus upon her warships.

"From here the inventor will go to Italy and Germany to continue his demonstrations."

Satisfied with the results of our demonstration, Col. Ferrié having obtained the desired permission from the French Minister of War, told me that I would be allowed to use the main antenna, which ran almost to the top of the Tower, for the purpose of making long distance radio 'phone tests. A couple of days of hurried preparation, allowing for the necessary changes in wave length of the transmitter and the connection of listening stations followed, and the night of the big test arrived. All evening Nora and I stayed at the transmitter, feeding records to the phonograph which was modulating the carrier current. Early in the morning, near dawn, we returned to our hotel to await results. Reports showed that we had been heard at many stations at distances of 100 and 150 miles from Paris. Two days later however I was officially informed that my radio music had been heard as far as Ste. Marie de la Mer on the Mediterranean Coast near Versailles, a distance of nearly 500 miles. This news was indeed a cause for happiness and rejoicing.

And to cap the climax, I received the following cablegram from New York: "Italy orders four sets. Shipment March 25. Remain there to install. Darby."

As soon as the reports from the Eiffel Tower demonstration were received we packed up the "cold cautery", or "radio knife" apparatus which I had brought with me from New York, and travelled to Berlin - my first visit to Germany.

Kaiser Wilhelm II was then at the apex of his power. Berlin was a magnificent and friendly city, and we found living in Germany at that time wholly delightful. I did not bring my radio telephone apparatus with me on this trip because I was satisfied that on account of the keen jealousy there of American radio progress, and rather involved patent situation, I would have great difficulty in obtaining permission for a demonstration. However I began active negotiations with the Lorentz Company for sale to them of my German patent rights, and demonstrated my radio knife to a Berlin manufacturer of therapeutic apparatus.

Their engineers expressed great interest in this new application of electrical currents in surgery, and inquired if I had ever applied the high frequency undamped wave currents to electro-therapy purposes, such as Diathermy. I confessed that I had never heard of Diathermy at that time.

I am not particularly proud in the long delay which intervened before I actually undertook to apply short wave, or high frequency, currents to obtain some of the benign effects which later resulted from long wave, low frequency diathermy. Not until 27 years later did I actually engage in this pursuit.

However the only source which was then known (in 1908) for producing undamped high frequency electrical currents, the arc in hydrogen vapor, was very poorly adapted to be included in a physician's armentarium.

During my visit to Berlin I had the opportunity of becoming acquainted with many eminent German scientists particularly interested in the wireless telegraph field. Among these were Dr.'s Zenneck, the well known author in the field of "Drahtlos", Hunnemann, Ernst Ruhmer, who quite recently, employing a Poulsen arc, had succeeded in telephoning some ten miles across the waters of the Wahnsee near Berlin; Dr. Wolf of the Lorentz Company, Graf Arco of Telefunken; and most especially Dr. Georg Seibt, a brilliant rising young German physicist, one possessing pronounced ingenuity, and who at that time was busily at work on the new system of quench spark radio telegraphy using the principle invented by Dr. Max Wien of Vienna.

In his laboratory Dr. Seibt showed me some most interesting experiments, convincing proof as to the remarkable efficiency of the quench spark combined with a high frequency (500 cycle) alternating current source. I at once realized that with the efficiency of this combination, and the comparatively high selectivity which the quench spark radio telegraph offered, as compared with the other types of spark telegraph, it should not be difficult for my Radio Telephone Company in America to enter into the wireless telegraph field, as well as that of the radio telephone.

I began therefore lively conversations with Dr. Seibt relative to his transplanting himself to my New York laboratory. He became very favorably impressed with the idea, and we left the matter open for further negotiations.

Shortly thereafter, Nora and I, having expressed back to her uncle in Paris my cold cautery apparatus, journeyed to Milan and Spezia by way of the St. Gottard tunnel and the ragged, precipitous, be-tunneled, littoral of the Italian Riviera. For our Berlin mail had brought instructions for us to proceed to the Italian naval base at Spezia, where the equipment which was being rapidly assembled in New York would be expressed, there to be installed upon four Italian torpedo-boat destroyers.

In Spezia we met difficulties galore. Neither Nora nor myself spoke Italian, but with her command of French we managed to get along very well. The apparatus was long delayed in arriving, and when installed the transmitters behaved very badly.

After baffling failures and much research it finally developed that the type of alcohol that was available in Spezia was so entirely unlike what we had been using in

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Insert after para. 4 in Tyne's page 142:

For years previously I had passionately admired Poe's poem to "The Coliseum, and as soon as I knew that I was actually to behold that magnificent ruin I addressed myself to the benign task of thoroughly memorizing those stirring lines. So here in Rome when I first entered that ancient amphitheatre, I left Nora seated in the cab, clambered up over wrecked tier and broken buttress, up to the topmost ledge, - where all its impressive vastness lay outstretched below me--and there , aloud, recited slowly those perfectly befitting lines.

Note GHC. Poor Nora! Honeymooning with Lee, an alcohol arc, and now The Coliseum!!!

New York that it was impossible to maintain the little arc in oscillation for any length of time. Finally denatured alcohol was obtained through Rome, made from an entirely different formula, approaching that of the American. Thereafter the tests were conducted in a quite satisfactory manner.

We remained in Spezia for nearly five weeks before turning over the equipment to the Italian officers. Then we journeyed on to Rome, for well merited relaxation and vacation. There again we were beset by reporters from the Roman newspapers, which notwithstanding their natural predelictions to Marconi printed long and enthusiastic reports of my work on Admiral Evans' battleship fleet, more recently in Paris, and finally at Spezia.

We remained in Rome until we received the check from the Italian Government for the four installations at Spezia, paid to us despite the frantic protests on the part of Marconi's representatives.

Marconi's representative in Milan, Senor L. Solari, judging from a one-column outburst appearing in the "Tribunal" of June 9, '08, evidently underwent a most severe conniption fit over the stories appearing in the Rome papers regarding my recent success in Spezia. (This was long before the Fascist censor was on the job!)

We returned to France through Marseilles, pausing for a few happy days at Monte Carlo. At the Exposition Building at Marseilles we again installed the apparatus which we had used in Paris, to make further demonstrations to the French steamer, Ile de France, for the benefit of a French Wireless Telegraph Company, who were now seriously contemplating purchasing my French patents. During these tests the conversation was overheard at the radio telephone station at Ste. Marie de la Mer, 78 miles away.

On my return to Paris I devoted my chief attention to demonstrating the radio-knife apparatus, which I had then received from Berlin, before a number of interested French surgeons. It was finally decided that I should leave the apparatus at the Hospital St. Louis, where it was later used in a large number and variety of surgical operations - in use until one over-enthusiastic young French surgeon, cutting with this new electrical scalpel too vigorously, too recklessly, severed a large artery of his victim, as a result of which the poor devil nearly bled to death.

The difficulty with the radio knife at that time (or cold cautery, as I then called it), lay not with the implement itself, but with the crude form of generator then employed. The small arc lamp was not reliable and showed a devilish inclination of going out of oscillation at a critical moment. It was not until years afterwards, when the oscillating Z-electrode tube was in operation, that the radio knife for deep cutting purposes was able to prove its immeasurable value to modern surgery. By which time my basic patent had nearly expired.

I had now tarried in Europe until mid-June. Nora and I were again in rural England, for a few days of rest and unalloyed honeymoon. But I had been too long away from my New York laboratory and must hurry back to the heat and rush of a New York summer. I decided to leave Nora with some of her English relatives of her father, at Baringstoke near London.

So early in June in 1908 I returned alone to New York, sailing abroad the German steamship Krown Princessin Cecillie. There I was delighted to find that the Radio Telephone Company had made good progress during my absence. The treasury was well stocked. A fine new laboratory had been opened up on one of the upper floors of the new "Terminal Building" at 103 Park Avenue, on the roof of which, two stories above us, was then being erected a fine steel tower with wooden mast atop, 185 feet above the roof; with Leon Thomas, a graduate of Clark University of Worcester in charge; and with him Frank Butler, Roscoe Kent, and one or two good mechanics.

Under these conditions I resumed work with a vim, my first efforts being directed along the line of improving my arc transmitter to obtain more power, and to get away from the inconveniences and uncertainties of the alcohol lamp flame. I turned by attention to the problem of maintaining this arc in continuous, steady operation. I found it necessary to maintain both (copper) electrodes in continuous motion, one of these a disk, dipping in a pool of water, from which the periphery of the disk could pick up sufficient water to form a constant source of steam, through the heat of the arc as it passed under the other electrode. This upper electrode was in the form of a tube of copper, the axis of which was offset at right angles to the axis of the rotating disc, the latter being the cathode. When 500 or 600 volts was applied across this steam arc powerful, but not strictly undamped, oscillations were obtained.

This type of arc was noisier to listen to than was the carbon copper arc in alcohol flame, but we found that the power radiated was several times greater than that which we had ever obtained in the arcs heretofore used. I began to design and

build larger and larger steam arcs of this type, totally unaware of the fact that in the little audion tube, which I was then using only as a radio detector, lay dormant the principle of oscillation which, had I but realized it, would have caused me to unceremoniously dump all the fine arc mechanisms which I had ever constructed into the ash can - a procedure which a few years later actually took place all over the world!

In Berlin I observed that Dr. Seibt and others who were then working on the quench spark principle had completely abandoned the old-fashioned Leyden jars as condensers for their transmitters, and were chiefly using a new type of glass jar condenser invented by Moskicki, a Polish savant. (He is today the honored President of Poland). I immediately realized that if the Radio Telephone Company was actually going to enter into the field with the quench spark it would be wise for us to acquire the American rights to the Moskicki condenser. These condensers were then being manufactured in large quantities at Friburg, Switzerland.

Arrived in New York, I immediately began negotiations with the Moskicki firm, and without much delay or difficulty was enabled to arrange a tentative contract which would permit our manufacture of this new device in the United States and Canada. Inasmuch as the process of silvering the internal and external surfaces of the long Moskicki glass tubes was a delicate and involved one, requiring very careful manipulation and skilled understanding, it was at once evident that some engineer from our force must be sent to Friburg for an intensive course of study of this new process. The thought at once occurred to me and to Capt. Darby that Nora de Forest was the ideal person to send on this mission. The idea, as explained to her by our correspondence appealed to Nora, and without delay she arranged to journey to Friburg, where throughout that summer she made an intensive study of every detail of the operation of constructing, assembling and testing the new Moskicki condenser.

August 12: "At Vineyard Haven, Rhode Island, off the yacht 'Radio' which Prest. J. D. Smith had leased and equipped with the radio-phone for demonstrations along the New England coast.

The gratifying success of our long distance tests from the lofty antenna on Eiffel Tower in Paris had convinced me that it would be possible to telephone from Paris to New York without wires. Nearing completion during that summer in New York was the lofty tower of the Metropolitan Life Insurance Company, at that time by far the highest structure in the city; and I resolved that if I could capture that tower, thereby nearly duplicating the antenna heighth which I had enjoyed at the Eiffel Tower, it should be possible to span the Atlantic with the human voice.

In Paris uncle Theodore Stanton had already approached his friend, the French Minister of War, with this ambitious idea, and had delighted me with the report that the Minister was keenly interested in the project. I lost no opportunity therefore in launching the publicity which would interest the Directors of the Metropolitan Life in cooperation with the French government in this notable attempt. As a result I find this clipping in my scrap book, a sample of many newspaper articles of similar tenor appearing at that time:

"July 1, 1908:

TEST WIRELESS ATOP EIFFEL TOWER

Dr. Lee de Forest Says His Telephone Songs Were Heard in Marseilles

Will Use High Station

Inventor Believes Paris and New York Could Converse in Code from Metropolitan Tower. Installs Instruments

"That it is possible to send messages from New York to Paris by wireless telegraph from the top of the new Metropolitan Life Tower building was stated yesterday by Lee de Forest, who returned on the Princesse Cecillie of the North German Lloyd Line from a trip to Paris and Italy, where he installed wireless telephone apparatus, and the French authorities allowed the use of the Eiffel Tower for demonstrations.

"'By the use of the long antenna, which for several nights was allowed me by the French authorities', said Dr. de Forest, 'I was able to send messages and songs by wireless telephone, which were picked up by warships near Marseilles, 500 miles away, the longest distance thus far recorded for wireless telephone.

"'I also heard plainly the messages sent out from on this side of the Atlantic by the Marconi people, a far greater distance than that of their station at Clifden, Ireland. The immense height of the Eiffel Tower contributed to all this, which was exceedingly interesting to me, and allowed me the opportunity to perform several experiments in order to perfect my own telephone instruments.

"The tests regularly made by the French Government were over the short antennae, as more closely approximating the condition on warships. The Eiffel Tower tests proved to me that it is perfectly feasible to transmit from New York to Paris from the new Tower of the Metropolitan Life Building, if the Tower of the Metropolitan Life Building can be used. During my absence I installed sets of wireless telephones on four Italian naval ships at Spezia, the home of the Duke of Abruzzi."

Success crowned my carefully laid plot for capturing the Metropolitan Tower, as indicated by the following:

August 15, '08, New York Commercial:

"FROM PARIS BY WIRELESS

Contract Signed in French City for Service to New York

Paris, August 24th. A contract has been signed with the view to immediate establishment of wireless telegraphy between Paris and New York. Experiments will be made shortly.

It was announced a few days ago that Dr. de Forest had leased part of the Tower of the Metropolitan Life Insurance Company's building for the purpose of establishing a wireless service to Paris, where the Eiffel Tower will be used as a sending and receiving station."

Note that at this time I did not expect to transmit the voice between the two cities, but to install first the quench spark telegraph apparatus, which I was confident Dr. Seibt was competent to design when he should come with me in the fall, as he had verbally promised to do. But I had the utmost confidence, and so stated, as already noted above, that it would not be many years before the human voice itself should be thus transported across the Atlantic.

These negotiations with the Metropolitan Life were carried on between myself and Mr. Ecker, who is now President of that gigantic organization. At that time the tower was not completed, and I was placed in contact with Mr. Le Brun, the distinguished architect of that notable structure. Le Brun accordingly arranged to implant on the under side of the upper lantern balcony a series of eight stout bronze hooks, to which my antenna wires could be safely attached. The transmitting station was to be installed in a penthouse on the roof of the old Metropolitan Life Building at the corner of Fourth Avenue and 23rd Street, which was ideally situated for installation of transmitting and receiving apparatus and from the roof of which the antenna could run in a clean sweep up to the lantern balcony of the Tower, a distance of some 750 feet.

The success of the radio telephone, first on Admiral Evans' ships, then from the Eiffel Tower, and later on the four Italian war vessels, had aroused great interest throughout Europe, so that now even the lethargic, unemotional, and slow-moving Lords of the British Admiralty had reluctantly condescended to purchase for trial two of my radio telephone outfits, conditioned upon satisfactory tests on board the old School Ship, Vernon lying in Portsmouth Harbor, and on the Cruiser Furious.

Therefore throughout this summer Thomas and I were busy designing and building the most improved type of radio telephone transmitter and receiver, to accompany me to Portsmouth, where I expected that Mrs. de Forest and I would carry out the prescribed tests, in much the same fashion as we had at Spezia during the preceding Spring.

Additional work which was being undertaken that summer is well described in the following newspaper article;

WIRELESS TELEPHONE IN OPERATION SOON

Philadelphians Will Be Able to Speak to New York Next Month Without Visible Conductor

Before another month has passed a man in Philadelphia will be able to speak to another in New York without the use of a wire to convey his speech; and there will be opened a new era of communication before which even the wireless telegraph fails.

Next week workmen will set about attaching a pair of wires technically known as the antennae to the flagpole of the Land Title Building, Broad and Chestnut Streets, and from this flagpole a message will be propelled through the open air to the first wireless telephone station in the country, on the Terminal Building in New York.

Both stations will form the beginning of a new system which the Radio Telegraph Company, the Philadelphia office of which is in the Land Title Building, is about to establish along the Atlantic Coast, touching at all the most important points thereon.

It is the Company's intention to get the system into working order between Philadlephia and New York in order that election returns may be exchanged between the two cities next November."

In the New York Tribune, August 18th, I stated regarding the proposed installation in the Metropolitan Life Tower:

"The radio telephone apparatus will be of 10 kilowatt capacity and capable, it is estimated, of covering 1,000 miles with the present type of apparatus. This will mean that wireless telephone communication can be established at once between New York and Philadlephia, Boston, Montreal, Chicago, and Havana, Cuba. With certain refinements of the art which I am now working on, it will be possible later on to telephone to the Eiffel Tower. Of course, the telegraph is far simpler, and it will not be suprising if this city and Paris are in direct wireless communication within the next year. Apparatus for the Tower has been under construction for some time and will be installed even before the antenna wires can be put in. The new station should be in operation on November 1st. It will mean an expenditure of about $6,000 to put the station in working condition. Due to the difference of the apparatus used in the United States and France the cost of the Eiffel Tower equipment will be somewhat more than that sum. 'Dr. de Forest says. As a paying investment Dr. de Forest is not enthusiastic over his scheme now. 'One of the first duties of the new kind of telephone, however, 'said Dr. de Forest, 'will be the sending of hourly news bulletins to ships equipped with the radio telegraph or telephone apparatus. More than one hundred vessels wireless-equipped now

enter the port of New York. Within a radius of 300 miles they will be able at once to receive by word of mouth from husky voiced telephone operators all the latest news, weather reports, stock quotations, and other information, without being dependent upon the varying skill of Morse operators. To make it even more interesting to passengers, a powerfull gramaphone there will reproduce for them all the best records of operatic and popular music."

The New York World, August 21, 1908 quotes me as saying:

"It won't be very long before you'll be able to hear Caruso singing a new opera role at least six months before the production is made in New York.'

"' The reason I am so confident, ' he continued, ' is because when I was in Paris last Spring I heard the wireless messages from the station in Glace Bay, Nova Scotia to the Eiffel Tower, and the machine used at that time was only of two horse power, while we have apparatus under design with ten times that power, which will make it comparatively easy to connect with the Metropolitan in New York.

"' The esthetic soul of the architect of the tower, Mr. Le Brun, was shocked. He thought there would be protuberances and wires that would destroy the symmetry of his tower, but not so. There were simply the eight little copper wire extending from the Tower down to the station, which will be built on the 11th story on the Metropolitan Building on the Fourth Avenue side, and these will be absolutely invisible from the street, so there will be no smack in the eye to art.

"' When I say, 'Dr. de Forest continued, 'that you can hear a new Caruso song a few hours after he sings it, I mean that if he sings in Covent Garden, London, for instance, the Gramaphone record is sent to Paris, there adjusted to our apparatus, and waved over to our tower in New York.

"' The time is not far distant when a passenger in the saloon of an ocean liner will be able to hear the strains of an opera which is being given at the Metropolitan, Manhattan, or Covent Garden Opera Houses.'"

The following translation of an article appearing during my visit in an issue of the Berlin "Beobacter" is of especial interest, as indicative of how even then I missed no opportunity of spreading my conception of the future mission of the new radio telephone - broadcasting:

"THE WIRELESS OPERA"

"The newest development in the rapidly expanding field of wireless telephony is the 'Wireless Opera." Lee de Forest, the English (sic) inventor of several systems of wireless telegraphy and telephony has now the intention to enthuse the most

important personages in London with his plan - to transmit an entire opera by the air of wireless telephony to an unlimited number of listeners.

"'Every man who dwells within the radius of 30 English miles of Covent Garden Theatre will be able to hear the opera within his own home by wireless. The apparatus necessary therefor is so cheap that every person can purchase one. The receiving apparatus is extraordinarily simple, and so small that it will cost only 60 marks ($24). All that the subscriber to the wireless opera has to do is to string a receiving wire to the flagstaff upon the roof of his house, to which the receiving and listening apparatus will be connected. The cost which will be imposed on him during the opera season will not exceed 4 marks monthly.

"' I have already transmitted a solo part over a distance of 30 English miles with satisfactory results, and the wireless transmission of music which will be played by the orchestra in any London theater, or sung upon any stage, is only a question of time.'

"Lee de Forest with his wireless telephone system installed on the warships of the United States has obtained good results at a distance of 40 English miles."

On September 1st, with Capt. and Mrs. Darby, I again set sail for Europe, again on the Krown Princessin Cecillie. Nora finished her work at Friburg in time to board my steamer at Sherbourg. Then the four of us journeyed together to Bremerhaven and Berlin. Our stay in Berlin was short this time, sufficient to close up some patent matters which had been pending awaiting my patent attorney's presence. We also closed the contract with Dr. Seibt whereby he was to journey to New York about the first of the year, to carry on his work in my laboratory.

Leaving the two ladies to return alone to London, Capt. Darby and I went down to Friburg, where we closed a formal contract with the directors of the Moskicki Condenser Company.

In London, while we were awaiting instructions from the British Admiralty to proceed with our installations at Portsmouth harbor, Nora, who had from her childhood been following in the footsteps of her Mother and her notable Grandmother, had always been an ardent suffragette, anxious to aid in that cause, in America or England. She now joined in a long suffragette parade through Hyde Park and down Whitehall to the Houses of Parliament. I stood by and applaudingly watched her pass, for I saw no reason why women should not be given the vote; and could not but admire the pluck and courage of those thousands of determined marchers. But Mrs. Darby's outspoken disapproval of the whole proceedings added nothing to the happiness of our remaining weeks in England.

The success of our tests at Portsmouth can best be described from the following, taken from the New York Commercial of October 2, 1908:

"TALKED FIFTY KNOTS BY WIRELESS

Dr. de Forest and his Wife Conduct Telephone Tests on British Warships

London, October 1. Dr. Lee de Forest, working on instructions from the Admiralty, has just concluded very successful tests of wireless telephone between warships and Portsmouth Harbor. Dr. de Forest operated the transmitter on board the cruiser 'Furious', while Mrs. de Forest was at the receiver on the school ship 'Vernon', both of which vessels steamed at full speed until more than fifty miles apart. As a result of the tests, Admiral Gamble, who superintended the experiments, has recommended that the Admiralty install two complete sets of instruments. Dr. de Forest said tonight:

'We talked at a distance of 50 knots, the longest authenticated record during such tests from ship to ship. The accuracy of the system really surprised me, especially when I consider the fact that we suffered severe interference from wireless telegraphy. Furthermore on board the Vernon they were testing condensers with a big spark gap, only two cabins from our receiver. Our tests consisted mostly of repeating New York stock quotations. Out of fifty figures there were only two mistakes.

'We have arranged for a British firm to take over our patent rights. I will shortly go to Paris to complete arrangements with the French Government for wireless telegraphy between the Eiffel Tower and the Tower of the Metropolitan Insurance Company Building in New York. Wireless telephony, the possibilities of which are enormous more than of wireless telegraphy may be established between Paris and New York within five years.'"

The effect of these demonstrations upon the British mind is well expressed by the following extract from the London Evening News of that date:

"From our special correspondent, Portsmouth, Thursday:

I learned that highly successful tests have been carried on on British warships with the de Forest system of wireless telephony. As already explained in the Evening News, it will be possible when the system is in operation for the officials at Whitehall to carry on conversations with the officers on ships in the harbor here.

Later in the evening the experiments were repeated for the benefit of a high official of the Admiralty, who expressed himself as more than convinced of the desirability of installing the system permanently. Dr. deForest's transmitting station was in a specially provided cabin at the stern of the Furious, whence a wire was run up the mast and across to the flagmast, where the end was suspended on insulators.

"At present Great Britain is behind Italy as well as America in regard to wireless telephony, but it is evident that this state of things is not to be allowed to continue."

One of the greatest thrills I ever had during this

season was to read the following from the Pottstown (Penn.) Ledger, October 23, '08, an interview with Marconi:

"And, going back to my own hobby of wireless communication, I want to say that we shall not have to wait long for the wireless telephone. De Forest and his colleagues are doing great things in that direction." Shades of Hertz and Maxwell! I never expected to live to see a tribute like this coming from Marconi!

After the Portsmouth tests I made a hurried trip to Paris where I conferred with General Picard, Minister of War, who was then deeply interested in plans for establishing wireless communication with New York. He promised to do everything within his power to facilitate the plan. While officially censored on behalf of the French Government, Gen. Picard wished it to be understood that the Government's object was solely to facilitate scientific experiment.

From Paris I again returned to London, whence Mrs. de Forest and I shortly sailed aboard the Lusitania for New York, where I landed October 30th, well satisfied with the results of my European trip during the year, but much disappointed to find that the Metropolitan tower was still uncompleted.

The New York Sunday World of November 1st, describing our arrival, had this to say:

"As the big Lusitania plowed her way majestically up the river to her pier there suddenly burst out from the rail a big purple, green and white banner bearing the cryptic symbol, 'Votes for Women'. Behind it beamed a tall, slender, young woman who didn't look the blue stocking in the least, Mrs. de Forest, wife of the inventor and scientist. Describing her trip: 'That was great fun,' added Mrs. de Forest. 'We were in lovely Spezia and the Italian Govenment wanted us to equip four Men of War. We taught classes of Italian officers, handsome creatures in gorgeous uniforms. I took one class, Dr. de Forest another.'

"'I need not state that her class was the more popular. There was one young naval lieutenant in boots, bearing a saber--fancy on shipboard! He came for three days and remained a fortnight. He gave a glowing report to his Government!'

"'You speak as if it were play. How could you learn electrical engineering?'

"'I had so much mathematics and hydraulics in college - it really is wonderfully fascinating.'

"'Dr. de Forest had to come home on July 1st and I stayed a month in the little old sleepy town of my birth and childhood, Baskingstoke, and then suddenly my husband cabled me to go to Fribourg, Switzerland and learn electrical condensing.' She went on to explain, 'I am one of the Directors of the De Forest Radio Telephone Company, being fond of executive work, and the Company

thought as long as I was over there I might as well look over the foreign patents and study the condensers in Switzerland, so that we would know how to make them in our future factory in Jersey City.'

"'Factory?' 'Yes, a condenser factory as well as a plant for manufacturing the wireless instruments. I am to be Supervisor, and I shall have my hands full for the next six months, as soon as I get my house in order. I see we need some new curtains.'

"'What about England and Germany?'

"We visited Germany on some other business and I did not do anything but translate, and helping with contracts. At Portsmouth, England we made tests for the British Government. There we spoke fifty knots apart, about 58 miles, you know. Dr. de Forest went on a ship going out to sea and I stayed on land, because I am always so seasick. Then we talked by wireless. The tests were splendid and everything worked out well. We had a beautiful time. Of course I did some suffragetting. I marched in two parades in London, and I carried a nice big banner marked "League for Self-Supporting Women in New York City." My mother's band of working girls numbers 30,000.'

"'Dr. de Forest returned to Europe in September, and after our English work we came back; eight months of delightful vacation.'

"'And this is our wedding breadfast,' broke in the husband, 'a little late, but American anyway.'

"'We have leased a station on the roof of the Metropolitan Life Tower, and offices on the ninth floor,' said the inventor. 'From that tower not long from now will be sent a message to the Eiffel Tower in Paris. We will literally put a 'girdle around the earth in thirty minutes' yet. Nora shall send the first message, but her work for the immediate future is managing the new factory in New Jersey.'

"'What are the prospects of wireless?'

"Both bride and bridegroom were all enthusiasm again. It has come, they were sure, to revolutionize science and human industry. It is rich, they believe, in far reaching possiblities, and wireless telephony, they feel, is bound to come."

The remaining months of that year were exceedingly busy. The business of the company had outgrown the manufacturing facilities of my laboratory, so the Newark factory was rented, including a large annex for the manufacture of the Moskicki condensers. Pending the completion and equipment of that factory, and the arrival of the necessary parts for the condenser manufacture from Switzerland, Mrs. de Forest went to work alongside of me in the laboratory on Park Avenue.

This continual propinquity, at home and in the office, where we were engaged in almost identical tasks, proved to have been a grave

mistake - the first flew in the texture of our love, the first rift in the lute.

Naturally I was working under great stress and drive, on my various improvements in the radio telephone transmitter and the audion detector and amplifier, training my men and looking sharply after a thousand pressing details. The results of such tension were bound to react unfavorably on one of somewhat similar traits, and filled with the instinct and yearning to work independently, away from constant domination.

About this time E. J. Simon, a young Columbia graduate, who was madly enthusiastic on the subject of radio, whose sparkling black eyes radiated continuous, and contagious, enthusiasm whenever we discussed his favorite subject, soon became a fixture in my laboratory.

In the summer of 1908 the Great Lake Telephone Company was incorporated as a sub-company of the parent concern, and Roscoe Kent was sent to Cleveland, Chicago, and Milwaukee, to superintend the erection, selection of sites, and erection of high steel towers in those three cities. The one in Toledo dated somewhat earlier.

Meanwhile I devoted most of my time to the growing problems of the Metropolitan Tower installation. The almost continual daily tests from the Park Avenue Terminal Building which included the transmission of voice and music to all who has receivers to hear, acted like sun and rain upon the growing crops in the spring. Enthusiastic listening "hams" began to spring up all over southern New York and Eastern New Jersey. As soon as our tower was erected on the roof of the Newark factory intercommunication telephone tests were a frequent occurrence.

Shortly before this the Stone Wireless Telegraph and Telephone Company of Boston had been compelled to terminate its activities, and some of Stone's best engineers now came with my Company. Foremost of these were Frederick Kolster, George Lewis, and Oscar Roos. So when Dr. Georg Seibt arrived, about the first of January, 1909, a highly skilled and competent organization was rapidly built up.

We were primarily busy now in the development of the quench spark for wireless telegraph, on which Dr. Seibt and Emil Simon concentrated especially; the improvement of our "synchronizers", or tuning devices to aid in elimination of interference; the manufacturing of transmitting and receiving equipment at the Newark factory; the installation of new stations going up on the Lakes and elsewhere; and the training of competent operators to be put in charge of those stations.

On the ninth floor of the Metropolitan Life Tower we opened a sub-office which was devoted wholly to the display and

sale of amateur radio receiving apparatus and parts, or our own manufacture, the first office or store in the world devoted wholly to the sale of radio apparatus to the public. A recent Harvard graduate, friend of Leon Thomas, Quincy R. Brackett, was placed in charge of this rapidly expanding end of our business. Brackett thereby became the first radio salesman in the world.

Dr. Seibt had brought with him from Germany many improved forms of radio receiving apparatus, such as new couplers, variable condensers, and the like. These we modified to meet American requirements, and began to manufacture on an ever increasing scale in our Newark factory. The business of our company began to grow by leaps and bounds. The Moskicki condenser manufacturing plant at the Newark factory, after overcoming one long series of difficulties, over which Nora de Forest, (aided by Mr. Giles, the Friburg engineer who had recently come over) successfully triumphed, was finally put into production. So that in the spring of 1909 tall batteries of reliable Moskicki condensers, which did not break down, were available for our new quench spark radio transmitters. The best and most powerful of these latter was, of course, immediately installed at the Metropolitan Tower. And ere long reports began to trickle in to New York from ships, and wireless stations down the Atlantic Coast belonging to the United Wireless Telegraph Company, of astonishing distances over which that high keyed, 1,000 sparks per second, note was heard and messages read through static and intereference which completely obliterated communication by the old low frequency spark of the United Wireless.

Naturally attempts were immediately undertaken to interest the United States Army and Navy officials in the advantages of the quency spark telegraph system. They began to follow the development of the new type of telegraph with the greatest interest, but it was not until the latter part of 1909 that we received our first contract, that from the United States Army Signal Corps.

But in the meantime my broadcasting efforts were by no means neglected. Mrs. Harriet Stanton Blatch, thoroughly alive to the possibilities of the new medium for popular propaganda work, eagerly accepted my invitation to deliver a talk on Woman Suffrage from the newly opened radio telephone station in the Metropolitan Life Building. Her speech was unquestionably the first radio telephone broadcast which might be classed as propaganda. The size and make-up of our audiences at that time were not such as to justify any particular hope on her part of having accomplished very much for the Cause which was so dear to her heart. However, considerable newspaper publicity resulted from the effort, which can be set down as a landmark in the history of radio development.

About this time the Philadelphis station on the top of the Land-Title Building, equipped with both the quench spark transmitter and the steam-arc telephone, was opened up. But inasmuch

as both our Terminal Building, and (usually) the Metropolitan Tower, stations were continually upset as our various tests and experiments were carried on, it became necessary to open another New York City station for communicating with Philadelphia. This was installed in the upper dome of the Manhattan Life Building at 52 Broadway.

It was daring indeed to select this point, for there we could be sure of the most complete and hostile interference possible to imagine. Nevertheless, as the dome was copper-sheathed, I was willing to accept this challenge, anxious to test a great variety of anti-interfering circuits which I had in mind, following the teachings disclosed in the Stone patents, but using especially the three coil pancake tuner, which I had found so effective in Havana and elsewhere.

In Philadelphia the situation was no better, as the United Wirless Station was on the Bellevue-Stratford Hotel, only a block from our Land-Title Building station. Nevertheless, by completely insulating the three different stages of my receiver, antenna, intermediate and receiving stages, each in a separate wire cage, all grounded, and with a high degree of loose coupling between the successive stages, and aided by the 1,000-spark frequency and the high selectivity afforded by the quench spark gap transmitter in New York, I succeeded in astonishing myself and my operators by actually enabling them to copy, regularly and at high speed, wireless telegrams from the Metropolitan Life Tower. And even up in the dome od the Manhattan Life Insurance Company Building, from the porthole windows of which one might actually spit upon the roof at 42 Broadway, good old "Burch" Burchard was actually able (when sober) to copy Philadelphia when the boys below us were doing their damnedest to interrupt our communication.

That was a good many years ago. We then had only the audion detector (and as effective forms of loose coupling as we know today) but I actually doubt if very much more effective work in cutting out vicious, near by, tremendously powerful interference had ever actually been accomplished than that which my operators at Philadelphia and New York succeeded in then overcoming. The old-fashioned spark gap and the carborundum detector which United was using at 42, and Pickerell up in the Marconi station on the Waldorf-Astoria with my old three-slide tuner, were simply put out of the running during those lively wars of interference in 1909 and 1910.

In order to be near to the condenser factory in Newark, where she then found it necessary to spend all of her time, Mrs. de Forest now decided to take up her residence in the little town of Milford, New Jersey, leaving to me the life of a bachelor in our Riverside Apartment. Her Mother had given up her apartment also and moved down to that little village to make a home for Nora, who was expecting a visit from the stork during the following June. This consideration alone made it quite impossible for her to dwell in our Riverside Apartment and make the long, tedious journeys by subway, ferry, and train to and from Newark twice daily.

I plead with my wife now to forget for some months to come all thought of her work and duties in the factory and to the company, but, sadly, without avail. The old urge and zest for engineering employment and hard, concentrated creative work which she had put behind her during the months of our courtship had now taken a renewed and redoubled hold upon her heart and mind, so that there appeared less and less room in her heart for those emotions and devotions which had meant so very much to me and to us both from the hours of our first acquaintance, until I had made the great mistake of making her a partner so to speak, in my daily tasks in laboratory and office. My subsequent observations had convinced me that such a form of close business cooperation between husband and wife very seldom results in increased or prolonged happiness for either. So, looking back upon the history of our romance and of our married life and subsequent developments, I am not at all surprised by the unhappy course of the history which follows.

Quite naturally the total separation which ensued, when we lived apart and I saw her only when I visited the Newark factory, did not prove conducive to a restoration of the old affection in our innermost understanding. The rift between us gradually widened, and not even the approaching birth of our child proved adequate to heal. A further element was the pronounced dislike which Mrs. de Forest developed towards the business managers of our company and their policies. Far better would it have been for me had I at that time shared her suspicions, or her womanly intuition, but I was so wholly occupied with the technical and engineering aspects of the company's development, realizing that Smit and Compton had actually done a surprisingly fit job of financing the company under such difficult conditions, and neither Capt. Darby nor I were disposed to drastically interfere with the fiscal management of the organization.

In the spring of 1909 our books showed that the treasury had some $125,000, and obligations and liabilities not exceeding one third of that amount, while the Great Lakes Wireless Radio Telephone Company, with stations at Chicago, Milwaukee and Cleveland to its credit, with a slowly growing number of lake ships equipped, also had some $100,000 in its treasury. So everything looked well and prosperous, for this my second enterprise, which seemed to be thoroughly on its way to making a permanent and ever enlarging success.

At a Directors' meeting in the late spring of that year, the President of the Company, J. D. Smith, tendered his resignation as an officer and Director, coolly informed us that

the last block of 20,000 shares of stock which had been sold had been taken from his own, and not the treasury's holdings and presented a balance sheet showing that the company was in debt some $40,000 and had practically no cash in its treasury; wished the remaining Directors of the Company every success and good fortune, closed his desk, and walked out of the door of the office.

On January 24, '09 the world was starled by the widely published newspaper reports of distress signals received by wireless from the steamship Republic, which was then in a sinking condition. This was perhaps the most prominent and widespread recognition of the inestimable value of wireless on shipboard. But the story of the Republic recalled numerous other instances of aid rendered those in danger of shipwreck, both actual and imminent, and the many less serious but almost equally frightful experiences of sea travellers in distress, whereby the value of wireless in making known the situation to passing vessels and to persons on shore, had been abundantly proved.

In American waters the De Forest wireless system had from the beginning done its full share in this magnificent work of salvaging property and lives. The following clipping appearing in the Norristown Herald under date of January 28, 1909 recalls that the first important use of wireless in the cause of saving vessels in distress was probably that of the Standard Oil Company's whale-back steamer, City of Everett. An interview with the skipper, Thomas Senlon, prompted by the Republic's disaster, raised a vital point for the consideration of Congress, which was then deliberating proposed legislation for the establishment of wireless telegraph apparatus on all vessels carrying sixty or more passengers.

"Captain Senlon claims that vessels from the other side of the ocean use the Marconi system while those from this side use the De Forest system. He declares that there is intense rivalry existing between the two. In fact he says that a prejudice exists. This was shown when the Republic refused to answer the wireless of the Everett, although in most urgent need of help. (And by the irony of fate not long after the operator of the Republic himself was madly clamoring for aid.)

"'My wireless operator, Finkelstein, caught the call for help, CQD, shortly after six o'clock Saturday morning,' said Captain Senlon, 'and reported to me at once. Only the fact that he was able to read both the De Forest (Morse) and the Marconi (Continental) codes made this a possibility. I had the operator repeatedly attempt to get into wireless communication with the Republic by the De Forest code, but we waited in vain for an answer."

Capt. Senlon's statement recalled the following item, dated October 20, 1904:

"SHIPS SAVED BY WIRELESS

News of the Everett's Plight Brought
The Lucas to Rescue

"A letter received by the De Forest Wireless Company from operator Heimbecker on board the S. S. Lucas brought information yesterday that by means of the wireless apparatus installed on that ship and on the steamer City of Everett, the latter vessel was discovered to be in a sinking condition in a storm that raged all day October 9th and most of the next day.

"Heimbecker was at the receiver when he found another steamer calling. He established immediately connection with the operator on board the City of Everett and learned that a hatch of the forward hold had been washed away and that she had shipped so much water that the Captain feared she might founder any minute. The Lucas stood by for 29 hours, placing herself between the damaged steamer and the wind, thus enabling the City of Everett to make the temporary repairs and pump out the water in the hold. She then proceeded to New York while the Lucas continued on her way to Port Arthur."

At this time the House of Representatives Committee on Merchant Marine and Fisheries was actively considering the question of compulsory wireless telegraph equipment for ocean steamers. Representative Cox of Indiana told the Committee that he would carry the fight to the floor of the House if the bill was not made applicable to the Great Lakes also.

At this time the Great Lakes stations of my Company were nearing completion. Owing to the lake shippers who were seriously considering the equipment of their lake vessels with wireless telephone or telegraph, my Company was naturally active in urging the passage of such eminently wise legislation by Congress. Representative Wilson of Illinois told the Committee that the 170,000 persons who travelled annually on the Great Lakes ought to have as much protection as the few thousands that journeyed on the sea.

In view of today's universal acceptance of the value and practically unanimous willingness on the part of vessel owners to equip their ships with wireless, it is difficult to believe that other members of the Committee expressed the view that the extension of the bill to the Great Lakes would work a hardship to owners without a justifiable return to passengers, as travel "is safe at present on the Lakes"!

Representative Whaley of Maine advised the Committee to go slowly when it was proposed to hold captains and officials criminally responsible for violation of the proposed law, the Burke Bill!

During those hearings representatives of the American De Forest Wireless Company, United Wireless Company, and the Radio Telephone Company were present, Capt. Darby, for our company, insisted that the Bill should make provision for increasing wireless telephonic apparatus, making the point that unless such provision was made the sudden death or disablement of a wireless operator would render the apparatus useless. He stated that the wireless telephone was now thoroughly practical, being used in the Navy, and had operated with great success up to 100 miles.

As usual, the Committee debated this wireless legislation endlessly, and no definite steps were taken in Washington at that time.

An interview with me published in the New York Times February 14, 1909 may be interesting:

"Dr. de Forest, in discussing the advantage of the wireless telephone over the wireless telegraph, said that the telephone is so simple in operation that any ship's officer could understand it. He pointed that if Binns, the ship's operator, had been killed in the Republic's collision with the Florida, in which the wireless house was wrecked, there would have been no one else on the ship to send out calls for help. Such is not the case on ships that carry the radio telephone apparatus, he says, for a dozen men can be ready to step into the breach.

"'Up to this year,' Dr. de Forest said, 'the developments in the wireless art have been almost rudimentary. What the future of it will be neither I nor anyone else can foretell. At present I am working on the telephone, the telegraph, and ship warning devices. The possibilities of the telephone are almost limitless, and I confidently predict that within the next few years every ship of a certain size that goes to the sea will be equipped with the wireless telephone.

"'I look forward to the day when by this means the opera may be brought into every home. Some day the news, and even advertising, will be sent out to the public over the wireless telephone.'".

In that interview I predicted many developments in radio, some of which have even yet not been realized, but are sure to come eventually.

"'In my new system (undamped wave) the tuning possibilities are almost limitless. Furthermore it is noiseless and can be operated at a much lower voltage than can the present spark system. The speed by which a spark transmitter can be operated can not exceed 40 words a minute. I expect to eventually attain a speed of 40,000 words an hour. There is no question but that the public can easily be induced to communicate by wireless instead of by mail. It must be done however at greatly reduced cost, and this is not possible by the wire system. Some day you will see a radio system installed on trains, by which one locomotive will be warned of the approach of another. This will prevent accidents which happen today when the block system fails to work.

"'A few years after Dr. Roentgen discovered the X-rays surgical operations were possible that were unthought of before his discoveries. Who can say that some such discovery will not be made in radio telegraphy and telephony at any time?'"

In view of the astonishing developments made possible by the development of the Audion tube during the succeeding decade, these words of mine in 1909 possess interesting and prophetic significance.

At the dinner given by President Smith to the employees of the Radio Telephone Company, held in Fraunce's Tavern at that time, an intensely interested guest whom I then first met, was Hugo Gernsback, who had shortly before established the first publication devoted to experimental work chiefly in wireless, "Modern Electrics". Gernsback was a daring pioneer in his field, endowed with enthusiasm, and to an unusual degree the gift of prophecy in this new and rapidly expanding field, in the recording of which his journals were to play such an important part through the years ahead.

Under date of February 20, '09, the Jersey City Journal stated editorially:

"Dr. Lee de Forest's predictions regarding the wireless telephone are bolder than the dreams of fiction, yet enough has already been accomplished to justify his prophecy.
* * * *

"He foresees the time when news and even advertising will be sent out to the public over wireless phones, and when the opera will be brought into every home by the same means. * *

"The world today listens to de Forest and pioneers of his class with an almost boundless faith. From what has been done no man would venture to place a limit upon what may be done in the domain of applied science. The general feeling is that only the surface of the field has been scratched."

The Atlanta, Georgia, Journal, under May 20, 1909, quotes me as follows:

"I look forward to the day when by this means the opera may be brought into every home; some day the news, and even advertising, will be sent out to the public over the wireless telephone."

St. Louis Post-Dispatch, February 21, '09:

"One of the chief claims for the de Forest system, however, is that it will become so inexpensive that it can be installed at a cost of not more than $15 by anyone, and enabling a person to hear an opera 30 miles away. All the individual will have to do will be to put up a flagpole on his dwelling, the cost to the subscriber during the opera season being estimated at 80 cents or $1.00 a month."

Another extract taken from the full page story on the wireless telephone, appearing in the Chicago Inter-Ocean, May 16, 1909:

"Still another feature of the invention, or rather, the benefits that may be derived from it, is for supplying music and other forms of entertainment to passengers travelling on passenger vessels. A service of this kind, aided by a huge receiver, so that all the passengers gathered in a large saloon could hear the music or operatic airs simultaneously, should prove a most valuable innovation for steamship travellers. It is within the range of possibilities at an early date that the traveller by Great Lakes steamers may be able to spend his evenings listening to the voices of Caruso or Melba simultaneously with the audiences who see the singers in person at Covent Garden, London, or the Metropolitan on Manhattan Island in New York."

In the latter part of December, 1908, I was visited by a special envoy, Henry Levin, who was sent from the Russian Government at St. Petersburg to learn the details of the radio telephone and to discover the practicability of the wireless telephone for the purpose of using it along the shores of the Caspian Sea, as the impossibility of uninterrupted use of the usual means of communication had been demonstrated.

Quoting from the New York Morning Telegraph, December 28, 1908:

"Mr. Levin spent several hours yesterday at Dr. de Forest's laboratory, after having listened at the receiver of the new "aerophone" in the company's experimental office in the Metropolitan Life Building. The representative of the Czar heard the langorous music of the 'Merry Widow Waltz', followed by the Russian National Anthem, a hymn, and the popular ballad, 'I Want Those Presents Back'. Then the voice of Dr. de Forest came to him, floating across the windy distance from the Terminal Building, wishing the Czar and his representative a Merry Christmas. Mr. Levin recognized the voice of the inventor at once and commented upon the fact that there was no interruption or disturbance at all, notwithstanding the fact that several wireless telegraph stations were operating in the immediate vicinity" (the nearest being the United Wireless station on the Waldorf-Astoria, and another the Marconi station on the roof of the Wanamaker Building at Eighth Street, where a young wireless operator by the name of David Sarnoff was presiding.)

"Mr. Levin has been a patron at the Murray Hill Hotel during the weeks he has spent studying the commercial value of the radio telephone, and will recommend to the Czar that a series of stations be installed along the shores of the Caspian Sea."

During all this period the Audion tubes which we had been using were exclusively manufactured by the McCandless Company in New York City. From the first tube up until 1909 the Audion tube envelope was cylindrical in shape, with candelabra base. The first filaments were of carbon; but it was not long before I substituted tantalum, and then, after a more ductile type of tungsten wire came upon the market, substituted for tantalum tungsten. In the first electrode tube the grid and plate leads came out through the wall of the tube just above the candelabra base. The only sample still existing of this early type that I know of is a small one which I gave in 1925 to my good friend, General Ferrie of Paris, where, so far as I know, it still reposes in the Archives of the French National Radio Museum.

But before we equipped the first ship in 1907 or even the yacht Thelma, I had modified the construction so that the plate and grid terminals came out the upper end of the cylindrical tube in two flexible leads. The grid wire was invariably sleeved with a piece of green insulation, the plate lead with red. This was easy to remember, as the "G" stood for grid. At first I called the plate electrode the "wing", as is indicated by some of the early patents, but later the anode was called the plate and continued to be so called up to the present time.

My terminology of the two batteries, the "A" for the filament and the "B" for the plate, has continued through all these years. Along about the summer of 1907 I conceived the idea of having two filaments instead of one in the audion, one as a spare, and McCandless accordingly brought out a small flexible wire from one end of this spare filament. I have before me a booklet entitled, "Instructions; de Forest Radio Telephone. Type C Apparatus" which gives full instructions to the operator for connecting and operating the arc oscillator, for tuning the transmitter, instructions as to how best to speak into the microphone, how to switch from transmitting to listening, etc. The receiving apparatus as described in this booklet, may be of interest today:

"Audion receiver lighting voltage: The audion filaments are made for 3 volt storage battery only. Higher voltages must not be used. Rheostat should be all in when connecting up a newly charged storage battery. That is, have rheostat turned as far in a counter clockwise direction as possible. Audion filament should be bright, but not excessively incandescent.

'Battery B

The Telephone Battery is in a box marked in blue print, 'Audion battery box'. The switch arms for same are on the front of this box. Sixteen cells are in all the time. (There were 50

volts available in a new dry battery, but the average audion tube of that day, on account of its incomplete exhaustion, gave a 'blue haze' if more than 24 to 32 volts were impressed across it.)

"Double Filament Audions

The double filament has twice the life of a single filament. When the first filament is burned out, unwrap the small bare copper wire which is coiled around the glass neck of the bulb and tuck it under the little brass tip which is soldered onto the outside cap of the stem; or put this copper wire around the wire stub soldered to the cap. This will put the second filament in the circuit, and Audion is then to be replaced in its receptacle inside the box.

"Connect the red wire leading to the large post marked 'B', the green lead to the post marked 'G'.

The two coil pancake tuner was then described.

In the apparatus installed on the Fleet in the fall of 1907, two Audions (we always used two with a cut-over switch so that if one burned out the second one could be instantly put into commission) placed inside of the battery B box, on top of which was located the pancake tuner. The idea of putting the audions inside the box, with the glass window through which they might be viewed, we found an excellent one to prevent the too easy stealing or "losing", of the precious bulbs. There were but a few of these in existence as they were not easy to manufacture, so we charged at that time a goodly retail price for these little lamps, which were cherished like precious gems by the operators and those amateurs who were fortunate enough to own one. Six and sometimes eight dollars, apiece was the "popular" price at that time. Today, when manufacturers of radio tubes are compelled to sell a lot of six for less than two dollars, their mouths water and they look pop-eyed at the price lists for audion tubes in those good old days.

It was in 1909 that McCandless recommended that we change the shape of our tube from the tubular to the bulbular type, still retaining that feature of plate and grid emerging from the end of the bulb opposite the filament. He found the bulbular type was much easier to manufacture.

Writing of McCandless and his early efforts to comply with our requirements in the manufacture of suitable three-electrode tubes, recalls vividly to me the fact that in the latter part of 1906, after one of many visits to McCandless' shop, I

jubilantly strode up 14th Street to Fourth Avenue, and then to my Parker Building Laboratory carrying in my coat pocket the entire world's supply of radio tubes, just two in number! At the time that I write this, 1939, it is estimated that radio tubes are being manufactured in various centers scattered over the face of the globe at the rate of 2,000,000 per day.

Newspaper cuts in my scrapbook of the period of 1909 show that at that time the two little audions, detector bulbs, still cylindrical in shape, had been taken out from the Battery B box and were mounted on the front part of the double pancake tuner box. On the end of this box, below the two audions, was mounted a type of "perikon" crystal detector which could be switched into circuit in place of the audions in case both of the latter were burned out, or (which was more frequently the case) the operator wishing to preserve the audion for long distance work used the crystal detector for easier ranges, where the superior sensitivity of the audion detector was not needed. But mounted in this fashion each audion was protected by a conical shaped wire cage set over the tube to prevent its being accidentally jarred or broken off by the operator. Perhaps these cages should have been locked!

The transmitter consisted of a handsome mahogany box containing two pancakes, primary and secondary, mounted so that the coupling between the two could be varied. The little carbon arc with the alcohol lamp was mounted on a bracket to the right-hand side of the cabinet. The microphones and mouthpiece were mounted on a standard telephone arm projected from the front of the cabinet. Two special carbon microphones, one on either side of the tapered end of the mouthpiece, were mounted on this arm in such a manner that the voice waves acted on both diaphragms. The two carbonbbuttons were connected in series in the earth connection between the secondary pancake and the ground. The slide tuner for adjusting the inductance in the secondary transmitter pancake was arranged so that the knob for sliding the contact came out through a slot cut in the front of the cabinet, where it was easily accessible to the operator.

That type of microphone and carrier-wave modulation was quite satisfactory so long as the smallepower arc oscillator was used; although there was a tendency for the carbon granules to pack, greatly reducing the modulation, or causing at times complete silence. So the operator had alwwys handy a pencil, or screwdriver, with which he could tap (more or less gently) the microphone to restore articulation. At other times the conversation could continue for long periods without interruption.

However when it became necessary to greatly increase the power of my transmitter, as with the arc in steam and with higher voltages, it was necessary to look for a better microphone device, capable of successfully handling 5 or even 10 amperes of high-frequency current.

Dr. Seibt suggested a "jet-microphone" with which he had done some experimentation in Germany, wherein a source of acidulated water, continually renewed by a small circulating rubber tube pump, supplied a fine jet which played on, or grazed against, a plate or baffle, of metal or carbon. This jet could be agitated by sound waves in a variety of ways, directly or electrically through a carbon-microphone-controlled circuit.

Dr. Seibt and I spent considerable time on this fascinating, by no means simple, research, and made some interesting progress (incidentally damaging considerable good clothing through acid spray). But before we had achieved anything which could be called practical the growing demands on Seibt's time by the quench spark development took him off this problem; and I was so frequently called out of town to supervise the field installations that this work was never really finished.

Meantime better and larger carbon microphones (from Germany) were obtained, and these in nests of from 2 to 6 in series-parallel (sometimes water-cooled) proved adequate for our requirements, up to the point where my radio-telephone development work was totally suspended by the collapse of the Company, in 1910.

On the top or the cabinet, or on the wall directly behind same, was mounted a rather large, hot wire ammeter, connected directly into the antenna lead, in such a manner that the operator while talking, could keep his eye upon the needle of the ammeter and thus determine by its fluctuation whether or not his voice was properly modulating the antenna-earth high frequency current. A small carbon filament bulb was also mounted on the front of the cabinet directly in view of the operator. By the glow of this lamp he could instantly tell whether or not the oscillator was in operation. The carbon of the little arc light was operated by a solenoid, so that it automatically fed against the copper anode, and in such a manner that if the arc should suddenly extinguish the solenoid would act to automatically strike the arc again.

The entire transmitting apparatus was compact and simple, possessing in almost every respect the characteristics which have, I think, distinguished my work in wireless and radio design since the very beginning of my work.

As evidence that at least as early as 1909 there were a sufficient number of radio hams with transmitters to cause very bothersome interference with wireless communication, is evidenced by a letter from myself appearing in "Modern Electrics" addressed to the "Wireless Association of America" to which organization I had recently been elected Honorary President.

"To the Members of the Wireless Association of America:

According to numerous authentic reports in the daily press, the question of wholesale interference - whether deliberate or unintentional matters little - on the part of wireless amateur operators, has recently become acute.

"Governmental stations have suffered most from this cause, on account of the great importance and urgency of much of their business; and wireless stations not equipped with perfected tuning devices have also been seriously interfered with by the countless spark stations of energetic but unthinking students.

"It is not the desire of anyone to put a damper on the enthusiasm for wireless work which so many of the American youths are displaying, but for their own best interest it is time to sound a careful warning.

"If the present promiscuous working of unlisted sending stations continues as it has, means effective and drastic will certainly be taken to remedy this evil, and that right quickly.

"Without question Congress will be asked to pass legislation requiring licenses for all transmitting stations, limiting their number in given districts, limiting their power, and prescribing the wave length that may be employed.

"All stations not belonging to the Government or to legitimate commercial companies will doubtless by absolutely prohibited by law if the present inconsiderate interferences are continued.

Such legislation will not be engineered by wireless experts in the art, and who alone are competent to frame intelligent restrictions which shall not hamper the proper development of the new art.

"If such legislation be hurried, ill considered and too sweeping it will be a very great misfortune, but such can be confidently expected unless amateurs at once limit the power and the activity of their transmitting stations.

This same newspaper article, from the New York Herald, went on quoting me:

"When I was in Washington last week I saw Lieutenant [illegible] of the United States Navy, who was delegated by Commander [illegible] to test and report on the practical value of the wireless

"Members of the Wireless Association of America have it largely in their power to avert this legislation. In your own interest, therefore, do so.

"Put up as many receiving stations as you wish. You can have all the fun and obtain all the telegraphic practice and instruction you desire without interfering with anyone.

"But transmitting stations of more than one quarter horse power, and they only with very carefully tuned radiating circuits, and using very weakly damped oscillations, should be at once discontinued if within fifty miles of government stations.

"Furthermore, confine your transmitters in every case to wave lengths of less than 250 to 300 meters.

"If you cannot do this turn your spark coil into an X-ray machine!

"Disregard of such warnings, whether or not you consider them right and just, will certainly result in drastic prohibitive legislation at no far distant date.

Cordially yours,

Lee de Forest"

By February, 1909, Admiral Evans' battle ship fleet had rounded Cape Horn and had reached the California Coast. By that time rather disquieting reports had come out from the West as to the unsatisfactory performance of the radio telephone on some of the war vessels. It was reported that the wireless telephone had not been of as much use as had been anticipated when the apparatus was installed. It was acknowledged by the Navy Department that the apparatus had fallen to a large degree into disuse. They stated that the trouble with wireless telephony was that when in use it precludes absolutely the use of the wireless telegraph. "The telegraph has a much wider range of usefulness and can be called on in all kinds of weather, and the ship commanders are more favorably disposed towards it than towards the telephone. The wireless telephone is in its infancy, however, and officers of the Bureau of Equipment are at work seeking to overcome the defects that now make it second in importance to the telegraph. Under certain conditions, it is pointed out, wireless telephony will be of even greater value than the telegraph. This might be the case in the course of naval engagements or when executing maneuvers."

This same newspaper article, from the New York Herald, states; quoting me:

"When I was in Washington last week I saw Lieutenant Sweet of the United States Navy, who was delegated by Commander Davis to test and report on the practical value of the wireless

telephone in its present state of development for use on United states battleships. Lt. Sweet made tests in December, 1907 and talked over the wireless telephone a distance of twelve miles in Hampton Rhodes. He reported favorably on the device and thought so well of its practical value that he approved our bills for the installations of the instruments, with what I considered unusual promptness. When the fleet was in Honolulu, I have been informed, Admiral Thomas issued orders that the vessels should carry on all inter-fleet communications by wireless telephone instead of by wireless telegraph."

"Dr. de Forest added that the wireless telephone was being constantly improved and that the apparatus had been materially changed since it was installed on the fleet a year ago." (This was a mistake; it should have been three months previously)

The New York Electrical World states in an issue of about this same date: "Recent reports from Washington that the wireless telephones installed prior to the departure of the battleship fleet on its cruise around the world were a failure are contradicted by accounts of their working given by newspaper correspondents with the fleet. One of these writes, 'The telephone has more than met the expectations of the officers, though they could not be used when the wireless telegraph held the air.'"

The naval reports referred to above are exactly what could have been expected, as I have previously pointed out in this history, on account of the sad fact that the apparatus had been so hurriedly installed and that very little opportunity for properly instructing the various operators on the vessels of the fleet had been given us. Consequently where careful operators were in charge of the apparatus, who really had an interest in making a success of the innovation, the results attained were consistently good. On other vessels, on the other hand, the results obtained were almost a total failure. It must be remembered also that the Navy accepted the system on the proviso, as stated in their contract, that communication between ships five miles apart could be maintained. This had been done successfully in all cases, with the exception of some of the torpedo flotilla.

When the battleships arrived at San Francisco there were numerous records reported of conversations over 25 to 40 miles.

During the spring and summer of 1909 I made several trips to the Great Lakes region to supervise the installation of our radio telephones and to conduct tests between the cities where we had installations. While I was in Cleveland, where out station was atop of the Hippodrome Building, two ships on Lake Erie had

been in a collision near White Fish Point, resulting in the drowning of 14 persons, and the total loss of one steamer. This sad accident prompted a letter to the owners of the two vessels involved in which I said in part:

"Referring to the lamentable accident to your steamer, the writer is convinced that had both of these vessels been equipped with the wireless 'range teller' device this costly disaster could have been prevented, with this toll of lost lives.

"The 'range teller' sends out automatically at a few seconds intervals a succession of three wireless signals, differing in pitch and note one from the other, and at the same time differing in intensity.

"The range graduates so that if two ships be, say, five miles apart the man listening at the receiver hears but one note. When the ships draw nearer to each other he hears two, and later three. In this way the navigator is assured of his approach to another vessel similarly equipped in ample time to stop the vessel or change his course. The device is entirely automatic, will require the presence of no operator on board, as the electricians on your vessels are fully competent to manage the apparatus. Any boat hand can be set at the telephone to listen for warning signals in time of fog or at night. He needs to know absolutely nothing about the Morse Code. It performs absolutely the same function as the lookout ahead, only working with ears instead of eyes."

I gave to this device at that time all the publicity possible, thinking that vessel owners might be aroused to the importance of some such radio safety signalling device. There is no question that such an installation on every vessel equipped with electric power would serve even now a crying need. And yet, so far as I know, nothing of this type of equipment has ever been actually installed on shipboard. It is to me absolutely incomprehensible why vessel owners (and legislatures who can correct their criminal indifference to the welfare of their crews, to say nothing of the value of their own property) have never, even unto this day, asked for or advocated the installation of such simple, automatic, short range, low power radio telephone automatic signalling, warning and comparative-distance determining, apparatus on all vessels which navigate through fog.

Millions have been spent today in perfecting (?) television, "facsimile newspapers" in the home, automatic warning devices aboard ship to respond to distant distress signals, etc., direction finders on shipboard, submarine detection, and many

other valuable or entertaining applications of radio signalling. But yet here stands one glaring omission, one crying need which can be so easily supplied and remedied, one not working a hundred per cent, of course, but one which nevertheless would doubtless have saved many hundreds of lives and an incalculable amount of property now resting in Davy Jones' locker, had my urgent recommendation to vessel owners on the Great Lakes in the summer of 1909 been heeded.

This same scrapbook of mine, covering the years 1907 to 1910, contains a brief prospectus of the Radio Telephone Company, printed in 1908, which outlines in a few brief paragraphs the various wide fields of usefulness to which the new radio telephone was eminently adapted. In view of the evident attempt on the part of some of the vested interests, even at this late date, to deny me even the credit of having conceived the idea of radio broadcasting (!) to say nothing of the continued efforts I made from the beginning to bring into being and develop that institution, I wish to quote the following paragraph from this leaflet:

TRANSMISSION OF MUSIC

"For the distribution of music - for example that from the 'Teleharmonium' in and around musical centers - the radio telephone means an enormous increase of patronage among music lovers. It will very soon be possible to distribute Grand Opera music from the transmitters placed on the stage of the Metropolitan Opera House by a radio telephone station on the roof to almost any dwelling in greater New York; this without any franchise, laying on conduits, maintenance of lines, etc. The same applies to all large cities. Church music, sermons, lectures, etc.

AEROPHORE AUTOMATIC SIGNALLING

"The Aerophore is an automatic signalling device which warns a mariner of near approach to a point of danger, giving him his direction therefrom, and that under all weather conditions when sparks, signals, or lights are almost obstructed or uncertain. The Aerophore is inevitably to be installed at countless danger points all along the sea and lake coasts, lighthouses, at the mouths of rivers, harbors, etc.

The erection of Aerophore stations along the Coast will compel owners to equip practically every vessel afloat with the simple receiving outfit required, thus greatly increasing the market for that sort of apparatus. The small Aerophore sets on shipboard will absolutely warn mariners of the approach of a vessel similarly equipped and its direction of approach.

THE AEROPHORE RAILROAD USE

"The Aerophore principle adapted to locomotives furnishes an additional block signal safety appliance of immense value. Engineers can be warned of the near approach of another locomotive one or two miles distant on the same track. This is independent of the radio telephone as above mentioned, and must inevitably be installed on the majority of locomotives, signal towers, and derailing switches throughout the existing railway systems in the country. Already several railroads, notably the Chicago and Alton, have been greatly interested in Dr. de Forest's wireless work to moving trains. Messages have been received on express trains travelling 40 miles an hour when 35 miles from the transmitting station."

As I have stated above, it is to me today, in 1939, a constant source of wonder and disappointment that such indisputably important applications of radio to the fields of safety signalling as I have here briefly outlined in this leaflet in 1908 have never yet, to the slightest degree, so far as I can learn, been put into actual practical application. There is absolutely no question as to the operativeness and practicability of the aforementioned "Aerophore" warning and signalling devices, which I outlined in great detail in two patents taken out in 1906, and which patents long ago expired. Certain it is that had my plans been carried out, had the rascally officials and promoters which were even then plotting to desert and scuttle this second magnificent venture been stopped from their nefarious wreckage, I am confident we would today see thousands of vessels, and every shore lighthouse along our American coast, equipped with this simple, low cost life-saving device.

Early in the morning on June 19, 1909 Mrs. Blatch telephoned me from Milford that I was the father of a little girl, born in the cottage there at Milford, that the mother and child were doing nicely, and that I should be permitted to visit my Wife and daughter next day. The following morning I drove over in my new Chalmers, my first automobile (!) taking with me Dr. Seibt and Leon Thomas, to meet our offspring.

That tiny baby clutching infantile fingers around my own quickly entangled my lonely heart in tendrils which grew to tightly enfolding arms of steel.

But that summer was again a bad one of separation, with the gulf between my wife and me slowly, fatally widening. Strive as I might, plead as I could, I found it impossible to

Insert after second paragraph on p. 172 of Tyne series/

Between Aug. 20 1908 and July 23 1909 I find no entries in my Diary, only blank pages, with this single exclamation: "What might have been here written! " And beneath this:

Ah, love, could you and I with fate conspire
To grasp this sor y shape of earthly things entire
Would we not shatter it to bits, and then rebuild it
Nearer to the heart's desire?

July 23 1909. You set too great a value on my poor sympathy. That costs nothing and is pitiably unsatisfying when the heart aches and aches again.

I have almost forgotten thelon nights, the hopeless daybreakings, --and yet I recall as I read your letter how I too eagerly drank in the words, spoken or written, from relatives who sought to lend me comfort. How it drove me within myself!

Never before or since that summer and the lonely years immediately following have I been so close to my own soul.

.. 'And part of him lived, but most of him died', when the revealed treachery clung for a few black month s its horrid shadow of despair and hate.

again perceive in Mora's heart the place I had once so fondly, so fully occupied.

"'And part of him lived, but most of him died', when the revealed treachery flung for a few black months its horrid shadow of despair and hate.

"Then was the time when I found it madness to remember - when to avoid despair and anguish I learned to forget - to stifle memory - the sweet with the bitter.

"And so much that was good and ennobling went out with that turgid tide, driftwood of my loss; and never has it returned.

"Yet - 'When an hour with calmer wing
Its down upon my spirit flings
That little time with lyre and rhyme
To while away - forbidden things!
My heart would feel to be a crime
Unless it trembled with the strings."

September 25, '09: "Last day at Yale Eyrie. Hudson-Fulton celebration. Early in the morning the fleet of seven nations had blazed a salute of a thousand guns, and now as the diminutive 'Half Moon' and the chugging 'Clermont', with their guard of man-of-war cutters, crept slowly up the aisle of festive waters, each vessel in turn fired a thunderous tribute, while the whistles of a thousand craft rent the air in loud acclaim.

"It was a thought-stirring sight, those two replicas, with two centuries of toil and brave struggle separating them and a yet wider gulf of magnificent accomplishment betwixt them and the mighty steam-driven Leviathans that thronged around to pay especial tribute.

"At night we had a family gathering here, the last that will ever fill my rooms. It was the last time-and the first time-that my child has slept beneath my roof. At last one dream of my years has come true. Dreams do come true!

"The scene from our windows on that night was fitting to this last occasion - the crowning beauty of all the glorious sights which I have ever beheld during the four long years while I have dwelt by this lordly stream. Each ship was illumined in great lines of incandescence before us. South, where the massive Frenchman lay, and upstream as far as the

eye could distinguish the golden glow of lighted masts, the English armada swinging in the night tide.

"It was a scene never to be forgotten, one worthy of the centuries-old anniversary which it was all to honor.

"Nora, nurse, and the sweet baby slept here, and this morning we took a ride up the Drive, to see by daylight and individually the great warriors, somber and gray, which guard this memorial stream.

"In the afternoon I drove them down to the D.L.&W. ferry en route to Milburn.

"And now I bid these old rooms and four years of my lonely life farewell.

"The Set of Moon"

Just three days since the crescent moon
Swung in the sunset skies,
A silver wire through a gay festoon
Of cloud-film draperies.
Oh, the new moon seemed a jewel of Day
Bequeathed to dazzle the Dark away.

Tonight I saw the great moon's blade
Red as blood o'er the western hill
Slowly thrust through the heart of the shade;
But the embered darkness seemed darker still,
And I watched it pass with a gripping throat
That the heaven light wanes, while the earth
lights float
By paths of fullest brilliancy
On the river's breast to the heart of me.

And I groaned that an earthly light still shone
In the blood-dim spot where the moon went down."

At this point it may be well to go a little into detail as to the original invention and fundamental set-up of the Radio Telephone Company. These were honestly and simply stated in a small Bulletin dated May, 1907:

"Upon the active management of every corporation rests the responsibility for its success. In this day of "frenzied finance," 'ornamental' officers and directors, etc., it is important to know who are the responsible parties behind an enterprise.

"It is, therefore, a distinct pleasure to be able to say of the Radio Telephone Company, which, through its development, offers so valuable an opportunity to early investors, that its active organization is composed of men who have put in their own money, and by their past records have been proven capable, honest, successful, and considerate of the interests of others.

"Out of the $2,000,000 capitalization of the Radio Telephone Company, sufficient stock to insure control is given for patent rights, initial investment and promotion. The 'control stock' has been tied up for a period of ten years, therefore the only returns it can bring to its holders, during that period, are the dividends which the Company may pay to its shareholders.

"The remaining stock, or allotments from it, will be sold, from time to time, for the benefit of the Treasury, at such prices as the directors shall decide. The plan will be to obtain as great a net amount of cash for the Treasury, out of the sale of this stock, as is possible, considering the expediency of providing quick funds for development purposes. It is expected that a sufficient amount will be realized from the first or 'ground floor' offerings to secure ample working capital.

"The by-laws of the Company provide that the holders of Treasury stock shall elect two directors, the control stock shall nominate two, and a fifth shall be chosen by the four thus obtained. This will insure to each interest equitable treatment and an unbiased management.

"Below is given a history of the initial directors, who have elected the following officers:

President - - James Dunlop Smith
Vice-Pres.- - Lee de Forest
Secretary - - Samuel R. Darby
Treasurer - - Granville T. Ivory

"Lee de Forest, Ph.D., Scientific Director - Dr. Lee de Forest, the American inventor, whose name has been identified with the commercial and scientific development of Wireless Telegraphy since his graduation from Yale University (Sheffield Scientific School) in 1896, is a characteristic American, keen of mind, athletic and seemingly endowed with an inexhaustible store of energy. Frequently, when some particular object is to be accomplished, he works steadily for sixteen to eighteen hours a day, for weeks. He will supervise the manufacturing laboratories, and look after, directly or indirectly, all Radio Telephone installations, wherever they may be, as well as constantly conduct new tests with every known form of wireless apparatus.

"Dr. de Forest entered the field of commercial 'wireless'

development, with strikingly original ideas, at a time when the practice of the art of wireless telegraphy was confused and apparently blocked, so far as long distance rapid transmission was concerned. With theory based on electrical experiments almost from childhood, and with a record of failures of others to guide him, he conducted his experiments on radically different lines, discounting accepted theories and attacking the problem from the standpoint of practicability. After disappointments, that seem to be the lot of all inventors, success crowned his efforts and has given him an enviable international reputation while still a young man.

"In 1902 the first De Forest Wireless Telegraph company was formed. Since that time, for five years, as director of the scientific division of the company, Dr. de Forest has seen his system of wireless communication extend in a manner exceeding the record made by all other new discoveries. His system has been endorsed by the United States Government, The Press, Corporate Industries and the public generally. All the long-distance stations established by the United States Government were designed by him. De Forest stations have been planted along the Atlantic and Gulf from Maine to Texas. In Canada, Central and South America, Great Britain and other foreign parts De Forest apparatus has been widely used.

"On the Pacific Coast the chain of De Forest stations rendered valuable service during the San Francisco earthquake, and when other communication was cut off between Los Angeles and San Diego.

"In far Alaska De Forest wireless brought a population covering a wide area in touch with the balance of the world, from which they were before cut off, especially during the Winter months.

"Hundreds of ships for the United States Government, the Standard Oil Company, Steamship lines and private yachts carry wireless telegraph apparatus of De Forest design, and he has the pleasure of knowing that in many cases valuable lives, on shipboard, have been saved by his invention. In fact there has been scarcely a forward step taken in wireless development in America, since he came into the field, except through his individual efforts.

"Early in 1907, his connection with the American De Forest Wireless Telegraph Company was severed. Dr. de Forest turned back to the company all the stock he had received for his inventions, accepting the license to use such patents as originated with him.

"Loyalty to those who purchased stock in his wireless telegraph system forbade him entering the same field, as a competitor, with a new wireless telegraph company. Therefore, from the bottom of the ladder he again began his climb--this time seeking Wireless TELEPHONE communication.

"He has been successful far beyond the expectation of his most ardent admirers. Within a few months he has brought the art of Wireless Telephony up to a place technically equal, except in distance covered, to the wireless telegraph. Wonderful has been his success. A dreamer, perhaps, but one who produces first of all and to a remark-

able degree practical results for utility. Who can say to what heights he may soar? With the best of his years before him, ability to command brilliant assistants, an energetic organization behind him, who may doubt that within a few years wireless telephones shall be as plentiful as the wire telephone is today?

"Dr. de Forest has contracted with the Radio Telephone Company whereby all his inventions relating to the art of communication or signaling intelligence, until A.D. 1917, shall become the sole property of the Company, and that he shall devote his entire time to the development of improved means of communication. No one can contend that a place on the Board of Directors should not belong to Dr. de Forest, no one can question the sincerity of his purpose, or that his greatest interest is in the success of the enterprise.

"Louis Rouillion, B.S., M.A. - Mr. Rouillion is well known as a leading authority on technical education. He is the author of standard treatises on the Economics of Manual Training, also Mechanical Draughting, etc.

"Samuel E. Darby, Secretary - Mr. Darby, an attorney of national prominence, received a scientific and technical education at the United States Naval Academy, Annapolis, Md., which institution he attended for a term of four years. He then entered the United States Patent Office at Washington as an Assistant Examiner and, during a period of eight years, advanced through the various grades of the Examining Corps to Chief Clerk, which position he resigned in 1894.

"He then engaged in the active practice of Patent Law as the junior member of the firm of Brown and Darby, Monadnock Building, Chicago, and has devoted himself to the profession, in Chicago and New York, ever since. He is a member of the Bar of the United States Supreme Court, and of the Supreme Court of the State of New York, as well as of the various United States District and Circuit Courts and Circuit Courts of Appeals.

"It is needless to state that the able aid of one whose standing is so high in his profession will be a valuable asset to any enterprise. In connection with the Radio Telephone Company the fact that Mr. Darby has consented to serve as a Director gives added assurance of the strength of the position claimed for the Company, in relation to the protection afforded by its patents.

"James Dunlop Smith, President - Mr. James Dunlop Smith was connected with Armour & Co., Chicago, many years; latterly as Superintendent and General Manager of one of their most important Eastern Territories, having charge of 23 branch and consignment houses.

"After careful and thorough investigation of the Wireless Telegraph field for more than a year, Mr. Smith decided to cast his fortunes with the De Forest system associating himself with the industry when it was still considered an experiment. He has been one of the most prominent figures in the commercial development of the wireless telegraph in America and it is largely due to his personal

efforts that so much of real advancement has been made. His interest in establishing the industry on a sound basis has never flagged, his concern for the shareholder has always been manifest, he is thoroughly familiar with any mistakes made in the wireless telegraph management and can profit thereby, so he is properly fitted to aid in the guidance of this 'new craft' in channels free from shoals.

"Mr. Smith, some time ago, severed his active connection with the American De Forest Wireless Telegraph Company. He retains his interest therein, but will devote his time and efforts to the newer means of communication--the Wireless Telephone."

With such an efficient and apparently honest set-up and financial management, one was well justified in assuming that the new enterprise, possessing as it did patent rights of demonstrated value (although no one then could even conceive of the immensity of that value), should have gone steadily ahead to achieve an important and lasting, if not dominating, place in the radio industry.

And yet, notwithstanding Smith's previous good record, the example of "Honest Abe" White and "Christopher Columbus" Wilson, who at that time were soaring high in their stock-inflated balloons, proved too great temptation. He proved not sufficiently intelligent to recognize that he had here the opportunity that comes to but a few men in their generation, to build up a new national industry of inestimable value to mankind--to be the pioneer inventor in Radio Telephony what Theodore Vail had been to the pioneer inventor in the Telephone, Alexander Graham Bell.

It has ever been my lamentable bad fortune never in all my successive foundations of fortunes, to have found my "Theodore Vail." Lacking such a friend and counsellor, capable of a wide vision, energetic, ambitious and absolutely honest--my life work has never been crowned with the complete success and earned reward to which my genius and energies have unquestionably entitled it.

And now, following upon that tragic Directors' Meeting which I have described and the unbelievably brazen announcement by James Dunlop Smith of his having coolly gutted the Company's treasury, Capt. Darby and I, together with E. E. Burlingame, who had been strikingly successful in raising the finances for the Great Lakes Radio Telephone Company, held several deliberation conferences as to the best course of procedure. Capt. Darby and I were strongly of the opinion that the proper thing would be to bring the entire matter immediately before the Federal District Attorney, with a view of having Smith put behind prison bars, where he deserved to be.

Burlingame, on the other hand, counselled that such course would result in immediately and completely wrecking the Radio Telephone Company, and with it, the sub-company, the Great Lakes. The wisest course, he argued, would be to have the Great Lakes Company lend the parent company sufficient out of its treasury to pay the obligations of the latter, so that the splendid work which was now under way could continue uninterrupted.

After much deliberation Burlingame conceived what, he argued, was a still better plan, the organization of a new and larger corporation, to be called the North American Wireless Corporation, which, through exchange of stock, could take over both the parent Telephone Company and the Great Lakes, and also the newly organized Atlantic Radio Telephone Company. Possessed of the assets of the three companies, he maintained that a bond issue could be floated, which would be far more successful than the continued selling of stock; and that by this procedure the new company, owning as it did the quench spark telegraph system, would then be in a position to enter actively into competition with the United Wireless Telegraph and the American Marconi Wireless Telegraph Companies, and soon be in a far stronger position than the now ham-strung Radio Telephone Company could ever expect to be.

I was not completely satisfied that this was the best procedure, but Burlingame's eloquence convinced Capt. Darby that he was right. Fully occupied as I then was with my laboratory and installation work, I was inclined to rely largely on the business judgment of Capt. Darby in such matter, and finally authorized him to draw up a contract with Burlingame covering the new amalgamation, and by which my original proportion in the Radio Telephone Company would be maintained in stock ownership in the new Corporation.

In that decision I made the second great mistake of my career - the first having been in 1906 when, instead of securing a capable fighting attorney to battle for my rights, expel the stock-jobbing bandits, and reorganize the American De Forest Wireless Telegraph Company, I turned back into that depleted treasury all my own stock, accepted a trifling sum and certain pending patent applications, and indignantly resigned.

So here, in 1909, it is my opinion that had Darby and I firmly adopted the course which we first considered, we could have saved the Radio Telephone Company in its original form, continued my experimental work in the laboratory until such time as I could do what I later did (in 1912) - prove to the Telephone Company that in the Audion amplifier lay their long-sought key to the Telephone relay or repeater, so urgently needed on their "long distance" circuits.

Had that course succeeded the entire history of Radio would have been written differently, and today the orginal stockholders of my Radio Telephone Company would doubtless have been in receipt of hundreds of millions of royalties and earnings from those corporations which have made billions out of the basic inventions then owned by my little $2,000,000 corporation.

Up to the summer of 1908 I never sold a share of my own stock, although under the terms of the original set-up I was to have the privilege of disposing of a small percentage of my holdings. But at that time I did authorize Smith to sell a few hundred shares of my stock, with the proceeds of which I made an initial payment on what I considered a highly desirable site

for my future home, at Spuyten Duyvil on the shores of the Hudson River, that lordly stream which I had ever loved so intensely.

With much pride I had taken Mrs. Blatch out to the site, Nora being in Europe at the time, to show her this choice location; and pictured to her with utmost enthusiasm details of the dream home which I there foresaw for her daughter and myself. Although she thought the location rather inaccessible, she agreed that Nora and I should be quite happy there; and when she returned in the fall to New York on the Lusitania from England Nora, while not absolutely sharing my enthusiasm, proceeded to draw up plans and outlines for the house which we expected shortly to start erecting there. Contracts were let and the building actually started in the Spring of 1909; and though I had paid only a few thousand dollars up to that date, the contractor continued with his work and finished the house, destined to stand vacant and desolate until I should enter it to establish, at last, a home four years later.

The defalcation of Smith had inevitably produced a very great restriction in the activities of the Radio Telephone Company, but the laboratory in the Terminal Building in New York, the Metropolitan Life Tower station, and our sales office for radio products for amateurs continued in operation throughout the winter of 1909-10. The Newark factory continued to function, but with reduced payroll. The Philadelphia station was maintained for a time. The Great Lakes stations were maintained in full activity, with the hope that ere long sufficient lake shippers could be interested in equipping with wireless telephone and telegraph to maintain those stations on a self-sustaining basis.

With the advent of cool weather autumm of 1909 Nora and little Harriet removed to the home which her mother had long owned at Wardencliff, or Shoreham, Long Island. Thither I made frequent week-end trips by automobile to see my little daughter, of whom I became increasingly fond - apparently in proportion as the former affection of my wife for me waned.

During this Fall the rivalry between the Radio Telephone Company and United Wireless for telegraph business became most intense. At that time, before the Federal law of 1912 regulating interference was enacted, it was too often the custom when another station was getting too much of the available business, or the operator of the station was not faring so well, to adopt the simple expedient of placing a dictionary, or some other large object, on the key and enjoying a quiet smoke. But my operators down at the Manhattan Life Building and in Philadelphia were not to be so hindered. They proceeded to screen their operating rooms with chicken netting, which was in turn grounded. Then a third sectional screen was put over the receiving apparatus and grounded. A coating of tinfoil was wrapped around the phone cord and grounded. With these extreme precautions and the sharp selectivity of the quench spark signals, telegraph traffic would be worked with ease.

It seems almost unaccountable that the directors and engineers who were seeking to create a new method of communication should stoop to such petty business as deliberate interference for the sake of suppressing competition, where the utmost in cooperation was demanded for the sake of the art. Yet the opposition resorted rather to cutting the other fellow's throat than to the perfection of the apparatus and the establishment of the new science on a firm basis in the economic structure of the country.

Never did I stoop to these usual tactics, nor did I allow my operators to do it, so far as it was practical to enforce such regulation. This was due more to my interest in the problems at hand and my idealism for the science, rather than to any high moral attitude. Being entirely human, there were times when I could have wrung the necks of various and sundry operators of the United and Marconi systems; but this type of interference resulted in high refinement in tuning devices and circuits, and in more complete shielding of receiving apparatus than would have been produced under less antagonistic, more cooperative tactics on the part of our competitors.

As was usual in my periods of deepest gloom or uncertainty, I again turned to music as my solace. Hence it was that during the winter of 1909-10 I began to contrive to realize my long advocated ambition for the radio telephone - the broadcasting of Grand Opera. Early in January I went to the Metropolitan Opera House and made the acquaintance of a kindly, bright-eyed, energetic young Assistant Director to Gatti Cassaza, Mr. Andreas Dippel, formerly a Wagnerian tenor in that organization. Andreas Dippel possessed the vision and enthusiasm which was exactly what I was looking for there.

When I outlined what I had done in the past, broadcasting the Telaharmonium music, and phonograph records from my laboratory, and outlined what I foresaw as a prospective field for my new radio telephone as a medium for bringing fine music to the masses, Dippel became intensely interested and actively undertook to enable me to carry out my plans to make the necessary tests for broadcasting Grand Opera.

I was now overjoyed. I harked back to old, almost foodless days in Chicago, when I would spend almost my last cent for a seat up under the eaves of the Auditorium during the Opera season there. Now I was no longer the hungry, penniless youth I had been.

Since then I had seen a great many of my schemes come into actual being. And now I was going to the opera again, but I was going as some part of it! I felt that I was doing something which might, in time to come, bring great music to many a young fellow in a position parallel to mine of the Chicago days.

By rare good fortune, Kelly M. Turner, President of the National Dictograph Company, was at that very moment installing his Acousticon microphone on the Metropolitan stage, with receivers in the office of Gatti Cassaza, whereby the director might hear what was going on on the stage over the telephone wire. I at once recognized that Turner's Acousticon microphone was exactly what I required to pick up the voice of the singer and the orchestra music at a distance, for in this respect the Acousticon was much superior to my own microphone.

The necessary permission having been given, Frank Butler and I proceeded to install one of my small carbon arc transmitters in the attic of the Metropolitan. We rigged a temporary bamboo mast upon the roof, lashed it to one of the short flagpoles there, and rigged up the largest antenna which was thus practical, with the lead-in wire running down through a ventilator to the transmitter. A "twisted pair" was run from the transmitter down through the flies backstage and connected to the Turner microphone. An ordinary telephone receiver was taped by me in front of my radio telephone microphone, and preliminary tests in the Acousticon downstage showed that a very fair re-transfer of energy was thus obtained.

For my debut in broadcasting of opera Dippel suggested the double bill of Cavelleria Rusticana and Il Pagliacci. The Acousticon microphone was located in the footlights, but for the opening aria, La Siciliana, in Cavelleria, which was sung behind the curtain, a duplicate microphone was located on a small table before which Ricardo Martin stood when he sang that aria. Then before the curtains were withdrawn for the opening scene, this microphone, wires and table, were swiftly removed out of sight.

This momentous event occurred on the night of January 13, 1910. The newspapers had been tipped off in advance and reporters were listening in at the Terminal Building, 103 Park Row, the Metropolitan Tower Station, at the Hotel Breslin, on one of the ships down stream, and at the Company's factory over in Newark. Kelly Turner superintended the arrangements down on the stage, and I was at the transmitter up in the attic of the Opera Building. Preliminary notices had appeared, as for example in the New York World, Sunday, January 9th:

"GRAND OPERA BY WIRELESS IS THE LATEST MODEL

"By the simplest of inventions you may listen now to the Grand Opera's greatest singers in your distant home.

"Messages picked out of the air without towers.

"Both wonders tested in World Office - in each a small box is the apparatus etc.

Turner was demonstrating in the World Office his ability to transmit over telephone wires Grand Opera picked up from the stage with his Acousticon microphone.

The World article continues, "Two new wireless marvels were tested by the World yesterday. One brings a performance of grand opera to the home of anyone having a telephone, the other picks wireless messages out of the air without the aid of the tower that has hitherto been considered necessary for the receiving of wireless telegrams. * * * * Grand opera by means of the ordinary telephone or by connection with a wireless telephone is shown to be no longer a dream."

The New York World of Friday, January 14th, had this to say:

"* * * There was some inconsequent wireless telegraph operator down Manhattan Beach way who broke in when Caruso sang and Martin soared, with a refrain in dots and dashes which as nearly as could be interpreted ran, 'I will now get up, and take a drink, and sit me down again.'"

The technical journal, "Telephony" carried an interesting account of the performance.

"GRAND OPERA BY WIRELESS

"Interesting experiments with the De Forest system of wireless telephony have been carried on in New York City with a view to determining whether it is practical to transmit music by this method. The experiments were carried from a transmitting station on the stage of the Metropolitan Opera House. Efforts were made to transmit music as far as Boston, and receiving sets were set up in several places in New York City. On the Royal Mail Steamer Avalon, 260 guests were assembled and listened to Caruso's voice produced by wireless telephony. The transmitter employed was the loud speaking instrument used in the 'Dictograph' as made by the General Acoustic Company, which is managed by Mr. R. M. Turner.

"Dr. de Forest reported that although it had been intended to continue the transmission of the music for an entire week, it was necessary to abandon the experiment temporarily, because it brought out several weaknesses in the methods used, notably the difficulty of using the ordinary loud-speaking transmitter such as the 'Dictograph' employs. According to Dr. de Forest at least 90% of the speaker's voice was lost before it reached the radio transmitter. It is expected that experiments will be resumed within a few weeks with apparatus which is designed especially to do away with the great loss hitherto experienced in transmitting in space to wireless apparatus. As soon as the system is developed so far as to really satisfy the inventor wireless opera will be furnished to the public.

"Satisfactory results were obtained at the stations where the Marconi magnetic detector was used, but not a failure to get a greater portion of the music took place where the receiver was equipped with the Audion, Dr. de Forest's well known invention. This sensitive device was included in the apparatus in the inventor's laboratory at the Terminal Building, 103 Park Row, and the Metropolitan Tower Station as well as the

Hotel Breslin, and the Radio Telephone Company's factory over in Newark. All these stations got encouraging results, said Dr. de Forest, although there was some interruption at the Hotel Breslin, where only a temporary antenna thirty feet long was used, owing to deliberate and studied interference from the operator of the Manhattan Beach station of the United Wireless Company. All other stations courteously refrained from unnecessary demonstrations of their power, and the Marconi Company was especially courteous in placing special equipment on board the Avon, anchored off 13th Street in North River."

It was indeed a bitter pill that only that station which I had especially designed and equipped in 1906, which bore as its call letters DF, should be the one whose drunken operator should deliberately interfere and attempt to make a failure of this epoch-marking demonstration. That incident was a very fair sample of the ethics of those notables who were then directing the destinies of the United Wireless Telegraph Company.

"Telephony" continues:

"Dr. Seibt, who recently came to America from Berlin, where his skill in wireless development is admired, is collaborating with Dr. de Forest in the perfection of the wireless telephone. The day after the experiment Dr. Seibt said: 'I consider the results of this first demonstration of its kind as full of promise for the future. Our greatest difficulty proved to be merely mechanical defects in the system used for transmitting the music to the wireless apparatus. We will overcome this probably by placing the wireless transmitting microphones on the stage, with some simple magnifying device for gathering the sound waves, and with the solution of this one problem I cannot see why we should not reasonably expect to transmit the entire audible part of the opera in such volume that it can be received in a room miles away as strong and clear at least as the music from our present phonographs.'"

The article continues with a brief description of the latest type of De Forest radio telephone, which may be interesting to technically minded readers:

"During the last 18 months Dr. de Forest has been developing an entirely new type of electro-magnetic wave sender, radically different from the arc type which has heretofore been used by himself and some other experimenters. The new oscillator, as it is called, is operated from a DC

source of 600 volts in series with the resistance. The oscillator is said to require no attention other than the closing of a switch to start it. The electrodes are both of metal, constantly renewed, never in contact, perfectly cool. No hydrogen nor hydrocarbon gas nor vapor whatsoever is employed.

"The wave length of the oscillation thus set up is reported to remain absolutely constant, without which it is always impossible to be sure that the receiving apparatus would be set at the proper position during a prolonged conversation.

"In addition to being constant in wave frequency and free from necessity of adjustment, the oscillator operates even more quietly than the smooth burning arc, so that at a little distance the only sound heard in the receiver is that of the voice itself. A simple water circulating system is combined with the apparatus, and this is made further use of to keep the two microphones of the transmitter perfectly cool. Dr. de Forest has developed a water cooled microphone transmitter, which, while allowing exactly as clear and free articulation as the noncooled type, can still carry a 2 to 4 ampere high frequency current for any length of time without any appreciable rise in temperature. This has, therefore, done away entirely with the bad 'packing' and breaking of the best non-cooled transmitters, and enables one to speak into the transmitter for any length of time desired without having to stop occasionally to shake up the granules, and with undiminished intensity of voice and clearness of articulation. The condenser is small and lighter than previously. The same form of primary and secondary coils that were found so efficient and convenient in tuning, together with the easily adjustable loose coupling arrangement, are retained, together with many mechanical improvements which have been worked out as a result of the long experience which the Radio Telephone Company has now had. In its instruments the little index lamp and handy listening key are retained."

During my week's work at the Metropolitan Opera House I became well acquainted with its Chief Electrician, Harry Williams, who naturally took great interest in my idea of broadcasting the opera music by radio telephone. He asked me to return for any performance I should like to hear, and share with him the electrician's box, which was beneath the stage and equipped with a small hood alongside of the prompter's box in the center of the stage, where at floor level one's head was only a few feet from the very center of the opera stage. Was that invitation a delight

to me! Time and time again I accepted Williams' kind offer, and there intimately renewed my familiarity with the favorite operas I loved so well.

Caruso was then in the fullest perfection of his voice, at the zenith of his career. I well remember how, in the first act of La Boheme, he was Rodolfo with Marcel and Collin battled boisterously with long loaves of french bread - and how Caruso, boy-like as usual, tried his best to kick some of the husky crusts into my face as I grinned up at him from my box.

And during the tragic last scene of Madame Butterfly, how lovely Geraldine Farrar appeared as she sat upon the stage, not five feet from me, singing softly to the little son as she blindfolded him and put into his hand the two small American flags. I could hear her distinctly whisper instructions to the little fellow. I am sure that no one was ever closer to Farrar as she sang in sweetest voice those affecting lines.

You may be sure I made the utmost possible of my "free pass" to the very heart of the Metropolitan Opera House throughout the rest of that season.

But by no means satisfied with my broadcasting of the voices of Signori Caruso and Martin, I wrote to the Metropolitan's great rival during these years, Oscar Hammerstein, Impressario of the Manhattan Opera Company, asking permission for his famous prima donna, Mme. Mazarin (recently imported for the opera Elektra) to sing into my microphone at the Terminal Building laboratory.

Hammerstein promptly complied, and I had again the unusual delight of meeting so great a star, and to personally instruct her in the technique of the microphone. Mazarin's voice was of such tremendous power that at first she actually blasted the microphone, causing it to cut off completely. The radiation ammeter needle swung down to zero - indicating much more than a hundred per cent modulation (!) so that I was compelled to have her sit back at a considerable distance, and then to sway forward somewhat for the softer passages.

The aria chosen was La Habanara from Carmen; and magnificently was that rich contralto reproduced in the listening headphones. The newspaper representatives were again on hand, some to photograph the artist at the radio microphone, others at the Metropolitan Tower receiving station, and elsewhere. Again this great novelty made interesting copy; but unfortunately my scrapbooks contain no clippings showing the exact date of this second broadcast of Grand Opera music.

Early in the spring of 1910 the United States Army Signal Corps, who had been carefully watching our developments of the quench spark wireless telegraph, had become convinced of its superiority and award the Company a greatly appreciated contract for the equipment on the Pacific Coast of two Army transports, the Dix at Seattle, and the Buford at San Francisco. While this new equipment was under construction Burlingame had so far matured his plans for launching a campaign to finance the new North American Wireless Company as to have his agents open offices in Seattle, San Francisco, and Los Angeles.

It was decided therefore that I should make an extensive trip to the Pacific Coast, stopping in Chicago to open up the newly completed station on the Majestic Theater Building, and then go on through Canada to Vancouver and Seattle, taking with me one of the newest type of radio telephone transmitters.

I greatly enjoyed this, my first first trip through the Canadian Rockies, and was profoundly impressed by the scenery of the Selkirks and the Bitter Root Mountains. Then too I was only too glad to get away at that time from the unpleasant memories and searing thoughts that ceaselessly plagued my mind. A complete change of scene was then imperative, and I was reconciled to leave my intensive laboratory duties for a season.

Leaving Roscoe Kent and Frank Butler in Chicago and Toledo, I took with me on this long trek a very capable and hard working young installing engineer, by the name of Frank Merriam.

I was met at Victoria by a group who took me up into the heart of Vancouver Island for a few days' well earned rest and some excellent fishing upon lovely Lake Cowigan, for steel-head trout - my first piscatorial expedition since bare-foot days at Talladega. There again, after long, laboring, laboratory years was I once more in the wild, unsullied hart of Nature.

At Seattle we made our headquarters at the office of James K. Baillie, Burlingame's head agent on the Pacific Coast, while Merriam promptly began the installation of the quench spark transmitter and audion receiver on the great army Transport, Dix.

Coincident with the installation on the army transport, Baillie had leased land across the harbor from Seattle city, where a 200 foot wooden mast was soon erected. In the

radio shack at his base Merriam and I installed the radio telephone transmitter which we had brought with us and began making tests with a few receiver stations that were at that time to be found along Puget Sound. I was greatly pleased with the Dix installation and the fine work which it immediately achieved. The Dix was copied in Honolulu from the West Coast, and later when the Buford was equipped in San Francisco the two transports were enabled to work regularly from port to port, something which had been absolutely unheard of up to that day.

All during the time that these ship sets were being installed Merriam and I were employing our spare moments with further tests. I was struck with the idea of employing the quench spark for the generation of slightly damped waves to be used as a carrier for voice modulation, not merely for telegraph signals. And as usual, as soon as I had the idea I set about perfecting the necessary apparatus to give it a trial. Ordinarily in telegraphing, if I were using a 500 cycle generator, the sound frequency was simply a pure high pitched note of 1000 frequency, with one discharge across the gap for every half cycle of the generator. However, when only a few of the tiny spark gaps were in series in the circuit it was possible to obtain a number of separate discharges for each half cycle of the generator. By this method an irregular frequency of about 15,000 cycles was obtained at the antenna input. This served very well as a carrier for speech modulation. Of course there was always the hiss of the carrier in the background, but the resultant telephonic message picked up was perfectly clear and distinguishable. There was very little harmonic "mush" created with the telephone, in spite of the fact that the microphone was put directly in the ground circuit of the antenna, the same as when using the carbon arc transmitter.

After a few busy weeks in Seattle I proceeded to San Francisco - my first view of that fascinating town, renowned of song and story - and the Golden Gate. Day dreams of a lifetime of longing seemed realized at last. Although the Phoenix City was then but four years arisen from her tragic ashes, although her shore streets still writhed in crest and node as the earthquake's trail, though shattered walls of tumbled palaces still crowned Nob Hill, I could yet be transported to that fabled Golden Age of yore, and the Roaring Forties. At once the spell of Bret Harte, and Robert Louis Stevenson fell upon me - at last to tread the streets that they described, the haunts they had made notable.

Baillie's representative, A. C. Hall, a most profane and literary cuss, possessed a fine edition of the Works

Stevenson, and in these, for the first time, I now browsed with indolent delight whenever a rare hour for idleness was granted me. Seated at twilight before his bronze galleon in Portsmouth Square, I imagined that I too, like him, was a lonely wanderer, a thousand leagues from all my old friends, thrilling with the same romantic thoughts of Pacific adventure which had inspired his graphic pen.

Our newly opened offices were in the Phelan Building on Market Street, and my first task was to rig an antenna between the two widely separated flag poles on its roof, and to bring down a lead into our upper floor office window. There I installed a complete quench spark telegraph station, for it was our chief intention to establish as quickly as possible radio telegraph communication with Los Angeles, if not with Seattle. As soon as Merriam had completed the installation on the transport Buford, and our long distance tests were made to the complete satisfaction of the Signal Corps officers, I journeyed southward to Los Angeles, my first glimpse of Southern California, in June, 1910.

How that lovely southern clime intrigued me! "The weather here now is ideal," I wrote, "just cool enough, never too hot, never rainy. A fog each morning, which generally vanishes by noon, leaving outlines of far away mountains green and inviting. The marvelous beach at Venice where I am at work lies some 14 miles from Los Angeles and stretches northward and southward for miles of smooth hard sand, where forever roll the tallest breakers I have ever seen; for nothing intervenes between this strand and China, 5000 miles away. And here, breathing in the fresh ozone of the marvelous Pacific, I am at work all day, day after day.

Shortly after my arrival I addressed the National Convention of Railroad Telegraph Superintendents on Wireless as Applied to Railroads. With them that night I made my first visit to Mount Lowe, up to the old Alpine Tavern and Inspiration Point, where I had my first gaze over the wide miles of the plains to the Pacific.

And shortly thereafter I journeyed to Catalina Island where I enthused still more enthusiastically in my description of the wonders of the sub-marine gardens. Surely Poe had gazed on such a world ere he wrote, "The City in the Sea" - or the writer of "The Nautilus".

My first radio task in Los Angeles was to demonstrate the radio telephone between Venice and Ocean Park, an easy task, but the results of which aroused an immense amount of interest thereabouts. Coincident with this was

the establishment of our radio telegraph station on the top of the I. W. Hellman Building.

I journeyed back to San Francisco on board the steamship Yale, my first voyage on that vast ocean.

After many delays and long series of testing, satisfactory radio telegraph communication was established between Los Angeles and San Francisco. The morse key at the latter station was placed in the hands of a long, gangling, soft-voiced, drawling southerner, by the name of Don Frix. But when it came to tearing off 40 and 45 words a minute Don Frix was no longer slow or drawling, nor languid. I doubt if I ever had a more skilled operator than he proved himself to be.

I recommenced now the experiments which I had commenced in Seattle, to adapt the quench spark telegraph transmitter for telephonic communication, believing that thereby I might achieve considerably greater distances than I had been able to do with the arc-in-steam.

Before I reached San Francisco the ether had been pretty well homesteaded and pre-empted by the McCarty boys of Oakland, notably Jack McCarty, who had some form of a telephone transmitter about as noisy and unmusical as a steam calliope, and whose voice was frequently heard in our audion detector. Consequently when my own radio telephone set was set in operation we frequently heard exactly what we had been led to expect, an uncensored outpouring of wrathful cussing and obscenity from Oakland, which was, to say the least, jarring upon our eastern sensibilities. Yet strive as we might, neither of our stations was able at that time to transmit the voice as far as Los Angeles.

Separated as I was then some 3,000 miles from my home base and laboratory, it was next to impossible to have any experimental work carried out as I wished and directed. A newly made San Francisco friend, Aylesworth, by name, an amateur of the first water and an intense admirer of the Audion, was a frequent visitor and of great help in my testing.

Reports of the financial condition of the Company back in New York were now anything but reassuring, and I made one or two hurried trips there to look over the ground and see what could be done to keep the magnificent plant and plan, which I had been building up since 1907, from folding up in total collapse. The condition of my marital affairs also was no more reassuring than I found the business situation to be. Work in factory and laboratory had so nearly ceased that early in 1911 I was forced to the conclusion that it would be only a matter of months, unless some new blood was transmuted into the rapidly

failing body, until a complete and lasting coma could be expected. With heavy heart I returned to my work on the Pacific Coast.

Early in March, 1911, I again returned to New York. While living there each morning at eight o'clock found me promptly at the apartment of Nora Stanton Blatch de Forest, who was usually by that time off to her engineering work downtown, and where I spent a joyful hour watching little Harriet have her breakfast and bath. My diary during those weeks contains little but detailed description of those delightful hours with my baby daughter who brought so much joy to my heart.

In this year, 1939, I am a proud grandparent of little Catherine 'Cookie' de Forest Allaban. So I cannot refrain from quoting the following paragraph from that first Diary of a Baby, written in 1911:

"Perhaps in a score or so of years this same scene will be repeated, and married Harriet (husband-loving, let us hope!) shall be herself be immortalized in my grandchild! I try to recall the summer less than two bitter years ago when she was a little round red wonder all creases and meaningless cries - seemingly so far from a human being; yet the soft kernel from which this adorable flower of sunlight and intelligence and love has grown! Oh, life, life - your mystery is beyond our wonder, above our awe!"

Sunday, April 2, 1911, San Francisco, after another day in the Muir Woods.

Now days of poverty were known once more - both for me and my loyal, plucky assistants, - to remind me sadly of early Chicago and Jersey City days. Frix and I found rooms in a little dump of a cheap hotel above "Coffee Dan's" basement eat-shop. That institution was indeed a valued asset - a great good bun and a large cup of steaming coffee for a dime!.

We lunched at a drug-store counter - usually on a malted milk and a "snail" (provided Hall's luck with the dice shaker at the cigar counter was good, as it usually was!)

Yet were we jolly, worrying little if at all - such was the atmosphere, physical and psychical, of old San Francisco in those pre-prohibition days. And there then was the Barbery Coast, and Chinatown, for surcease from sorrow. More than ever now did I feel kinship from R. L. Stevenson. And when there was no work to do I loved to withdraw to my little

room - there to spend busy hours in writing - attempts at prose and poetry - among these "Lost River" - a sad allegory, relating to the love which had welled so romantically, had sunk so sadly into life's barren sands.

That last trip to New York convinced me that I could no longer look forward to redemption of the sad wreck which had been my second foundation of fortune and lasting success. I accepted the doom and reconciled myself to the fact that I must at once seek employment. For some time past I had cultivated the friendship of Cyril F. Elwell of Palo Alto, one of the most brilliant graduates from Stanford University, who two years previously had brought from Denmark the American patent rights, blue prints, and specifications of the Poulsen arc generator, and "tikker" receiver. With these as assets, Elwell had succeeded in organizing the Poulsen Telegraph and Telephone Company, which had at first been inadequately financed by sale of stock to the public. Operated on a small scale at Palo Alto, and with the encouragement and moral backing of some Stanford professors there, he had finally succeeded in interesting several San Francisco capitalists, largely through the promotional efforts of one Beach Thompson.

At the time I met Elwell, Thompson had reorganized the concern into the Federal Telegraph Company, with Elwell as the chief engineer and large stockholder. He had, of course, read of the work I had been doing in radio telephony in the East, and was particularly interested in my audion detector. I had invited him to look over what I had in the offices of the Company in the Phelan Building, and had then made the suggestion that it might soon be necessary for me to seek radio employment on the Pacific Coast. This idea immediately appealed to Elwell, and without difficulty he obtained permission from Thompson to give me employment at a fairly lucrative salary in the Palo Alto laboratory of the Federal Telegraph Company.

April 2, 1911: "It seemed strangely good to be back again by the strand of the Pacific, where I hope to live. Tomorrow I start work with the Poulsen Company. It will seem good to begin my real work once more. For a year now my time has been mostly lost, my energies dissipated, my genius wasting, while this lost structure of the stock castle builders, built upon my foundations - was falling dismally around my head, and their heels."

But now it seems that as a last hope the New York office had wrought a complete reorganization of the North American Wireless Corporation. A capable business executive was made President, and a German-American electrical engineer in whom he had utmost confidence, Fritz Lowenstein, had been

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Insert after second paragraph on Tyne page 199.

Now, I believe, I am loved by a very young lady, one who has captured my heart's devotion deeply and altogether. More than once my eyes have beamed with a new happiness. As the little toddler was being tucked safely under the blankets of her crib came the soft, cooing of her voice, 'Papa, Goodnight'.

Alas, that the Mother's wings are never spread above that twilight nest. I run away from duty at 4:30 or 5 every night and spend at least the last hour of her day with the baby,or else see her at 8 a.m. and enjoy an hour, or often two, as Elizabeth has her in her bath, and then play with her, or make her kitten do funny dances, to her hilarious delight Scarcely a day passes that I do not arrive at 91st. St. from downtown.

The faithful nurse, Elizabeth (Beffet)watches the child constantly andgives her far better care than her own mother.I think she is sorry for me, for the shameful manner in which I am treated by the two women of this household.

It is not intentional ~~xxxi~~ neglect nor deep seated indifference on Nora(s part, but the logical resuly ugly symptom of the unnatural, unaffectionate manner of her bringing up-the intense desire to live up to the artificial ideals that she, her mother, and their cult of zealots have shaped for themselves.

Financial support is not the sum total, circumference and bounding surface of true motherhood.

May 11 1911. Dear Elizabeth today surreptitiously slipped into my pocket a tiny little brown shoe, one of the ~~xxixx~~ first pair she ever wore. May it bring good luck to me, and may it moreover be a symbol of the footsteps thru her life to come, beside which I may be companion Pilgrim.

placed in full charge of the engineering and manufacturing activities of the company. Some attractive United States Government contracts had again been secured; and to effect necessary economies the Newark factory had been completely closed and our Governmental contracts had been turned over to the C & C Company on the outskirts of Newark. So it seemed wise to have one more conference; my presence in New York was once more requested.

I remained in the East on this occasion about six weeks, but in my diary I can find nothing but descriptions of my daily visits with little Harriet.

May 22, 1911: "Out at Shoreham Long Island, where Harriet has been now for a week. I dread the long separation and the hostile influence working upon her which must soon be my hard fate. I was born to be robbed - robbed of many of the best of college associations - robbed of the best of social influences - robbed of my opportunity to invest, for research during fertile years - robbed of the fruits of all my years of toil (twice robbed here) - robbed of my wife, robbed of a house and a home (and who loves a home and real homelife more than I?) - and now to be robbed of so much of my Baby's life, her daily growth and life and charm and love - her first companionship - to be robbed of my child entirely - that is the hope of my enemies, 'my family". God grant that this plan at least may be foiled! Surely something is wrong with my character; some vital lack there must be that I have permitted myself always to be thus defrauded and despoiled. * * * "

"I went down yesterday for my last visit - for how long who knows, with my little girl - one day before her second birthday - two years old tomorrow. The joy of being with her was not completely spoiled by the 'Separation Papers' with which her mother there presented me.

"She and Elizabeth were at the station to meet us, and she recognized me immediately. She is a trifle larger, just as beautiful, and prattles a deal more than when I was last at Shoreham. She now frames quite long sentences together, having a deal to tell about baby this and baby that. About the first remark her mother made to her, as Elizabeth put her into her carriage, was 'Say, "Votes for Women"! I spoke up, 'Don't you do it, say I love Papa", and quick as a flash her tiny little heart responded and she said, 'I love Papa!" Whereat my faith in womankind and kind women revived! * * * "

And now again back to the little laboratory at Palo Alto, to the kind of work that I loved so dearly. First there was an abundance of tasks for me in outlining

to Elwell and his engineers many of the facts and lessons which I had amassed during my past years in developing the wireless telegraph. The loop antennae, the loose coupling devices, improved double fan antenna for transmitting, etc. I was soon dispatched to the Beach Station of the Company, a few miles south of Golden Gate park, where operators A. Y. Toole and McNeal were exceedingly busy handling telegraph traffic with the Los Angeles Station of the Company on West Adams Street.

Those two stations were already heavily crowded with traffic, so I promptly devised a "diplex" system of telegraphing, using a high speed copper, which automatically changed the wave length of the transmitter from A. to B. a great number of times per second, so that both the A. and the B. operator could dispatch their messages as fast as they pleased, each man quite independent of the other. In the receiving station in Los Angeles, two independent receivers connected to the same receiving antenna were tuned one to the A wave and the other to the B, so that there two operators could receive their respective messages independently of each other.

A great deal of research and experimentation was necessary before the actual copper mechanism was finally designed and built in such shape that it would stand up under the extremely tough conditions obtaining when this relatively large amount of undamped wave energy was rapidly shifted from one wave length to the other, each circuit being alternately supplied from the same Poulsen arc source. Yet I finally overcame all these difficulties. The diplex system was finally pronounced a success and put into daily operation during the rush traffic hours at San Francisco. But before duplicate equipment could be built for the Los Angeles end it was decided to erect a second and much larger transmitting station on the bay promontory at South City, so that the Company would have two independent stations at San Francisco.

One of the first things I learned after joining the Federal Telegraph Company was that their method of keying was very unlike that used in spark telegraphy. The arc-generator was in operation continuously, without interruption or cessation so long as the operator was transmitting. His key merely operated to alter the number of turns in the antenna helix, in other words the amount of inductance, and therefore the wavelength of the transmitted wave. In their parlance when the key was closed the "sending wave" was radiated; when the key was up the "compensation wave" was being sent out from the antenna.

I noted that at certain times, almost daily through most of the year, and under certain meteorological conditions, most surprising changes in the intensity of the receiving signals, when using certain wave-lengths occurred. For example, the Los Angeles Station might be using a 3260 meter wave for sending, and a 3100 meter "compensation" wave. Within a few moments this "sending" wave would grow faint or completely die out at the San Francisco receiving station (350 miles north), while remaining or normal strength at Phoenix, Arizona, (300 miles east). Yet at the same time the "compensation" wave, which was less than 5% shorter, continued to come in at San Francisco with full, even at times increased, intensity.

During such periods of fading it was necessary for the operator to reverse his transmitting key, so as to employ what was previously his "compensation" wave for signalling purposes. Then when this "compensation" wave in its turn began to fade the operator would once more reverse his key. Otherwise if both of these waves were reported as faint the sending operator must find a wave length which did not fade at that time, between those two stations. (What hideous night-mares would our F.C.C. engineers have then suffered - had there been any such!)

This phenomenon, which was then defined as "selective absorption" was particularly marked along the Pacific Coast. It occurred most frequently near sunset, extended late at night, was seldom observed at mid-day.

My observations demonstrated the existence of this fading as due to atmospheric causes, as indisputably as had been theretofore the then universally recognized phenomena of "daylight absorption" over long distances.

I made many careful observations of this novel effect, heretofore unobserved, or at least unrecorded. It was evidently a property peculiar to undamped wave transmission. It had never been observed in all my wide experience with damped wave transmission from spark transmitters, quench or open gaps.

A year later, in the fall of 1912, while in New York I had the honor of collaborating with a few other radio pioneers, like Robert Marriot, E. J. Simon, Fred Kolster, J. K. Thompson, and Dr. Alfred Goldsmith in founding the "Institute of Radio Engineers". At one of the first meetings of that body - (destined later to exert such profound influence over the gigantic developments of the then infant science and industry of Radio) I presented a

paper describing these newly observed, and wholly surprising phenomena of selective fading.

In this I stated: "It is however possible that under certain atmospheric conditions, such as the presence of low lying clouds, or fog masses (a condition which occurs along the Pacific Coast with great regularity through certain seasons of the year) the energy of the higher portions of the wave is deflected, bent downward. The receiving antenna is then acted upon by two wave trains, following paths of unequal lengths, or even of unlike velocities, thereby a phase-displacement and resultant interference occur at certain localities, which become nodal points where total of partial annulment occurs.

"Certain writers, in speculating as to the phenomena of wave propagation over the earth's surface have already suggested the possibility of such interferences. Thus Dr. George Pierce, of Harvard University, says in his book, "Principles of Wireless Telegraphy": "The stratum of upper atmosphere (Kennelly-Heaviside layer) rendered conductive by the sunlight may serve to some extent as a reflector of the electrical waves, so as to assist in confining the waves to the surface of the earth - and transmission would be easier in daytime, except for a possible interference between the direct and reflected waves. This interference, <u>if it should exist</u>, would intensify waves of some wave-lengths, and possibly annul waves of a different wave-length; so that by changing the wave-lengths through a range corresponding to a half-period it ought to be possible to turn the interference to advantage. <u>No such effects have been found</u>." (italics mine)

"Dr. Pierce's conclusions as to such reflection causing enhanced daylight transmission are of course directly contrary to fact. The Ionization of lower air bodies by daylight more than counteracts any benefit from reflection from upper strata, but with on-coming darkness the evidence of such reflection has, I think, now been found and in great abundance."

"Bear in mind that at this time no long-distance transmission with short or ultra-short wave-lengths had been attempted. And I was dealing here with grounded waves several kilometers in length. Until the oscillating triode and feed-back circuits were perfected undamped short wave lengths, of any useful energy, were never generated. So the true reflections from the Heaviside layers and resultant interferences between the sky and the earth waves could not exist, or be observed.

The reflections with which we were here concerned were very plausibly the result of layers of the atmosphere, or strata thereof, possessing marked gradients, such as of moisture content, temperature, barometric pressure. Recent observations serve to point strongly to the conclusion that the lofty Heaviside layers, or the ionosphere are by no means the only ones which may be responsible for the annoyances experienced today from "fading." Others far lower play a part.

"At all events," my paper continued,"this selective atmospheric interference affords one more evidence as to the utter futility of scientific attempts to predict by general calculations the quantitative laws of radiation and energy transmission in actual wireless telegraphy.

"As a practical proposition such mathematical analysis is worse than useless, however, exalting from the standpoint of academic theory. Too many factors of the equation must necessarily remain unknown. The alleged mathematical laws of radiation and absorption are completely misleading, and to that extent harmful. It is equally unprofitable to attempt to postulate from the general laws of thermodynamics and mechanics the exact force, direction, and pulse of the winds about a mountain, or over the waves of the sea!"

Thus was published the first knowledge that there was such a thing as selective fading, and the word definitely put in the dictionary of the radio engineer.

It was at this old Beach Station that I first met Charles V. Logwood. Logwood was totally unlearned in engineering, innocent of mathematics, and yet possessing an inborn instinct, a boundless amount of ingenuity, resourcefulness, and the quality of determined stick-to-itiveness which peculiarly endowed him for work in radio invention and design, to a unique and most remarkable degree. In all my wide experience I have never met anyone possessing to such an unusual degree, in one brain, all those invaluable characteristics.

Charlie Logwood at first was a little jealous of me, rather resentful that I should have come into the organization, probably to intrude in a field which he, quite justifiably, had mapped out for himself. But after we had together 'jointly and cooperatively' settled determinedly upon the tough problem given us by the Directors (to make the newly opened Poulsen station at Medford, Oregon into a reliable commercial correspondent with San Francisco and Seattle) Logwood began

to realize that I could be of some real help to him, began to respect my superior training and knowledge, my many long years of hard-bought experience in radio, and the practical wireless education which I had acquired.

Charlie had never seen an Audion until I showed him one, but he immediately fell in love with the little device, became imbued with respect and admiration for the mind which had produced such a wonder, and thereafter devoted himself wholeheartedly, and with the utmost loyalty, to cooperating with me in whatever task I should undertake.

A close and intimate friendship developed between Charles Logwood and myself which lasted throughout my stay with the Federal Telegraph Company in Palo Alto and for many years afterward in New York, through the brave days and the long battles which marked the founding of my third fortune and the gradual upbuilding of the deserved success in which we could both take such a profound and well justified satisfaction.

While I was developing the diplex transmitting system for the beach station Charlie Logwood was of great assistance to me. Frequently we worked there all night because we could not begin our experiments or alterations until traffic was shut down in the late evening. Those were happy nights to recall when Logwood and I, having done our preliminary work in the afternoon, would go over to O'Neill's house for supper, one of Molly O'Neill's famous corned beef and cabbage dinners, washed down with large bottles of Tacoma beer, repose for an hour or two, and then go back to the station which we would in secret dismantle and tear to pieces as soon as A. Y. Tule had gone home for the night. Then by early sunrise we would rearrange the circuits and put them in order for the day's traffic, walk over half a mile of beach sand to the end of the trolley line and take the car back to the S.P. station and the train to Palo Alto for a day's rest; or sometimes to seek slumber in some cheap San Francisco hotel.

My Sundays during this period were frequently spent in exciting and health-giving hikes and climbs around the Sausolito hills, a Sabbath habit which I began to develop shortly after my first arrival in San Francisco. How fascinated I became with old Mount Tamalpais! It was Hall that first thrilled me with the beauties of that country, that Marin County. He positively refused to walk ten yards, so with Frank Merriam, Don Frix and myself he would usually take that equivalent of a cog-

wheel railroad to the top of Tamalpais or down to the Muir woods, for our Sunday in the open. And even when I moved to Palo Alto I would come up by train, take the ferry for Savsolito, and either alone, or preferably with Logwood, spend the entire day in vigorous climbing, sometimes going over the ridge as far as Rodeo, where a little runnel empties into the thirsty sands by the plunging sea.

"I am happy in my work, just now on the photographic printer for the Federal Telegraph Company - but harrassed, as is my usual lot, fool that I am, with divorce and separation suits; debts and doubts, longing for my child, yet not allowing myself to hope, or remember."

January, 1912: "A new year, a new work, in a new land. Yet the old work and the land already old to me are forever new, even as my work in wireless is forever new. Now may the ill luck of the old year, and the old years and land East, follow me no longer."

Now Sunday after Sunday, as my diary reveals, I spent in healthful hiking over the lofty hills, or exploring deep canyons in Marin County, or down on the Peninsula as far as Halfmoon Bay. Never in my life had I found the opportunities for such type of exercise, and this communing with the heart of Nature. These Sunday excursions brought me the change and rest that was solace to mind and heart, which was in large measure my salvation.

"In the little laboratory house I am hard and happily at work, nights and days. A host of new problems are before me, many fascinating ones to which the spark telegraphy (at least under the distinguishingly incompetent or criminal management by which it has always been cursed) has not attained.

"For example, Diplex Telegraphy, both for sending and receiving, amplification of signals of the compound tikker, as well as by two relays, improving efficiency of arc, silent or singing, or new sending and receiving sets.

"Then there is my old enemy, the 12 year old bete-noir of all wireless investigators, as yet baffling us all, when vicious - "growling" static.

"I make frequent trips into the city to the big station with this or that instrument for trial, but the quiet of this village, its dreamy dawns, its warm noons,

its silent nights, its welcome atmosphere of quiet erudition and genuine, unpraised effort seem to be working upon my mind and body a wholesome peace and contentment, which is good, though sometimes almost alarming!

"Am I peacefully asleep and content while Destiny passes. Somehow I do not desperately fear this. Each dawn brings hope; while a new health and unknown physical strength, a renewed youth, grows within me. It is California; and I am only 38! I choke back the bitterness, and forget New York and its crimes."

One afternoon late in March, while Elwell was in Honolulu supervising the expected opening of wireless telegraphic service with the new South City station, I was visited by two men who quietly informed me that as United States Marshalls they had an order from the Federal Judge in San Francisco for my arrest.

Stunned, I inquired the cause - "use of the mails to defraud" read their papers. They were kindly disposed and gave me until midnight to arrange for bail. I at once telephoned Beech Thompson at the Company's San Francisco office, and fortunately found him in, hurriedly explained my perilous predicament. He went to the bat with vim in my behalf, and by ten o'clock that night had arranged with two wealthy members of the Board of Directors, men whom I had never even met, to post the $10,000 cash demanded by the Court. Thus had I shudderingly close escape from prison doors that seemed suddenly yawning before me, victim of those unprincipled promoters who had so villainously wrecked my handicraft, and stolen savings of the multitudes who had with their earnings backed my efforts to create a new art and industry.

I find this entry in my diary: "Palo Alto, March 29, '12 - Since Wednesday I have worried more over what my arrest will cost my dear ones than about its outcome to me. Being guiltless I fear not the outcome - only this heavy and renewed expense and the sense of the rank injustice of it all. I will probably fight it out here and not go East for a long time, as here is my work and my income, especially during the coming Summer when "static" problems must be solved.

"If this trial results in sending that arch-crook, James Dunlop Smith, to the 'pen', I'll be glad.

"One thing was quickly sure, that I had made some mighty staunch and true friends in need in the great

great West. When two Directors of the Company employing you, one of whom you have never seen, hustled out between 4 and 6 of an afternoon, when banks and Commissioners' Offices are closed, and put up a $10,000 bond to keep you one night out of jail - it spells FRIENDS with big letters."

"I have wired and written Mother and relatives not to be alarmed, and I want none of my dear ones to worry over this. It will all come out right and be forgotten, along with some other lesser, but more solemn, troubles of by-gone days!

From a letter I wrote to Mac Horton: "Of course, you have heard the news and are saying, 'Poor old Doc', 'damned shame', etc. So it is, my old pal, and you can help me by telling whom you know or meet that I am not a crook. After working as I have, as you know I have, for this great cause for twelve years, it's kind of tough to have this handed to you by the United States as a reward. But, oh, there's time yet. I can still be happy!"

The shame and harmful publicity attendant upon the arrest of the Directors was the blow which put the final quietus upon the yet bleeding corpse of the Radio Telephone Company and its ill conceived successor, Bulingame's North American Wireless Corporation.

Long before this had I, unsurprised and approvingly, read of the arrest, trial and prison sentences imposed upon Col. Christopher Columbus Wilson and certain members of his choice gang of wireless wreckers of my first enterprise, Directors of the United Wireless Telegraph Company.* Yet notwithstanding that, Charles Galbraith and his corps of honest, capable, hard-working men, engineers and operators who had been instrumental in building up the American De Forest Wireless Telegraph Company, had gone determinedly ahead developing "United" along sane and business-like lines until, at the time of its forced and wholly unjustifiable bankruptcy, this successor to the Company I had founded had far more wireless telegraph installations, on ship and ashore, than all the other wireless companies in the world combined!

Only by this forced receivership and sale was the American Marconi Company enabled to commercially survive. But by this strategic move and dominating strategem the latter Company acquired over night almost a total monopoly of wireless telegraphy in the United States, a thing which they never could have accomplished by dint of their incomplete and sadly shattered patent position, or by virtue of the superiority (sic) of their system, or methods.

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* For some reason, best known to the U. S. Prosecuting Atty. "Honest Abe" White was not indicted.

And until after the War, and the subsequent gradual substitution of the three-electrode tube transmitter and audion (as detector, oscillator and amplifier) the bulk of the ship and shore equipment in America was still the remains of United Wireless and American De Forest Wireless Company's design and manufacture.

But thus the American Marconi Company (British dominated) managed finally to become the great and powerful nucleus which, after the World War, made possible the Radio Corporation of America.

And now my Palo Alto work went on apace. Since the first of 1912 I had had as my assistant, in addition to Logwood, one Herbert Van Etten, graduate of Stevens Institute (New Jersey) an engineer for the Pacific Tel. & Tel. Company in San Francisco, who desired to change to the new work in which we were here engaged.

Soon we three became coordinated in the task of signal amplification. Elwell had placed the Palo Alto engineering, the design and construction of ever larger transmitter arcs, in the charge of Leonard Fuller, under whom worked Ralph Beal and Archie Stevens - men who have since carved well their names in the annals of modern Radio.

Late that Spring I felt financially justified in seeking again to establish a home. I contracted therefore to installment - purchase a neat and cozy little cottage on Bryant Street and invited my dear Mother, then visiting my sister, Mrs. Philip Ralph, in their little ranch at Edison, California, to make her home with me. At that time I had become happily reconciled to the thought of becoming a Californian, permanently associated with the Federal Telegraph Company, to which I was already assigning certain patent applications.

Mother accordingly came up to Palo Alto and lived with me there in quiet peace and contentment. Until I saw, late that Summer, my great opportunity, in demonstrating to the Telephone Company my audion amplifier. I firmly resolved then to stage a <u>second</u> come-back.

And I did. But the dear Mother continued to dwell in Palo Alto, almost until the time of her death, in 1927.

Now the Federal Telegraph Company demanded more in telegraphic speed for their rapidly growing trans-Pacific and coast-wise traffic. The first photographic printer on which I had toiled assiduously in the little hot box of a station

at Los Angeles was proven too elaborate and unreliable. I had suggested that we cut the Gordian knot with a simple fine steel wire. Pat O'Reilly, San Francisco agent for the American Telegraphone Company, was keen to comply with my request and loan me two of the telegraphone machines. I ran these at high speed while recording their own high speed telegraph signals, transmitted by a previously punched tape, the same as had long been used in high speed telegraph for cable transmission. I then re-ran the steel wire at a rate slow enough to permit the operator to transcribe the recorded messages.

This was all very well, but the long distance telegraph signals impressed thereon from Logwood's simplified but highly ingenious "tikker" were too weak for satisfactory recording.

Thereupon Logwood and I, using the audion tubes and batteries which I had brought down with me from the deserted Phelan Building Station, set about constructing therewith an amplifier for telephone signals. Van Etten, telephone engineer, watched with keenest interest, but with conservative and constructive skepticism. He well knew how the telephone profession had vainly toiled for many years to accomplish exactly what we raw wireless inventors, unlearned in the telephone art, were so innocently, sanguinely, attempting.

So I made of Van Etten my umpire. Whenever I had a new circuit arrangement, new induction coil set-up, with his watch tick at the transmitter (a telephone receiver) and with the headphone set for listening, I would ask "Van's" opinion as to whether or not I had here attained any amplification. For with the audion bulbs we were then using, more or less gassy, designed entirely as radio detectors, and with thick coarse grid structure, it was by no means a simple thing to obtain any observable degree of amplification of telephone signals. For tedious weeks Van would merely shake his head. Finally Charlie and I secured a degree of amplification which would not be questioned or denied.

"Waal", finally drawled Van Etten - "The thing do boost!" At last we had triumphed. Thereupon I set about cascading two audion tubes, the "wing" or plate circuit of the first feeding through a properly designed telephone repeater coil (I had the shop wind dozens of these during these experiments), the grid circuit of the other, usually omitting from this circuit the grid stopping condenser which I had always used in radio detector work.

We now found that we were stopped from obtaining greater amplitude by the fact that when the B. battery potentials were raised to secure greater power output the tubes invariably "blue-hazed", on account of the gas therein. I had recently obtained a dozen tubes from McCandless, exhausted to the very limits of his lamp pumps. These were too soft however, so I finally found a maker of X-ray tubes in San Francisco, (Lamont, I believe, was his name) who retubulated and re-exhausted the McCandless bulbs, giving them the identical treatment he had been giving his X-ray tubes. With these re-exhausted tubes we could safely apply as much as 220 volts or more to the anodes.

Now with these audions, in double and triple cascade, I really began to get astonishingly fine amplification. We tested this amplifier always by reproducing magnetic records from the Poulsen telegraphone. I had obtained a small loud speaker, which was nothing more than a large telephone receiver, a short elbow-shaped double-mouthed horn attached thereto. My method of measuring the relative amplitude levels obtained under varying conditions was truly simple, but effective. Instead of "transmission units" of the telephone engineer I measured my gains in "blocks" and "half-blocks"! I placed the loud speaker in the laboratory window and walked down the street until the threshold of clear audibility was reached. After I had obtained a "two-block" gain I felt reasonably satisfied with the audion amplifier!

Whereupon I sat me down and wrote a long detailed description of what I was doing with the audion as a telephone amplifier to my good friend, John Stone Stone, in New York. By return mail he replied expressing the utmost interest in the information I had conveyed to him, and volunteered his willingness to lay the matter of this telephone repeater, or amplifier, before his friend, J. J. Carty, Vice President of the American Telephone and Telegraph Company in New York City. Further correspondence followed, and soon Stone informed me that he had made arrangements for me to demonstrate the audion amplifier before engineers of the Western Electric Company in the Bell Telephone Laboratory in New York.

But before this occurred, in the early stages of my development of the cascade amplifier, I accidentally made a discovery, the discovery which was destined a few years later to completely revolutionize the entire art of radio transmission.

This was the "feed-back" principle. Van Etten's notebook, which has now become classic by having been introduced as evidence in one of the most long-drawn, bitterly contested and

historic interference procedures in the history of the United States Patent Office, states that on August 16, 1912 I had so arranged the inductance coils, connecting the first and second audions of the cascade amplifier, in such a manner and with such connections, that lor or high musical tones could be heard in the telephone receiver connected to the output circuit of the second amplifier. The record goes on to show how we investigated this phenomen and found that we were able to change the pitch of the reproduced note through a wide range of frequencies, depending upon the amount of inductance in the circuit and capacity in shunt thereto; and how by reversing the connections (either to the input of the second audion, or the output of the first) the feed-back or regenerative effect would be annulled; and then by renewed reversal, reproduced.

One of Van Etten's notes (he was the recording secretary in these experiments, Logwood and I being too busy and excited in preparing the circuits and calling the turns on the experiments to pay much attention to the actual recording of the results obtained) - these notes show in one case, how we, having at the time available only one satisfactory audion, had undertaken to make that bulb do the work of two by deliberately connecting or associating the output circuit with the input - a true revelation of the fact that we then understood thoroughly the phenomenon with which we were dealing, the feed-back principle, and even at that early date were seeking to obtain self-amplification. But in so doing we obtained instead self-regeneration, or in other words put the audion into a self-oscillating condition.

My own notebooks confirmed these operations. But the earliest entry, which in the later opinion of the Supreme Court definitely determined the earliest date which I could claim for my discovery, the feed-back circuit, was an entry in Van Etten's notebook.

In the latter part of September Beech Thompson was then undertaking a business trip to New York, and very kindly offered to take me along with him, for I had frankly explained to him the entire situation, that John Stone Stone had made definite arrangements with the Telephone Company for me to give a demonstration before their engineers in New York. I showed him my earlier patents, assigned to the Radio Telephone Company, covering both the grid audion and the three-electrode tube amplifier, so that Thompson clearly realized that ownership for my invention could not be claimed by the Federal Telegraph Company. Yet he was generous and big hearted enough to do what he could to facilitate my plan to interest the Telephone Company in a device which, while it might be interesting and useful to the Federal Telegraph Company in amplifying their signals, should on the other hand prove of inestimable value, in fact indispensable, to the Telephone Company on their long distance lines.

Arrived in New York I made the Engineering Society's Library my headquarters and there spent most of my spare time in studying, delving through engineering journals to which I had been denied access while in Palo Alto. But first I set up my cascade audion amplifier in an upper room of the Fine Arts Club on Gramercy Square, where John Stone Stone was then living. Stone, of course, expressed the very keenest interest in what I had there to show and listened intently to my account of all I had to relate, regarding the experiments I had made in Palo Alto leading up to the construction of the finished amplifier.

Among other things I informed him in detail of my discovery of the feed-back phenomena and how I had applied this, even using in addition to the telephone induction coils my pan-cake tuner coils wherein audibly high frequency oscillations must have been generated. Stone's testimony to this effect in the subsequent Interference Proceedings and Supreme Court hearings proved of great importance.

Now without delay Stone arranged, through John J. Carty, for me to take the apparatus down to the Western Electric, Bell Laboratories on West Street, where a small room was set aside for this purpose. Early afternoon of the first day I had the apparatus set up and in operation, then notified Carty. And the Western Electric and Bell Laboratory engineers filed in to see what de Forest, the wireless telegraph man who had rather recently been filling the ether with voice and music instead of dots and dashes, might possibly have to offer which could be of interest to the telephone engineers.

This corps of telephone engineers was headed by Dr. J. de Forest Arnold. Under him was Richards, Dr. Colpitts, and several others whose names have since escaped me. The men were mildly interested in what I had to show them, asked me a few questions, and finally suggested that I might leave the apparatus there overnight and perhaps come in the following day, at which time they might desire to ask further questions. J. J. Carty was conspicuous by his absence.

On the following day the attitude of these previously indifferent and rather aloof telephone engineers towards myself and my apparatus had undergone a very marked and encouraging alternation. Where before was indifference and an attitude of boredom, now an atmosphere of keenest interest pervaded the room. As one after the other donned my awkward headphones and listened to the resounding thud in their ears when I dropped a handkerchief a few inches away from the telephone receiver which was acting as my input transmitter, expressions of incredulity and surprise spread over their faces. At the close of the seance it was very evident that all present were keenly interested in the audion amplifier as a telephone repeater or relay.

Dr. Arnold asked me if I would be willing to leave the apparatus with them for a short time, and inasmuch as the circuits which I had shown them were in the main covered in my earlier patents, he assured me and Mr. Stone that my rights in the invention would be most scrupulously guarded.

And so the matter rested (so far as I was able to find out!) for nearly one year. I was perfectly willing to leave the apparatus with the Western Electric engineers to make any further tests or experiments which they might see fit, believing that in this manner their interest in it would be most rapidly and intensely focussed, and that it should not be many weeks before they would be in a position to inform me whether or not the Telephone Company was interested in the possibility of acquiring rights under my patents for use of the devices and circuits on their long distance telephone lines.

John Stone talked to Carty and was informed that the Telephone Company's engineers would lose no time in giving the matter a most thorough investigation and would rapidly come to some definite conclusion. However, Stone was treated in this matter almost as cavalierly, and with not much more consideration by his old associates in the Telephone Company, then was I, a young stranger, almost an intruder upon their especial preserves - to wit, no information whatever was vouchsafed.

So I lingered on in New York, week after week, expecting some report from West Street, or 195 Broadway. Meantime, inasmuch as I had been wise enough to bring with me two sets of audion amplifiers, I began to demonstrate to other parties with my duplicate set. O'Reilly of San Francisco had insisted that I go to Springfield, Mass., headquarters of the American Telegraphone Company, and demonstrate there the audion amplifier as applied to the telegraphone. This I did. The Telegraphone directors there and their New York representative and attorney, "Honest John" Lindley, showed considerable interest in the possibilities of using this amplifier in connection with the Telegraphone.

On this trip to New England I seized the opportunity of going to Gloucester, Mass., where President Taft was then residing at his Summer cottage. I brought with me a letter of introduction from President Hadley of Yale University, to whom I had previously gone, explained to him the sad predicament in which I had found myself as the result of my arrest the preceding Spring by United States Marshalls in Palo Alto. President Hadley was all sympathy, readily accepted my interpretation of the situation, and agreed that it was an outrage that I should have been arrested in company with the rascally defaulters, through whose dishonesty alone my Company had been wrecked and the investment of all the stockholders thereby jeopardized or lost.

President Taft listened to my story in a sympathetic frame of mind and informed me that he would communicate with George Wickersham, his Attorney General, in the matter. I felt much relieved thereat, and knowing that I was innocent of any wrong-doing, and then still endowed with a patriotic, blind belief in the inherent justice of the great United States Government, proceeded on my way rejoicing.

At that time I called on John Hays Hammond, Jr., who had expressed great interest in my audion detector and wished to consult me regarding the possibilities of applying the amplifier to some dirigible torpedo experiments on which he was then engaged in Gloucester. I spent two very delightful days in his home and laboratory there.

During the early part of my stay in New York I had renewed with great delight my old acquaintanceship with Emil J. Simon, who was then employed by old Col. John Firth, the man who first took me under his wing and showed the first interest in my wireless telegraph apparatus and plans when I first came to New Jersey in 1901. One night in October "E.J." and I went to the Grand Opera House to a performance of the Quaker Girl, a tuneful little musical comedy which was then enjoying considerable popularity in New York. He was acquainted with some of that company, and after the performance introduced me to a charming member of the chorus, Miss Mary Mayo, who possessed a dramatic soprano voice a very unusual quality, absolutely true to pitch and of a natural bird-like purity.

With us at the time was J. E. Thompson, one of my former engineer operators for the Radio Telephone Company, who with Cyril Hinshart had been of inestimable aid in establishing our New York-Philadelphia communications from the Metropolitan Life Tower.

This chance acquaintanceship rapidly deepened into a sincere mutual interest, and by the end of that momentous year of 1912 to deep affection and love between the beautiful Mary Mayo and myself. So that when the San Francisco office finally wrote me that if I wished to continue in their employ it would be imperative for me to return to my Palo Alto work, we promptly decided upon marriage and a Western honeymoon.

By this time, since John Stone Stone had received no information whatever from the Telephone Company as to what progress they were making with the audion amplifier and their definite decision regarding interest in the rights thereto, and inasmuch as "Honest John" Lindley and the Telegraphone Company's directors were equally undecided, or disposed to indefinite postponement, to continue with the Federal Telegraph Company was my only alternative.

I learned that Gen. George Wickersham was in Chicago at that time, and I seized this opportunity to call upon him. He had received instructions from his Chief to look into my situation, and now merely waved me on my way with an encouraging gesture, but nothing definite. I knew of nothing more that I could do in the matter, which seemed to be in good and friendly hands of the very "highest up". There was nothing more for me to do than to return to Palo Alto and continue with my work in radio.

Palo Alto: January 30, 1913: "Back again after four months in New York - momentous months - back again, yet so differently.

Mother continued to live with us there, all in happy contentment. But I, although happy and wholly occupied with my laboratory tasks, lived ever in the hope that the audion seed which I had sowed last Fall back in New York would soon spring up into a new harvest, calling for my return, to reap at last the reward for which I had battled since my first inception of the three-electrode tube.

In March of that year John Stone Stone came to San Francisco to see me. He had had intimations from his old friend, J.J. Carty, that the Telephone Company would be definitely interested in acquiring rights under my audion patents if the tests still under way in New York continued to give promise of commercial applicability to their lines; and that he desired, in such event, to deal with Stone as my representative.

Whereupon Stone and I drew up a gentlemen's agreement, whereunder he was empowered to negotiate with the Telephone Company for the sale of these rights, and to receive a commission if such sale was effected. The sale price for the wire rights to the patents was not then fixed, but the sum of $500,000 was mentioned as a fair price.

My efforts during that Spring were divided between improving the transmission of the new high-power station at South City and in the laboratory, the latter chiefly directed to further efforts to eliminate, or at least to greatly reduce, interference from static disturbances.

The South City station originally had one large fan antenna supported between two 300 foot wooden masts, but the energy radiated was far from satisfactory. I had the contractors double this span, stretching the two halves away from each other as far as feasible, in a diamond shaped formation. This was an improvement, but not sufficient. I then rigged a wide horizontal flat-top antenna stretched between the two towers and half

way up, extended between the two fans. From both ends of this flat top cables were brought down and connected to the earth plates. These latter I had designed of a multitude of long spokes of copper strips and copper wires, extending radially from the station in every direction, because the high plateau on which the station was erected was altogether too dry to afford a satisfactory ground connection.

This novel arrangement of a compound antenna increased by 25% the best previous radiation, and Honolulu immediately reported a marked increase in the strength of our signals.

During the preceding Spring in Palo Alto I had striven by various ingenious methods to obtain a heterodyne detector, in other words an oscillating detector which would heterodyne with the received undamped wave signals from the distant transmitter, to give us, instead of the rough musical note of the ticker, clear high-pitched musical sounds similar to that which I had long ago found so effective in my spark telegraph days. But now, in the Spring of 1913, profiting from what I had learned the preceding August relative to the feed-back principle, I hooked up the audion detector with a small pancake coil in the plate circuit which was loose coupled to a similar pancake coil in the secondary of my receiving transmitter transformer, that is, in the grid-filament circuit of the audion.

And now for the first time, listening to the signals coming in from South City, I was able to record in my laboratory notebook this phrase, destined later to become historical in the annals of that famous interference with Armstrong: "This day I obtained the long sought-for beat note phenomena."

In high glee I called in Fuller, Beal, Stevens and Logwood to the receiving laboratory room where I was then at work. They all heard the Poulsen signals, as they had never heard them before, in the form of a high, squealing note, the pitch of which could be altered at will by simply changing slightly the tuning condenser in the grid circuit. No one but Logwood however understood the circuit whereby I was able to obtain this highly desired effect. All congratulated me and seemed keenly delighted to know that the audion detector, long proven of value in spark telegraphy, could now be directly applied to the great benefit of the Poulsen system. This, in addition to its amplifying qualities, for which it was already in use at the South City and Los Angeles stations for amplifying the tikker signals.

The historic occasion above recorded was in Mid-April, 1913, and the brief recording of the observation in my laboratory notebook was destined to play a most important part many years later in the Patent Court litigation which was finally terminated

by the decision of the United States Supreme Court - not once but twice - that I was the originator of the basic feed-back and regenerative circuits, circuits which have since proven themselves to be of incalculable value, not only in all types of radio transmitting and receiving equipment, but to the physicist and the industrialist as well.

About this time I began to receive encouraging letters from "Honest John" Lindley and his then associates in New York, Dr. Louis Duncan and his business partner, Sam Young. These letters indicated that this group had become very much interested in the audion amplifier and that very shortly funds would be provided to bring me again to New York to carry on certain laboratory experiments which I had outlined to him in my previous visit, the combination of the audion amplifier with a specially designed type of telegraphone recorder and reproducer, one which could be synchronized with a motion picture film for the purpose of achieving talking motion pictures.

Toward the end of April funds were actually in hand for this Eastern trip, together with assurances of definite employment again in New York. So I resolved once more to cross my Rubicon, burn my bridges behind me, leave our little Palo Alto home, which had been my shelter for less than a year, and take my bride back to the metropolis.

So, following a delightful three days' automobile tour down the peninsula, where we slept among the big Sequoia of the Santa Cruz grove, bowed to the spell of the old Spanish Mission at San Juan Babtista. I again packed up my audion amplifiers, personal belongings, and bade a long farewell to Palo Alto, and the California which I had learned to love so dearly. I turned the home back to the original owner and established my Mother in a very pleasant little apartment. There she seemed quite contented, because she had already during her one year's stay in Palo Alto formed many pleasant acquaintanceships with the good ladies of the church, and especially with Mrs. Albert de Forest and the fine old mother of her husband, who was a distant relative, son of Tracy de Forest, a brother of my grandfather, Lee. I could feel, therefore, that I was leaving my Mother in congenial and rather delightful surroundings, where she would be far happier than any place back East.

Arriving in New York early in May, I learned from Mr. J.J. McKelvey of Spuyten Duyvil, of the real estate company which had contracted in 1909 to build the house for Nora Blatch and myself, that the house had long ago been completed but never occupied; and that he would be glad to have us move in and occupy the premises, until such time as we could find a way for paying for it, or until some other purchaser of the property could be found. Thereupon

Mary Mayo and I moved down from the little inn at Spuyten Duyvil into the new home, which I forthwith named "Riverlure" - "Where dreams come true." We lived there through that summer, content with very scant furnishings, such as I could obtain on very long term installment payment plans from Bloomingdale's in the Bronx. Mary Mayo became a good cook, and we managed to get along quite comfortably, so long as I was in receipt of the small salary that Duncan and Young were paying me.

The old 14th Street Studio of the Biograph Company, Mr. Hammer manager, whose main studios were then in the Bronx, afforded ample room for me to work. For Hammer was very much interested in the plans as I outlined them to him for creating the talking picture. The American Telegraphone Company at Springfield was also interested in the possibilities of using the Telegraphone for this work, and furnished me with their newest model. There was an old projection machine available on the premises, and I began to design and have built mechanisms whereby the telegraphone wire was run over a large pulley attached to the socket spindle of the projector in such a manner that the steel wire would exactly synchronize with the picture film.

Experiments were encouraging, so much so that it soon became evident that I should have a piano for recording purposes. About this time the meager finances which had been supplied by Messrs. Duncan and Young became more and more irregularly forthcoming, more meager, and finally dried up altogether. So here again I found myself high and dry, without money but with plenty of courage, and determined that I was working along a line which could bring a fortune!

And when in my desperation I went to Honest John Lindley and almost begged him for a brief continuation of my meager salary, or even as a personal loan, I received only his comforting word: "The curse of the poor is their poverty!" Had the stingy old fool but known <u>who</u> was, even then, ready to bid for limited rights under those Audion patents!

Mary Mayo hocked her ring and I my watch, so that I could rent a piano, because I was convinced that if I could make a few satisfactory demonstrations with my talking picture apparatus it should not be difficult to interest the Biograph Company to finance my further work.

And still no further word, either to Stone or myself, from the Telephone Company. I went to see my old friend and helper, McCandless. He informed me that for some months after my demonstrations before their engineers Dr. Arnold and Richards

had caused him to build a large number of audion tubes of various types and designs. But that since a long time he had neither seen nor heard anything from that quarter.

Still nothing definite came of these efforts, and my condition became desperate indeed. Just how we managed to exist through the balance of that summer I cannot now say, but the fact remains we did, and furthermore we entertained company at Riverlure. John Stone Stone came to call upon us, and dear old Mac Horton, to renew in happy reminiscent converse the lively battles we had waged away back on the Coasts of Hollyhead and down along the Carribbean waters, with vicious static and vicious insects and foul smelling drinking water - to say nothing of the ceaseless night vigils during the war maneuvers on the Sound; and later on the southwest coast of Ireland, where the rains fell and the winds were fickle, and the Bell tetrahedral kites cracked up!

During this summer I was occasionally in contact with Burlingame and some of his henchmen, dummies whom he had placed in particular charge of the moribund Radio Telephone Company. One day late in August these informed me that they had been approached by a dapper young attorney, by the name of Sidney Meyers, who informed them that he represented clients who were interested in obtaining the rights under the audion patents, and that if the various interests who might claim ownership to the patents at that time could all get together, his clients might be interested in making an offer.

Shortly thereafter this same Mr. Meyers called upon me at my 14th street studio. He was pleasant and suave, and explained his errand. I informed him that ten months previously I had demonstrated my audion amplifier to the engineers of the Western Electric Company and they had seemed well pleased with its possibilities for application to long distance telephone lines, and that ever since then I had been waiting to hear from the Telephone Company regarding the purchaser of the patent rights; that the wire rights in which he said his clients were interested could be of value only to the American Telephone & Telegraph Company, and that I could not understand how any other party could be interested in acquiring the wire rights under those patents.

Meyers assured me, "on his word of honor as a gentleman" that he did not represent the Telephone Company. He was very secretive as to who his real clients were, but when I pressed him for further details he admitted that it was possible they might have some idea of developing the invention further and then interesting the Telephone Company therein. He stated that his clients had authorized him to offer $50,000 for the wire rights under a

group of seven audion patents. This was their price and there was no need in our attempting to raise their offer, as that was the limit. In other words, he very politely told us that we could "take it or leave it". But that before any money was paid over contracts would have to be drawn up, stockholders meetings of the De Forest Radio Telephone Company, the Radio Telephone Company and the North American Wireless Company must be held authorizing the officials of those companies to sign, and that I myself must sign the contract personally.

I was, of course, disturbed and greatly disappointed not to have heard any word from the Telephone Company, but well realizing the desperate condition of the Radio Telephone Company and the the North American Wireless, and of my own situation, and well realizing (then almost literally) that the crust of a loaf is better than no bread at all, I advised the company's officers that we had best accept this proposition of Meyers, whose offer, had we then realized from whence it came, could well have been characterized as a piece of "crust". Sidney Meyers informed us that he had looked thoroughly into the condition of the Companies and found out that the Radio Telephone Company was badly in arrears with its New Jersey State taxes, and that it might even be necessary to go through the formality of an auction sale of the assets of that Company at the Court House in Trenton. This suggestion fairly frightened us, because we well realized that under those conditions his clients could probably angle to obtain not only the wire rights but all of my patents in toto, for a few thousand dollars, of which we would receive not one cent.

Accordingly Mr. Sidney Meyers was authorized by us to proceed immediately to draw up the necessary papers. The North American Wireless Telegraph Company was a Maine corporation, so it was necessary for us to go through the formality of holding a stock-holders' meeting at Portland. Meyers' clients obligingly advanced a few hundred dollars to pay the expenses of holding this meeting, and a group of some six or eight journeyed to Portland for this purpose.

During the trip I became well acquainted with Frederick Williamson, one of the Directors, the only one of the lot who seemed to understand me and my previous services, and to sympathize with my predicament.

Shortly after we held a stockholders' meeting of the Radio Telephone Company in Jersey City, at which, I being a majority stockholder, and very much to the surprise of Burlingame's dummy President, proceeded to elect new Directors, who in turn elected Frederick Williamson as President and myself as Vice President of the Company.

And so at last the papers were all signed, sealed and delivered to Mr. Sidney Meyers. Capt. Derby approved the assignment papers, giving to Meyers "and his assignees" exclusive wire rights to the group of seven audion patents. His check for $50,000 was duly turned over.

To me now this was as a breath of air to one smothering- as a morsel of food to a starving man. I had already located a new empty loft building on Sedgewick Avenue, the Bronx, at High Bridge, within ready access from my Spuyten Duyvil home by New York Central train. I finally persuaded Williamson that this was the ideal spot for my laboratory, while an office should be opened down town for better reaching vessel owners and the growing number of amateur wireless fans.

For I was determined to lose no time in getting under way again, just as quickly as was humanly possible, my experimental laboratory and the manufacture of radio receivers, amplifiers and set parts, for new markets which I was confident could be rapidly built up.

No sooner was Meyers' check in the bank than I wrote to Charlie Logwood to pack up and come East to me. Nothing loathe to leave California, where his marital affairs had recently met tragic shipwreck, he came on, but by way of Washington with C.F.Elwell, where the two demonstrated at the big new Arlington Naval Wireless Station a large Poulsen arc, Logwood's "tikker" detector, and a cascade audion amplifier which they had constructed in Palo Alto after my departure.

So there in the large empty two-story loft of the High Bridge plant Logwood and I began immediately our experimentation with audion amplifiers and oscillators, where we had discontinued that fascinating work more than a year previously in Palo Alto.

And now, shortly prior to my first Thanksgiving Day in the new home, the black lowering cloud of that dread Federal prosecution mantled my soul with sodden gloom.

Throughout the preceding summer I had done nothing to prepare my defense. I had been quite without funds all those months, while Capt. Darby had employed Martin J. Littleton to defend himself, and the others had hired expensive counsel. Knowing that I was not dishonest, had robbed no one, I felt perforce compelled to rely on my blind faith that Justice would triumph, that no judge or jury could find me guilty.

Yet my perilous predicament had been noised around. Certain of my Yale friends, notably Lloyd Smith, 95S, Chairman of the Yale Scientific Monthly, at the time he elected me to the new Board, and George Parmly Day and George McLanahan, '96, of Washington, realizing my peril far more than I had, circularized, entirely unknown to me, certain of my classmates and had underwritten a "de Forest Defense Fund" amounting to perhaps $8,500.

An active, crusading young attorney, Howard Deming, then arose to defend the maligned inventor, who, lacking such aid, would have been able to put up no defense whatever.

And so I began to prepare. My nights were spent in the laboratory with Logwood, but my days were spent at Deming's office, where John Stone Stone was usually found aiding in every possible way to defend the intrinsic value of my inventions, of the patents I had assigned to my company. Frank Butler came on, under subpoena, from his Toledo home. Leon Thomas and others of my old boys were glad to testify as to the practical value of the invention, and the honesty of the inventor.

All of the defendants were charged with "use of the mails to defraud, by selling stock to the public, in a Company incorporated for $2,000,000; whose only assets were de Forest patents directed chiefly to a queer little bulb like an incandescent lamp which he called an "audion", and which device had proven to be worthless - was not even a good lamp."! And contemptuously the learned prosecuting Federal District Attorney held up for the jury's gaze one of the little bulbs.

Furthermore, the Federal District Attorney informed the Judge during the course of his attacks on me, against whom he showed an especial animus, "de Forest has said in many newspapers, and over his signature, that it would be possible to transmit the human voice across the Atlantic before many years!"

"Based on these absurd and deliberately misleading statements of de Forest the misguided public, Your Honor, has been persuaded to purchase stock in this Company, paying as high as ten and twenty dollars a share for the stock!"

The learned District Attorney, Robert Stephenson by name - a man who if still alive must be highly proud of the statements he made during that trial - ended his impassioned plea by urging in the name of the People of the United States, that de Forest, Darby, and their associates be given the limit of the law and be sent to Atlanta Penitentiary.

And now did Mr. Sidney Meyers come to my defense to inform the Court that he, on behalf of certain clients, (unknown and unnamed) had only a few weeks previously paid $50,000 for limited license rights under the patents on this same worthless audion tube? Sidney Meyers was conspicuous by his absence from that Court.

And now did any representative of the Telephone Company who had for the year past been spending large sums in experimenting with and perfecting the audion amplifier for use on their long distance lines, come forward to inform the Judge and jury that they considered the invention as possessing very great potential values - that they in fact were the mysterious, hidden clients of Mr. Sidney Meyers? Or that their President, Mr. Theodore Vail, was then prepared to sign or had already contracted with the Panama-Pacific Exposition, guaranteeing (through the instrumentality of the audion amplifier) to establish transcontinental telephonic communication between New York and San Francisco against the opening

of that Exposition early in 1915? The Telephone Company was conspicuous at that trial of Darby and de Forest, in dire jeopardy of their honor and freedom - by total absence of any representatives of that mighty organization.

And so the long dreary weeks of that trial dragged on, six of them, terminating at last on the last day of that Hoodoo Year, of '13.

The Judge's charge was given to the jury at noon. The jury was out for 13 hours. From the streets below that upper court room in the old Federal Building we could hear the mounting din and clamor as the milling throngs celebrated that New Year Eve. Mad joy and reckless gaiety below - awful dread and horrifying suspense in the hearts of those above, who nervously awaited the exit from the jury room of twelve "good men and true".

Could it be, I reasoned, could it be, in reality, possible that <u>this</u> should now be my actual predicament - my reward for all the years I had toiled and economized, to build on foundations so carefully planned, firm foundations of character and hard scientific study, of endless experiments; always rebuffed but never baffled, discomfited but never discouraged? Oh, it could not be! They could not find me, or good old honest, trusting Captain Darby actually guilty of fraud. That was impossible!

And yet as the jury filed in and took their seats my heart beat with trip-hammer blows. My breath came and went uncontrollably, loud and raspingly, so that Deming by my side muttered, "What is the matter with you, de Forest?"

One kindly face in the jury covertly smiled at me I thought. I braced myself for the verdict.

"Smith, Tompkins, Burlingame - guilty on all counts."

"De Forest, Darby - NOT GUILTY!"

Then the jury filed out, out-stretching cordial hands to the Captain and myself.

So that was our Happy New Year!

On that night, after I had first telephoned to relieve my wife's anxiety, Darby and I took several members of that jury down across the avenue to a crowded Pub, where we all drank each other's health and prosperity.

And then I took the Broadway subway for the long walk from the 231st Street station over the black hills of Spuyten Duyvil - to "Riverlure, where dreams come true" - into a New Year.

Throughout most of the weeks of that trial Logwood and I lost no opportunity to experiment and design. I knew the United States Navy was much interested in the audion amplifier to be used in connection with their wireless telegraph receivers. So I designed and built samples one, two, and three-stage amplifiers, housed in tall narrow mahogany cabinets, with 60 volts of dry cells for each stage, with hard rubber or bakelite panels, carrying filament rheostats and "B battery" switches. The audion bulbs hung pendant one above the other, from sockets hung to the front of the panel.

Usually the uppermost bulb was the detector, with grid condenser and high resistance leak attached to inside of panel. These grid leads at that time consisted of graphite pencil marks on white paper, cemented to small bakelite slabs.

The Navy wasn't long in ordering such samples; and soon repeat orders began coming in, in encouragingly increasing quantities.

We had equipped the shop downstairs with lathes and drill presses, and these soon began to hum with new industry, gladdening my long-battered heart. The downtown office now hired A. B. Cole, the first radio-parts salesman since the early regime of Q. H. Brackett in the Met. Tower. Bulletins and Circulars were published, and the trams began to beat a new pathway to the corridors of 101 Park Avenue, next door to the old Terminal Building, where still stood the steel tower of my 1908 laboratory. This we repurchased and installed atop of the High Bridge factory.

One of the first tasks to which I assigned Logwood after the new laboratory was "organized", with pathetic quantity of equipment and instruments, was to set up the oscillating audion feed-back circuits of the preceding year at Palo Alto. Because I was eagerly impatient now to create a new radio telephone transmitter, far better than the carbon arc; although I recognized that at first it could be of only a few watts power - then to increase this power as fast as our ingenuity and McCandless' improved pumps would permit.

In the course of these experiments - I think it was in late November or December, 1913 - while Logwood and I were hooking up such a circuit, we by mistake connected the lower end of the high frequency coil in the plate circuit directly to the stopping condenser of the grid, instead of to the terminal of the B battery. In other words, the B battery then led directly to the plate, with the radio frequency inductance and variable condenser in shunt thereto, connected across the grid and plate electrodes of the tube. We did at once not discover the mistake, because the audion began to oscillate as we had expected. At this time our simple test for determining whether or not a tube was oscillating was to listen in the telephone receiver in the plate circuit and then to touch with the finger one of the terminals of the filament or grid. A characteristic clucking sound indicated that the tube was then in oscillation.

But now when we analyzed this circuit we found that we had made a new invention, or discovery. We called this the "Ultra Audion", because when it was used a detector of undamped waves it was far more sensitive than anything we had hitherto used, and was moreover decidedly simpler, calling for less equipment than did the audion with two inductances, one in the plate and the other in the grid circuit - the more conventional feed-back circuit.

For some time thereafter we preferred this Ultra Audion circuit for our transmitters. Inspection of my patents will show that most of our power transmission and circuits during the next year or two embodied this so-called Ultra Audion circuit.

Now with this little transmitter, or oscillator, comprising one of our standard high-vacuum amplifier tubes, (which were still two inches in diameter) with the secondary of a telephone repeating coil connected in the grid circuit, and a microphone and battery in the primary circuit, we were able to transmit beautifully clear, though faint, telephonic messages across the laboratory. The receiver was a simple audion detector, or combination of detector and amplifier. The perfection of operation and flawless clarity of this transmission, although from a mere toy, delighted me no end; and unquestionably aided me to bear up under the crucifixion which I was then undergoing downtown.

Another thing I did while the trial dragged on to its fateful close ("even while the Jury was out", as Deming upbraidingly remarked when I told him of my plans) - together with Williamson and the aid of a keen and resourceful attorney, Banzaff by name, I reorganized the Radio Telephone Company, so to speak; forming a new corporation to be called The Radio Telephone & Telegraph Company, the stock of which should be offered in exchange, on a fair basis, to the old stockholders of the Radio Telephone Company, and to the bondholders of the North American Wireless Telegraph Company.

It required all the courage and swift adroitness of Banzaff to so proceed as effectually to checkmate Burlingame's dummy president, Walters, who was still taking orders from his Atlanta-bound chief, and striving his yellow damnedest to put the old corporations into bankruptcy, so that he could, perhaps as receiver, batten on the wreck. But this choice Son of Belial was finally ousted, and our plans carried through to my satisfaction and the potential salvation of those stockholders who, during the succeeding two years, elected to make the proferred exchange of their stock.

And thus at last, in 1914, clear sailing again loomed ahead. And once more, and for the third time, was I enabled to lay again a foundation for my life's success - this time determined that no sinister, false friends should, boring from within, destroy the fine thing which I was building.

I was now to receive a modest salary - assured at least until that $50,000 had been all expended in rents and materials - payrolls

and advertising - plus patent expenses! And determinedly now did all hands plan and toil that the remnants of that sum should not be paid away before the income of the Company should exceed the outgo.

And so I could begin now to pay off that large indebtedness. And I pared personal expenses to the very bone until that duty had been performed in full. This job lasted until the first anniversary of my trial, as shown by the following letter from George Parmly Day of Yale University.

"40 Wall Street,
New Haven, Conn.
Nov. 18, 1914

Guy E. Beardsley, Esq.,
Secretary, Class of 1896S,
153 Oxford St.,
Hartford, Conn.

Dear Mr. Beardsley:

You will no doubt recall my letter of November 15, 1913, in regard to the indictment of Lee de Forest, '96S., with three others by the United States Government, for fraudulent use of the mails, etc., and setting forth the necessity of prompt action to avert the probability of his being "railroaded to jail" even though he might be innocent. You will, perhaps, remember also my statement that because of the urgency of the situation I had "agreed with George McLanahan to underwrite with him the expense of having the case properly prepared and de Forest defended, confident that when matters were explained to his Class the members of '96S. would raise the $2,500 necessary for these purposes."

As a result of your efforts in the matter 29 members of the Class of '96S. contributed a total of $803 to the "De Forest Defense Fund". Subsequently a subscriber from another class who (like "the underwriters") had never known Lee de Forest, contributed $227. These gifts made possible a return to "the underwriters" of $1,030 in all, but left the latter still $1,470 out of pocket, as a result of their action in paying in the total amount of the "De Forest Defense Fund".

"The result of the trial justified the efforts made in behalf of de Forest, as the Government failed to prove its case against him. Upon the conclusion of the legal proceedings Lee de Forest announced his intention of repaying at the earliest possible date the sums subscribed to aid him, and has now repaid such subscription in full, his representatives having placed in my hands a sum of money sufficient to return to each contributor the amount of his subscription. He has furthermore, by adding interest on the sums advanced, made possible

he repayment of such subscriptions without deduction for expenses ncurred in soliciting funds in his behalf, etc.

Because of the publicity given by you originally to the ppeal for contributions to the "DeForest Defense Fund" I feel that like publicity should be given to his action in so promptly repaying ubscriptions. In spite of the fact then that but a comparatively mall number of '96S men contributed to the fund I shall hope that ou will inform every member of the class of the manner in which ee DeForest has discharged his obligations.

Faithfully yours,

(signed) Geo. Parmly Day"

In January, 1914, on a visit to Washington soliciting rders from the Navy and Army, I called on McLanahan to express my ratitude. He listened to the account of my trial, and in departing aid, "Now, de Forest, that you are out of that mess, the best thing or you is to forget radio and find a 'garden variety" of job for ourself. Good luck and good bye."

I forebore to express aloud what his blind, unthinking advice ad made to surge through my brain. "Sez you!!" -- would have briefly hrased it, had such 1939 slang then been current.

His parting words made more obdurate my firm determination o complete this adventurous comeback on which I had now happily ngaged, to carry through - despite hell and high water - and riends, - to a grand success which should be a final vindication f my judgement, and my plan of living and fealty to my ideal.

Also during that Fall of 1913 I presented a paper on "The udion Amplifier" before a meeting of the Institute of Radio ngineers at Columbia University - the best attended meeting yet eld by that burgeoning organization. My demonstration of the crash- ng sounds emitted from my loud speaker when I dropped a handkerchief n the table before the telephone receiver aroused great astonishment nd applause.

On that occasion young Edwin H. Armstrong, clad in deepest mystery, had a small, carefully concealed box in an adjoining room into which neither I nor my assistant Logwood were permitted to peek. But when he, Armstrong, led two wires to my amplifier input to demonstrate the squeals and whistles and signals he was receiving from some radio telegraph transmitter down the Bay, "C.V." and I thought we had a pretty fair idea of what the young inventor had concealed in his box of mystery. So we proceeded meekly and obediently, to amplify whatever signals came over the wires from that room.

In 1914 the National Academy of Science held Convention and an Exhibit at the Bureau of Standards in Washington. There Dr. Frederick Vreeland was demonstrating his mercury vapor audio-frequency oscillator, or pure sine-wave generator. Dr. Irving Langmuir was in charge of the highly interesting exhibit of the General Electric Company. I demonstrated by ultra-audion oscillator, its output amplified by three audions in cascade, and fed into a loudspeaker with metal horn. Its piercing note I could run over the entire audible gamut by simply twisting the condenser knob. This phenomena was then wholly novel, and brought many interested savants to our booth.

Among these strode hurriedly, in great excitement and high dudgeon, Prof. Michael Pupin, whom I had long known as a kindly friend. "What right have you," he loudly demanded, "to have that here? That thing is not yours. That belongs to Armstrong!"

I was nonplussed, too flabbergasted to reply. Open eyed, but close mouthed, I gazed upon his surprising wrath, and continued the siren sounds.

Then I knew for a certainty what it was that Armstrong had had in his little magic box at Columbia. And that outburst by Prof. Pupin was the opening gun of the bitterly contested patent battle, to be waged for years in the Patent Office interference proceedings; and thereafter for years more, until "at long last" the United States Supreme Court should finally decide that historic contest.

At that same meeting in Washington Dr. Langmuir, fingering in a friendly manner one of my audion tubes, remarked: "When you put that little grid in this tube you really did something." This, coming from an expert authority like Langmuir, I considered as praise indeed.

Even before the beginning of the great World War in August of this year, the military attaches of Great Britain, France and Japan had visited our High Bridge factory for demonstrations of the audion, now useful as oscillator as well as an ultra-sensitive detector and amplifier - in a field where it stood alone.

McCandless' factory was swamped with orders for tubes. I think he "bootlegged" quite a little, for the news soon spread among fandom as to where these coveted tubes were alone manufactured.

But not alone for long! Soon reports came to my ears that the American Marconi Company had found, (despite repeated asservations of Prof. Fleming in columns of the London Electrician that the de Forest audion was nothing but a new American name for the Fleming valve) that operators were putting the "bloody valves" into their table drawer, were demanding and secretly using the de Forest audion in their place.

And so it was not strange that bars were noted before certain windows in the Belleville, New Jersey, factory of the Marconi Company, where Chief Engineer Roy Wiegant was burning midnight juice. Eventually, it was reported, Wiegant had discovered that the grid was non-essential, that a tinfoil or metal band about the Fleming valve made it the equal of the audion, as detector.* More, that the vacuum rectifier now under his magic touch had become an amplifier, and then - even more astounding - was an oscillator as well!

And yet most "valves" issued from that plant were painted heavily with black, and strangely had <u>four</u> conductors protruding.

And now L F.H. Betts of the firm of patent attorneys who had from the beginning represented the American Marconi Company, the same firm whom I had good reason to know and respect for the long, tough battle, they had given me 12 years before on the "four tuned circuit" patent of Marconi, notified us that the audion was an infringement on the Fleming valve patent, and requested a conference with Capt. Darby as our attorney, before they filed suit under those claims.

At this conference Darby informed them that our information was to the effect that the Marconi Company was even then infringing the three-electrode audion tube patent. The de Forest company would be compelled to file counter-suit under our own patent claims.

* My Pat. 841386 - Jan 15, 1907

At one of these conferences Betts suggested the wisdom of interchange of licenses on the patents in dispute. I was agreeable to accepting such a proposition until Betts stated that such an agreement must stipulate that the De Forest Company should not enter the maritime wireless telegraph field- must confine itself to the radio telephone. That limitation we could not see. We were already building some direct current radio telegraph transmitters designed for marine telegraph, and were already installing under contract aboard two coast-wise vessels. Good old Harry Mac Horton and some of my old wireless installers were now back with us for this work, and Mac Horton was, of course, tremendously pleased. "This is just like the good old days, Doc," he exclaimed, as he broughtin another ship contract, and became busy at our High Bridge factory superintending the construction of this new apparatus. It was in fact this very activity in the marine field, now to be their own exclusive bailiwick, which had determined the Marconi Company to bring new patent suits, if necessary, to stop our competition.

It might have been the part of wisdom to have accepted Betts' proposal, ended then and forever the subsequent annoying and costly litigation. Such an arrangement would have rendered unnecessary, perhaps impossible, the subsequent contract in October of that year with the Western Electric Company and their chosen representative, Sidney Meyers. Perhaps we could have then stipulated that the Marconi Company should not be empowered to license any others under my audion patents without our consent and just division of accruing royalties.

In such case the history of my own company and of the entire radio industry would have developed quite differently. Had I then known Judge Julius Mayer, as I later came to know him and concerning him, I would not long have hesitated in accepting that offer!

Such considerations and discussions are however, only idle speculation. Suffice it to say that Capt. Darby and I finally decided not to compromise but to fight. One weighty factor in this decision was the fact that the Fleming valve patent contained several obviously invalid claims, claims broad enough to actually cover the ancient "Edison effect". Therefore Farnsworth, who was now called in to lead our attack, as having had valuable early experience in battling with Betts and Marconi, argued that the Marconi Company, now admittedly using the solid audion, had absolutely no defense. We could at once obtain an injunction against their continued use of the audion, which they now found so essential in the conduct of their long distance transmissions. Meanwhile their suit must fall from invalidity, and we could then enter into the more equitable type of contract to which we felt we were emminently entitled.

And so we joined battle. Farnsworth asked that Judge Mayer hear the case. Because during the earlier months of that year, when Fessenden was suing the American Marconi Company under his high-frequency spark patents, I had been a fact witness for the defendant, and my testimony regarding my very early use of that type of spark, first at Armour Institute, then during the 1905 yacht races, and later at Las Brisas, Key West, had been a strong factor in causing the Court to find the Fessenden patent invalid.

After that trial the Judge had expressed the friendliest and most cordial attitude toward myself, as did the Marconi Company representatives. I was then very much "persona grata".

So now, we reasoned, Judge Mayer would be eminently fair, and give us "all the breaks". But we overlooked the parallel fact that he had also "smiled" (broadly) upon the Marconi Company during that previous case.

At the trial's opening Betts did two amazing things:
A, filed a disclaimer of the broad invalid Fleming claims;
B, admitted the validity of my grid audion patents and infringement.

Farnsworth at once moved for a permanent injunction against the Marconi Company, which of course was then incontestable. But we had "reasoned without our host". "Oh no," quothe the Honorable Judge Julius Mayer, "these parties came into court and in forthright and manly fashion admit their sins. They should not therefore be punished for so doing." "Injunction is denied!"

Evidently Betts could have taken the bench and Mayer the attorney's place. From then on we were licked - and we knew it. We were licked before we entered that court, but didn't know it. Wiegant showed the Judge that the Fleming valve was an amplifier (every radio engineer knew that it wasn't). Then he proved that the valve was also an oscillator (which every radio student knew was untrue - except that when gassy and in series with a high resistance the "RC" effect could make of it a controllable interrupter).

Greenleaf Whittier Piccard, Farnsworth's milk-fed caponic witness, made a (not) glittering ass of himself; and when he failed in this the Mayer-Marconi combination helped him along.

At the end of that horrid fiasco we were thoroughly licked and knew it. Had Betts but realized in time how thorough a job for them Mayer was pre-set to present, he need not have admitted validity or infringement of the basic audion claims!

So on to the appeal. That finally came to Court. Philip Farnsworth, now delectable in morning frock coat, striped pants and white spats, must have had the same irritating effect on grouchy old Charlie Hugh (Chief of that Court) that he had on Mayer when less sartorially gotten up. Anyway that lordly "Duke of Ulcer" soured on him, thoroughly and throughout - and also exhibited an inexorable animus against me.

So again we got what was coming our way. Thenceforth we were in jeopardy for every audion-detector amplifier which we sold. The mutual accounting proceedings, pro and con, dragged on and on before a Master, sweating away time, patience, and our scant profits. We had sold no "valves" - only audions. The Marconi Company, however, had sold valves and not audions (ostensibly and according to Fleming). If there were audions among them the Wiegant paint had usually effectively disguised the fact!

By those classic decisions of Messrs. Mayer, Marconi and Hough, such a hopelessly mixed situation resulted as to keep the industry of radio tube manufacturing in a befuddled mess until years later when the Fleming valve patent expired. Neither company could manufacture without the other's consent. Finally Marconi licensed Moorhead of San Francisco, whom we had closed up by injunction, so eventually through this distant and involved channel, the situation became somewhat less tangled; but always costly and never satisfactory to any parties involved except to the patent attorneys.

Toward the close of that summer the Allied Armies, being already deep in the horrors of war, began to order from us large quantities of tubes and amplifying apparatus. Our facilities for supply became altogether inadequate to the demand, and soon all those nations were forced to begin manufacturing to supply their own requirements.

In October Sidney Meyers paid us another visit. Williamson and I twitted him and his "word of honor as a gentleman" unmercifully. Because long months before we had learned that a reassignment from him to the American Telephone and Telegraph Company had been registered in the U. S. Patent Office!

So now he frankly said he came again as representing the Telephone Company and that they now wanted to acquire additional license rights under those patents for the fields of radio signalling. They already possessed the wire rights. Meyers began with a generous offer - $10,000, believe it or not! I demanded $100,000, "take it or leave it". This time he did not know how near to the barrel's bottom was our treasury. We finally compromised on $90,000. Papers were drawn up and duly signed.

This additional sum seemed a godsend to us at the time, harassed as we then were by that Marconi suit. However, looking backward, we should rather have put the company and its patents on ice, closed shop, lived again on cheese and crackers for a year, rather than to have given that company assignable rights to the patents now proven so absolutely indispensable for radio signalling.

For thus we could have reserved for the Radio Tel & Tel Co. exclusive right to license other companies as well as the Bell System and its subsidiaries. In time then we could have thus

been in receipt of very substantial and constantly enlarging royalties from every manufacturer of receivers or amplifier equipment, and from every radio communication concern, save only from the Telephone Company and its dependents.

But the yearn to manufacture, to construct, to keep forever active in a well equipped laboratory was constantly upon me. I could not endure the thought of again watching the world whirl on, inactive, assailed by doubts and lingering misgivings - supinely awaiting another, richer ship to arrive.

And so this second deal was consummated. And again the factory hummed. The laboratory was busy night and day, new inventions, additional patents, mainly directed to improvements in vacuum tubes and their circuits, ever seeking to increase the power I could get from larger and better evacuated "oscillion" tubes. We now began to install our own tube factory and pumps, to compress our own liquid air for the high vacuum pumps, and to prepare our own oxide-coated filament material.

1915 was to be the World's Fair year. Elaborate plans and enormous sums of money had been spent in preparation of the beautiful Panama Pacific International Exposition at San Francisco to commemorate the opening of the Panama Canal. The De Forest Company was then in a sufficiently prosperous condition to justify us in maintaining a large exhibit, for we well knew the interest which proper display of the audion detector and amplifier and our various types of amateur apparatus would there arouse among the visitors generally, to say nothing of the interest we expected to find on the part of the attaches of foreign governments at the Fair. Consequently I went on to San Francisco in the latter part of January, taking with me a goodly amount of equipment and a young assistant by the name of Ehuen B. (Chief) Meyers, a great friend and former associate, in the early days of the Poulsen Company, with Charles Logwood.

By the time the Fair was opened our exhibit was in complete array and I had a little time to look about the Exposition. I was particularly interested by the exhibit of the American Telephone and Telegraph Company, also in the Palace of Electricity, located not a great distance from our own exhibit. There I found that several times each day a popular lecture was delivered in their small amphitheater, at which the speaker outlined in popular language and with considerable detail the history of the Transcontinental Telephone Line, which had just been opened between New York City and the Exposition in San Francisco. At the close of each lecture opportunity was given to those interested to listen to the sound of some man speaking in New York City; after which the New York receiver was switched to Coney Island, so that those on the Pacific Coast might hear the swish and roar of the breakers on the Atlantic.

The speaker described the line of the telephone company in great detail, made due emphasis upon the use thereon of the Pupin loading coils, which equalized or balanced the line for all the various frequencies involved in human speech. But not one word

had he to say about any telephone amplifiers or repeaters along that 3,000 mile stretch of wire, which alone made possible that amazing feat of voice transmission. So far as his public was led to understand, the voice of the distant speaker was heard thus clearly and distinctly without the aid of any booster or amplifier. Certainly if the existence of any such device were to be inferred, not the slightest hint as to the nature of that device was given or that it might perchance be a strange little three-electrode vacuum tube. The public was given to understand that this crowning achievement of the telephone was made possible wholly by the unaided efforts of the telephone engineers, with the single exception of the loading coil which came from an outside source.

I listened to this lecture in dumfounded amazement. Could it be possible that the gigantic Telephone Company, having 18 months previously taken full advantage of the impecunious condition of the Radio Telephone Company and myself to obtain the absolutely essential rights which they required to make good President Vail's pledge to the Directors of the Panama Pacific Exposition, had in addition the unmitigated gall, (or the negative dishonesty if you like) to virtually deny publicly this credit? By their silence and unwillingness to give credit where credit was justly due they now denied the inventor even the satisfaction of acknowledging that his years of effort and toil and daring ingenuity had resulted in an invention which lay wholly outside the ken and vision of their own corps of engineers, and yet which they had eagerly seized upon to make possible this triumph to which they had been eagerly looking forward through how many hopeful years.

At the close of these lectures the Telephone Company handed out to all who would read them neat little booklets, the title of which read:

THE STORY
OF
A GREAT ACHIEVEMENT

Telephone Communication
From Coast to Coast

I studied this booklet carefully, especially the chapter headed "Solving the Problem". Their story read, "Who did it? Who made this wonderful achievement possible? Ten thousand men, beginning with Bell and Watson tinkering away with the first true telephone in an attic forty years ago. * * * *

"There has been no isolated problem; literally as well as figureatively the development and perfection of the system has been 'all along the line'. The fight, this new "winning of the west' has not been a duel, to be won by a single inventor struggling for the solution of some one big problem, but a battle, a campaign in which thousands have helped to overcome a thousand hindrances and imperfections and difficulties."

True in part; but equally true that a more abominable lie than the above misleading inference and omission had never been printed.

But let us read on:

"In all of the 3400 miles of the line there is no spot where a man may point his finger and say, 'here is the secret of the transcontinental line; here is what makes it possible to telephone from New York to San Francisco.'"

Is it possible that the Telephone Company's hireling essayist was suffering from qualms of conscience, or that what had preceded induced him to put in this last statement?

And two pages thereafter is the picture of handsome, benevolent John J. Carty, to whose door more than to any other may well be laid the culpable, the abominable treatment in this whole transaction which was handed out by this giant corporation to his dear friend John Stone Stone, and to the poor inventor whom he had represented in the original transaction.

As I read through this atrocity my blood boiled. I then recalled the fact that back in New York, in December of the preceding year, when the newspapers heralded the opening of the transcontinental line and many distinguished citizens were invited to 195 Broadway to be present " on that auspicious occasion" - engineers, scientists, capitalists and publishers, educators and politicians - my invitation had been conspicious by its absence, had doubtless been mailed to the wrong address.

I recalled that when my old friend and newspaper writer, "Clare" Thompson, had learned from me of the part which the audion amplifier had played in making possible that transcontinental service, he, in the white heat of indignation, had gone to all of the metropolitan newspapers with a carefully worded statement blazing a few pertinent facts, and pointing out what the Telephone Company was evidently unwilling to admit. And how when these statements of Thompson were published Vice President Gherardi of the Telephone Company was quoted as explicitly denying that the Telephone Company used in any way any inventions of Lee de Forest! Furthermore, when the reporter interviewed Theodore Vail, President of the American Telephone & Telegraph Company, Vail also informed them that, so far as his information went, there was no such thing as the "audion" used on the telephone line, and inferred that he had never even heard of Lee de Forest.

So now in San Francisco I hied me to my room in the St. Francis Hotel and spent the entire night drawing up a booklet which should be a facsimile duplication in size, color and format, of that historic "historical" document put out by the Telephone Company, but the title of which should read:

"The Story of a Great
Achievement
Which Made
Telephone Communication
From Coast to Coast
Possible"

I made the pages of that booklet spread before the public a few terse statements which chanced to be wholly omitted from the corresponding booklet put out by the Telephone Company. In this booklet I outlined very briefly a little of telephone history - the 20-year futile search of the telephone engineers for a repeater or amplifying relay, which should be at once extremely sensitive, free from delicate and frequent adjustment, yet which would amplify every modulation or variation of the human voice without distortion, and without which relay the telephone at that time was limited to a few hundred miles.

"This problem of the Telephone Relay had baffled all the numberless inventors and engineers in the telephone industry, both of the Bell and independent companies. It was the ignis fatuus, the illusive will o' the wisp, which looked so simple, yet which eluded their most praiseworthy efforts.

"So keen did the search become, so hopeless seemed the realization, that an eastern telephone company in the late nineties offered 'One Million Dollars for a Successful Telephone Relay.' That prize was never claimed, nor awarded.

"Almost without exception these telephone engineers and inventors attacked the problem from the same angle. They saw one method which afforded a solution. That was: to associate in some manner the elements of the well-known telephone receiver with the well-known telephone transmitter, or carbon microphone. The method was a mechanical one, and always, in the last analysis, failed.

"If sufficiently sensitive, its elements required constant adjustment by experts. Temperature changes upset the delicate balance of its parts if amplifying sufficiently. Moreover it "packed" or "fried," was horribly "microphonic." Unless in perfect adjustment voice distortion was a frequent fault. As a matter of course it failed to perform the inconceivably difficult and delicate task asked of it - where current changes representing a millionth part of a watt of electrical energy were required to push and heave pieces of iron and lumps of carbon!

"Yet the telephone engineers persisted; numberless patents were issued, and untold thousands of dollars were spent on the problem. And meanwhile, through all those years, the long distance telephone halted; stopped effectively by that trifing little barrier - the Repeater Relay.

"Professor Pupin, of Columbia University, had discovered and patented the inductance coils which alone made it possible to speak intelligibly on overhead lines one thousand miles, or over cables twenty miles in length. He sold his patents to the Bell Telephone Company fifteen years ago, but the transcontinental telephone still remained a commercial impossibility. Theoretically it was possible to build a line with very large copper conductors and plentifully spaced with Pupin coils, to enable us by using large electrical currents in the transmitter to telephone across the continent. But commercially the staggering cost of such a line put this method absolutely out of consideration--it was impossible. So the telephone world waited hopefully for that yet unfound: The Relay which could alone enable one to send, clear and audible, the infinitely delicate variations of the voice across North America.

"And that amplifier was at last discovered--not by telephone engineers, whose minds had for years spun in the old rut of receiver-microphone "siamesed" together.

"We must thank the 'Wireless' for this revolution in ideas telephonic, which at last and alone enables you today to talk from the Panama-Pacific Exposition to New York or Maine.

'Way back in 1902, Dr. Lee deForest, beginning his pioneer experiments with wireless detedtors, discovered that a heated gas was 'sensitive' to the weak 'wireless' waves, and could constitute a new detector for use in radio telegraphy.

"In 1905-06 he made on this principle a genuinely practical detector, possessing a sensitiveness far in excess of that of any hitherto known wireless receiver. Indefatigable in his efforts to further improve and apply his 'Audion,' this little incandescent lamp (which made audible the action of the 'ions,' or sub-atoms of the heated gas around the filament), Dr. deForest discovered that these 'ions' responded to telephonic currents, as well as to those of the far higher frequencies used in wireless.

"He found that when this strange device, so utterly new to the telephone field, was properly connected in the line between a transmitter and a receiver, the Audion actually amplified the voice currents, giving a reproduction of perfect fidelity without a trace of lag or distortion, yet with an increase in volume, or intensity.

"He patented the Audion Amplifier in 1907, but it was not until 1912 that he had brought it to such a state of perfection that he felt justified in bringing it to the attention of the engineering staff of the American Telephone and Telegraph Company.

"One year later that company purchased an exclusive license under all the deForest Audion patents for wire telephone purposes. It was not long thereafter that unofficial announcements were made that in 1915 the long-dreamed-of transcontinental line was to become a reality.

"True, from small beginnings the transcontinental line has been evolved. All honor to the hundreds of engineers and inventors

whose cumulative work has made this possible. BUT IS NOT TRUE TO SAY that, 'In all the 3400 miles of line, there is no one spot where a man may point his finger and say, Here is the secret of the transcontinental line; here is what makes it possible to telephone from New York to San Francisco.'

"One element after another came--first the Bell receiver; then the Berliner microphone; then adequate line construction, and Pupin coils to prevent voice distortion, but the one last missing link--the genuine sine qua non, is the AUDION AMPLIFIER OF deFOREST. His little lamp links at last the Eastern with the Central, the Central with the Mountain, and that with the Pacific Coast lines.

"What then is the nature of this wonderful device which today brings New York and San Francisco into the same telephone booth; or which, if we choose, unites the yelp of the sea lions on the Cliff House rocks with the bark of the 'hot dogs' of Coney Island?

"The Audion Amplifier consists of a small incandescent lamp bulb exhausted of air, containing in addition to the usual filament, two thin plates of nickel about one-eighth of an inch from the filament, on either side. Between the filament and plates are two pieces of nickel wire bent grid-shaped. That is all. Can you imagine anything more simple--more utterly unlikely to operate as a repeater of telephone currents? Small wonder a telephone engineer did not conceive the idea!

"The incoming current, to be repeated and amplified, is conducted to the 'grid' wire. The outgoing line is connected, one terminal to the plates, the other to the filament. In this circuit is found a battery. A separate battery lights the filament to incandescence. The heated gas becomes then a conductor of the local current from the battery, which can pass from the cold plates to the hot filament.

"In other words, negatively charged 'carriers,' 'ions,' or 'thermions,' as they may be termed, speed in invisible streams, of almost infinite tenuity, from filaments to plates, passing in their migration through the spaces between the wires of the 'grids.' Now the slightest electrical potential, or charge of electricity, impressed upon these grids from the incoming telephonic currents deflect or retard some of these tiny carriers of negative electricity. This effect is always proportional to the cause, so that the current changes produced in the outgoing, or 'plate' circuit, are exactly similar to those current changes, or electrical charges, upon the 'grid' wires which produced them. But the changes in current thus produced are many times in volume or intensity the changes in current which caused them. In other words a unit electrical charge delivered upon the 'grid' produces a deflection, or stoppage, of six to ten unit electrical charges passing from the filament to the plates. Hence we have the strange amplifying properties of the Audion.

"The one most essential and completely novel element in the whole strange device is the 'grid' member, interposed across the path of the traveling ions ('wanders' as their Greek name implies).

"Dr. deForest chose to deal then with 'ions,' gas atoms or subatoms--matter in its most tenuous form--what Prof. Crookes well styled the 'fourth state of matter.'

"Try to imagine one of these ionic carriers of the voice currents or electric charges, and contrast it with a carbon granule of a microphone transmitter of the early 'telephone relays.' Compare a soap bubble with a load of coal, and you will have some relative idea of the difference between the delicacy and elegance of the Audion and that of the old microphone relay.

"Is it then strange that we point to the deForest Audion Amplifier as a device in a class distinctly alone; epoch marking in telephony as it is in wireless; as wonderful in its nature as it is novel in the methods of its operation?

"Now a word relative to the future of long distance telephony:

"The deForest Audion is today receiving wireless messages in New York, and at the great naval station at Arlington, Va., from San Francisco, Hanover and Nauen, Germany, and even from Honolulu, in day time.

"Nothing approaching this detector in sensitiveness has ever been produced. With the amplifier, in connection with the Audion detector, it is now possible to ring a bell in our exhibit booth, Liberal Arts Building, San Francisco, from the signals sent from the big wireless station at Tuckerton, N.J.

"Only one obstacle today stands in the way of transcontinental telephony <u>without wires</u>--that is a transmitter, voice controlled, which can handle fifty kilowatts of electrical energy. That obstacle can be overcome. Experiments already made warrant this promise.

"Transoceanic Telephony by submarine cable, with numerous Pupin coils and the Audion amplifier, is theoretically possible--commercially an utter impossibility. The cost of such a cable would be prohibitive.

"But Transoceanic Wireless Telephony is today almost within our reach. The deForest Audion and amplifier, extending as they have the range of wireless, making loud those signals which are otherwise inaudible, alone makes this far-reaching revolution in our future means of communication possible.

"We may confidently look for this next great achievement within five years.

"Below is a list of the deForest Audion U.S. patents, licensed to the American Telephone and Telegraph Company:

824637	837901	867878
824638	841386	879532
836070	841387	943969
836071	867876	979275
	867877	995126

"In addition to the above this company owns some one hundred and seventy U.S. letters patent, issued to Lee de Forest, John Stone Stone, and others."

The next day I found a firm of printers, and by the following day the attendents at the De Forest booth were handing out this second edition of "The Story of a Great Achievement", in large quantities, to thousands of sightseers just come from the Bell Telephone booth, marvelling at what they had heard and mystified as to how it had suddenly been made possible. That second edition amplified their understanding!

Not satisfied, I erected a long, handsome sign at the back of our booth reading, "The De Forest Audion Made Possible Telephone Communication from Coast to Coast." And Meyers and I chuckled to watch the Bell engineers, one after another, walk nonchalantly down the aisle to read slant-wise that informing message, the truth of which they too well understood to attempt to deny.

But there was one satisfaction relating to the opening of the Panama-Pacific Exposition to transcontinental communication, which was not totally denied me. The formal opening of the gates was to be signalled by a wireless flash from the great Naval station at Arlington, Washington, controlled by a key pressed by the finger of President Wilson. This signal was to be received by an antenna run from the top of the Tower of Jewels to a Federal Telegraph Company receiver, whence it was to be amplified by one of my three-stage audion amplifiers, and thus to control the firing of a cannon. We radio engineers present on that occasion were never quite sure that the signal came direct from Washington, or Tuckerton or was not relayed from the South San Francisco station of the Federal Telegraph Company! But at all events the signal arrived and the amplifier magnified it to the proportions necessary to operate the opening gun!

Before the close of the Exposition our Company for its exhibit was awarded a Grand Prize and Gold Medal as had been the case at a World's Fair at St. Louis in 1904.

A few weeks before I left New York for San Francisco Ridgwood and I had completed the installation of the radio telephone transmitter in the baggage car of the crack passenger train of the Lackawanna Railroad. The receiver was located in the rear observation car in a manner similar to that which I had employed ten years before on board the Chicago & Alton Flyer. But now the communication was to be by telephone rather than by telegraph.

The Lackawanna Company had purchased our old radio telephone tower at Albany and moved it down to the D.L.&W. yards at Hoboken, where a similar radio telephone transmitter and receiver were installed.

At this time the oscillating audion had not been developed to a point where we could expect to transmit through this agency voice over any such distance as we now wished to cover in these railroad installations. So we used instead a very neat, compact type of quench spark-gap radio telephone supplied from a 600 volt direct current generator. This generator was mounted in the baggage car, coupled directly to a special steam turbine supplied from the train's locomotive. The voice quality obtained by these means, while rather noisy, nevertheless was plain and distinct.

A clipping from the New York Times, February 10, 1915, described this application of our radio telephone railroad service as follows:

"PHONES TO STATION
FROM MOVING TRAIN

Lackawanna Road Sends
Wireless 26 Miles from
Lounsberry to Binghamton.

Transmitted by 110 volts

Turbine, Using Steam Power
from Locomotive, Operates
Generator in Baggage Car.

"The first completely successful tests of the wireless telephone from a moving train were made on Sunday on the Delaware, Lackawanna & Western Railroad, when spoken messages were clearly heard twenty-six miles from Lounsberry to Binghamton, N.Y.

"More than a year ago the Lackawanna made use of the wireless to send messages from fixed stations to moving trains. The receiving apparatus could be operated on thirty volts, but it required 110 volts to operate the powerful transmitter needed to transmit the human voice through the air(.')

"Four months were required to equip a train with the sending apparatus. A combination mail and baggage car was remodeled in the company's shops at Kingsland to accommodate a five horse power steam turbine with a generator belted to the turbine, taking 125 pounds of steam from the locomotive. In the first car next to the baggage car a compartment two feet six inches by three feet was provided, where the telephone apparatus was placed.

"Wires in conduits carried the high tension current from the generator in the baggage car to the wireless room. The first four cars of the train were equipped with aerial wires, eighteen inches above the top of the cars, and from four to five amperes of current were produced for radiating purposes. The wireless transmitter used on the train was the invention of Lee de Forest of this city.

"L.J. Foley, Superintendent of telegraph and wireless on the road, said yesterday that he expected within a few months to find wireless telephone messages sent from moving trains for fifty miles. This is all that is required for railroading, because divisional stations are usually about 100 miles apart. The chief advantage in railroad operations that would come from the use of the wireless telephone, Mr. Foley said, was in the dispatching of freight trains must stop frequently for telegraphic instructions.

"Arrangements undoubtedly would be made, Mr.Foley said, to enable passengers on moving trains to talk over the telephone to persons at stationary telephones in large cities along the line.

"All that is necessary to give the wireless on a moving train the power to communicate with any telephone subscriber is a wireless receiving station at the main telephone office in any city equipped with a telegraphone. The voice of the person speaking from the moving train is registered on a phonograph record, and is almost instantly reproduced and relayed over the telephone wire. The cost of telephoning, according to Mr. Foley, would be above the usual long-distance rate, but would not be prohibitive."

. . . . . .

The year of 1915 saw several significant beginnings, embryonic at the time perhaps, but destined in later years to grow into mighty developments, in radio signalling of every type, and in industrial applications as well. Early in that year I began work on the first musical instrument utilizing the oscillating audion, one with the audible "beat-note" effect, produced by two radio frequency oscillating circuits, one of which was adjustably varied, so that notes of any desired pitch could be produced.

The other method was by direct feed-back in circuits of audio frequencies where the tones were varied by altering either the capacity across the inductance or by varying the high resistance in the grid or plate circuit. By the latter means I found I was able to obtain a great variety of tone qualities or timbres. So that simply by closing certain switches the loud speaker would give forth sounds resembling violin, cello, woodwinds, muted brasses; and other sounds resembling nothing ever heard from an orchestra or by the human ear up to that time - more like those emanating from a populous barnyard, or of the sort now so often heard in the nerve-wracking, maniacal, cacophanations of a lunatic swing band. Such tones led me to dub my new musical instrument the "Squawk-a-phone", as I jokingly exhibited it at our Class Dinner that Winter at the Yale Club.

But later I did give a lecture and serious demonstration of the new method of generation of musical tones at a meeting in Brooklyn of the American Institute of Electrical

Engineers and the New York Electrical Society, which proved so novel and entertaining that I was compelled to repeat the seance for the benefit of late comers. I recall that Elmer Sperry was present upon that occasion and showed intense interest in that novel instrument as demonstrating genuine musical possibilities. The special hard designed for that purpose was known as the "Singer", a name retained by that type for years thereafter.

And now, 1939, this ancient idea on which I filed patents in April, 1915, (Patent No. 1543990) has been licensed to the Wurlitzer Company. The idea then demonstrated was the basic principle on which the marvelous pan-orchestral instrument, the Hammond "Novachord" was developed.

I was intensely fascinated with the idea at that time and, had conditions permitted, would have desired nothing so much as the opportunity to develop it then into a practical, key-operated instrument of genuine interest and value to musicians, as has now been done by the ingenious and highly talented experts of the Hammond company. The Novachord embodies 142 three-electrode tubes, as tone generators, and amplifiers!

Among the more active radio amateurs at that time in New York City were several physicians and professional men who made of it an absorbing hobby. Some of these were experimentally inclined. Foremost among them was Dr. Hudson, who had used the audion when its filament was of tantalum wire. Later when McCandless shifted to tungsten Dr. Hudson noticed that the thermionic emission within the tube suffered. He induced McCandless to make up for him some tubes around the tungsten filament of which he wound a fine spiral of tantalum wire. We were much interested and found that the so-called Hudson filament tubes performed distinctly better, both as detector and amplifier, than did those having the plain tungsten filament.

This was before the General Electric engineers had brought out the thoriated tungsten filament. Soon after our sales demands were for the Hudson filament audions almost entirely, and large quantities of these were sold. For the ham cult was now growing rapidly and the manufacture of audion tubes became a substantial portion of McCandless' lamp business - a thing which he didn't particularly relish, for he had a great deal of trouble with the little devils, regarded the business largely as a nuisance, and never went after the problem of audion manufacture on an engineering production basis.

Ere long his company was taken over by the Westinghouse Electric, and thereafter he was not permitted to continue the manufacture of audion tubes. As a result several bootleggers sprang up over the country, chief and most mischievous of which was Moorhead of San Francisco, aided and abetted by my Fair (?) representative, E.B. Meyers.

In the early Summer of 1915 William K. Vanderbilt, Jr. requested that we equip his palatial yacht with the radio telephone, and install a duplicate station located at the yacht landing on his estate on Long Island Sound. There Logwood and I

installed a new type of transmitter and receiver, combined in a very practical form, resembling somewhat a telephone wall set in common use at that time in rural telephone subscribers' stations. The transmitter used the same quench spark-gap with flat electrodes of tungsten, supplied from a 600 volt direct current generator, as was installed on the D.L.& W. train. This yacht installation was very simple to operate, and Mr. Vanderbilt's skipper aboard the yacht and his helper ashore carried on very satisfactory telephonic conversations up to distances of 20 or more miles across the waters of the Sound. They were not radio technicians in any sense, but the apparatus, especially the receiver, was as simplified as to require no special skill.

Throughout the preceding months I had been actively at work in developing the "oscillion" (as I then styled the oscillating power tube), to carry larger and larger amounts of power. By that time Henry Coyer, my loyal and indefatigable superintendent of the newly installed exhaust pumping plant, had acquired great skill along those lines - the design of improved seals, heat treatment of the nickel plates and tungsten wire grid structure, the manufacture of liquid air in our newly installed plant in the shop basement, etc.

Two, and later three, skilled glass blowers were kept hard at work day and night assembling oscillions and repairing the pumps and glass manifolds. I had previously no conception of the endless list of troubles and disasters with which such a vacuum tube plant could be endowed. One fault or failure corrected, and some other immediately followed suit.

My first oscillions were of spherical shape, three inches in diameter, constructed by McCandless and exhausted in our own plant. Then we obtained four inch and five inch globes direct from Corning, and made our own tubes completely. At first, due to slight traces of gas which we were then unable completely to eliminate, our transmitter tubes became very hot. A small fan blast proved inadequate when I stepped up the power, so I immersed the oscillion bulbs in a cannister of water, and contrived to master the insulation difficulties thereby encountered.

Until we could build oscillator tubes of sufficient power to drive our high frequency bombarder, we were unable to sufficiently heat the tube electrode while on the pump, to eliminate all the gases therefrom. At an early stage we had built tubular vitreol gas-heated furnaces, hydrogen filled, wherein we thoroughly treated the plate and grid electrodes before assembling; and little by little learned how to highly exhaust power tubes which held up under the 25 watts, 50 watts, and later 125 watts of plate current, which we applied thereto.

By the summer of 1915 I had abandoned the spherical type of transmitter tube and we began the manufacture of the cylindrical form, using glass blanks two and a half inches in diameter and 10 inches in over-all length. The plate and grid leads continued to be brought out through the upper end of the tube, the filament leads from the lower.

About this time we began to receive orders from the United States Navy, which had been very carefully watching the development of the oscillating tube. The Navy specifications called for small transmitters about 1-1/4" in diameter, 5" in height over-all, with all four terminals coming out at a common base. These bases we turned up out of bakelite, equipped with three pins. The fourth terminal came out of the side of the base, it being the bayonet joint pin, which thus became the earthed filament lead. I think these were the first power tubes ever made having the four terminals brought out at the lower end. The Navy engineers had designed their own small transmitter sets in which these new power tubes were to be used.

About this time, summer of '15, exceedingly interesting rumors reached me from Washington to the effect that Western Electric engineers, imprisoned in the newly erected barracks near the base of the tall wireless towers at Arlington, were exceedingly busy assembling there God-knew how many tall racks filled with oscillator transmitter tubes, similar to those longer ones, my own, which I had just shown to the Naval officials.

Thereby it became evident to me that my friends of West Street were now intent upon a project destined (if not expressly so designed!) to prove to the world in general, and to the Department of Justice of the great United States Government in particular, that my six-year earlier prophecy of trans-Atlantic radio telephony had not exactly justified my being railroaded to Atlanta Penitentiary.

For this vindication at least I was, of course, profoundly grateful to the great Telephone Company, now so busily engaged in assembling en masse those three-electrode oscillating tubes, for proving that I had been no mere idle dreamer.

Of course I had hoped, was still fondly hoping, that it would be my own good fortune to be able myself to resume, perhaps again from the Metropolitan Life, the work and plans abandoned in 1910 to first demonstrate the possibilities of voice transmission with the Eiffel Tower in Paris.

But when we signed that second patent licensing contract with the Western Electric the year before I had, unwittingly, signed the death warrant to such hopes and plans. That measly $90,000 which the Telephone Company had given my company, and which alone enabled them to pull off this terrific coup, had been, of course, altogether too inadequate a sum to permit our beating them to this spectacular feat. Possibly those officials had so calculated when their representative, Hon. Sidney Meyers, had paid over that (to us then large) sum.

And so in the Fall of that year, the press dispatches from Washington announced that radio telephone voice tests were

shortly to begin from Arlington to the Paris Eiffel Tower; and also to the Pearl Harbor Station at Honolulu.

Thereupon I resolved to be in Paris upon the occasion of the public opening or formal demonstration of that magnificent accomplishment, the true grandeur and social significance of which I felt no man was in better position to appreciate than myself. For well I knew, from earlier experience, that I could expect no engraved invitation to Washington; nor recognition for any part which I had played in making possible this transoceanic radio telephone - any more than had been accorded me in San Francisco a few months before.

Consequently my wife and I secured war time permits (not then easy to obtain) and hurriedly embarked for England aboard the slow Cameronia of the Anchor Line - doughty Capt. Bone in command. That was indeed a perilous voyage through submarine infested waters, growing more so as we neared the Irish coast. But we escaped the torpedoes, spent a few days in foggy, blacked-out London, where we arrived two days after Zeppelin bombs had destroyed a nest of buildings next to the Hotel Astor where we were domiciled. Those ruins were ghastly reminders of the dangers we had courted.

The London newspaper reporters interviewing me demanded what useful invention I was bringing with me to aid the British War Office in warding off the deadly Zeps. I had entertained no such thought, but realizing then what was evidently expected of me, conceived then and there, and explained as I talked (!) the combination of two or more large megaphones, mounted in gimbals, each equipped with a microphone leading through audion amplifiers to a headphone to be worn by the solders on watch. I explained how with two such gigantic "ears", each feeding a separate amplifier and earphone - the observer could detect at a great distance and accurately locate the source of the Zeppelin's propellers.

Details of this spontaneous American invention appeared in that afternoon's papers, and I promptly received an invitation to visit the British National Defense Council, old Hiram Maxim in charge, to explain my ideas to that Board. The first thing Hiram Maxim said to me was, "de Forest, do you know in America a worthless rascal by the name of Hudson Maxim? That blank-blank scoundrel happens to be my brother!" I was dumfounded by this astonishing outburst. For I had had very pleant conversations on several occasions with Hudson Maxim in New York, and regarded him most highly.

Thereafter we got down to cases. I sketched out as I explained my "Guardian Ears" invention, and picked up from those fine, alert British officers a large amount of most interesting information regarding the War and their methods of combating the Huns in the trenches and from the air.

Thereafter I had no difficulty in obtaining the coveted permit for Mary Mayo and myself to proceed to Paris. Sad sights indeed met our eyes in the French capital. Few men were seen, and all of these in uniform. One of the most appealing sights in my life was that of a regiment of poilus, in horizon blue uniforms and steel hats, with bugles blowing gaily, marching past the Tuilleries, many with wives or sweethearts running by their sides, some carrying babes in their arms, calling cheering or cheerful words of farewell, as those weather beaten soldiers in heavy field equipment marched bravely to their dooms.

My good friend of 1908 of the French Army, Gen. Ferrie, was away at the front, and I found it quite impossible to obtain permission to visit the military radio station at the Tour Eiffel, where the first telephone messages from Washington were then being received by the French radio engineers. But the Paris newspaper men, especially the Americans among them, were all greatly interested in the information I gave them regarding the trans-Atlantic telephone transmission and what part therein was being played by the three-electrode tube, then being used as oscillator at the Arlington transmitter and here in Paris as detector and amplifier. By that time, of course, all French radio men had become thoroughly familier with the audion as a receiver. For nothing else was then in use, and the French factories were turning out by the thousands radio tubes of their own design.

A brief stay in that dark and saddened capital, formerly the world's gayest, was quite sufficient; and after visiting a French hospital where my good friend, and former uncle, Theodore Stanton, was in partial charge, we entrained in wretched coaches for Bordeaux in the South of France, the only port where passenger traffic with New York was then possible.

The trip home on the "Espagne", guarded for the first 100 miles from the river Gironde by two French torpedo destroyers, was long and tedious. And glad indeed were we to find ourselves safe once more in good old U.S.A.

Upon my return to the office I was saluted by Charles Gilbert, the young treasurer who had been chosen shortly before my departure for Europe to aid Williamson in managing the fiscal affairs of the Company, with the cheerful information that Williamson had conspired, almost as soon as I was aboard ship, to oust me from the Company's management.

Shortly after the formation of the Radio Telephone and Telegraph Company, I had negotiated with John Stone Stone and his Board of Directors to purchase all the Stone patents, some sixty in number, giving in exchange a large block of our stock.

I considered these Stone patents as exceedingly valuable, covering, as they did broadly all systems of loose-coupling primary, secondary, and intermediate circuits. Among them was the Stone-Cabot patent covering the application of a positive potential to the grid electrode of the audion.

In my audion amplifier patent #841387 I had clearly shown the control electrode (shown then as a plate) connected to the negative terminal of the biasing battery. It is true I did not in the specifications describe its use or advantage, but the diagram is as plain as can be. No electrician viewing this diagram (Fig. 2) with its battery polarities as there marked, could for a moment fail to recognize that the control electrode is not only connected to the negative terminal of the A. or filament battery, but that in addition a separate biasing battery is so connected as to put an additional negative bias voltage upon that control electrode.

Why, in view of this indisputably clear revelation in 1907 that I had used and published the negative potential bias as applied to the third, or control electrode, of the audion, any judge could later hold valid the Lowenstein "negatively-biased grid" patent is, and always was, incomprehensible to me. True, Lowenstein clearly first described the advantages of using the negative grid bias, but equally clearly he was not, in view of the plain disclosure of my 1907 patent, entitled to broad claims covering this valuable feature.

But now, recognizing that I had shown the third electrode connected to the negative terminal of the biasing battery, Stone and Cabot elected to disclose and claim in their patents the advantages of reversing this polarity, and making the grid positive!

The Stone company, or its directors, thus having become substantial stockholders in my company, were in a position to aid Williamson in his attempt to call a stockholders' meeting and possibly oust me from my control. Messrs. Johnson and Brown, to whom Stone had largely delegated the business matters of his defunct corporation, came down to New York for this meeting. I had returned in the nick of time.

I had no great difficulty in persuading them as to the rank injustice and irrationality of Williamson's proposal. It was defeated. Williamson thereupon offered his resignation, which was promptly accepted. I was elected President of the Company, Charles Gilbert, Treasurer. Shortly thereafter, in a stockholders' meeting, the name of the Company was changed to read "The De Forest Radio Telephone and Telegraph Company".

. . . . . .

The year of 1916 is memorable. It marked very definitely the actual beginning of planned and systematic Radio Broadcasting and using the three-electrode tube as transmitter.

Early in the summer of that year Henry Coyer, in charge of our glass blowing and high vacuum exhaust pumps, had so mastered his technic that we were turning out with fair regularity serviceable, reasonably long lived, oscillion tubes of 50 to 125 watts plate dissipation.

Cylindrical glass vessels, 10" x 3" in diameter; fine mesh grids of tungsten wire supported on glass, and later nickel, frames, located between two flat plane plates of heavy, hydrogen treated nickel, with tungsten and thoriated-tungsten wire, or our own oxide coated filaments - such were the characteristics of our most favored type of power tubes.

In some cases all four leads were taken out at the base of the vessel. In others, of maximum power, the plate and grid leads were brought at the top of the tube. High frequency bombardment of the elements, while on the pumps, was later adopted; but at first we depended upon high oven temperatures and long continued exhausting. Glass mercury-vapor diffusion pumps, using liquid air of our own manufacture as refrigerant, gave us X-ray vacuua. Such an oscillator tube, mounted on a small bakelite or marble panel, carrying plate and grid "tickler" coils conductively associated, was the type first adopted as our standard transmitter. Grid modulation was used throughout all this developmental period.

The top of our High Bridge tower, 125 feet above the factory roof, was yet far below the level of the High Bridge and Washington Bridge and of the stone cliff on the west side of the Harlem River opposite us. A less desirable site for a transmitting station could scarcely be imagined. However an antenna was now rigged and systematic tests of our transmitter panels and oscillator tubes were undertaken.

Logwood and I had a number of skilled radio fan friends in Manhattan and the Bronx, and soon our phone was kept busy with reports from these listeners and others, as far afield as Bridgeport, Connecticut, and down New Jersey way.

"Riverlure, September 10, 1916: The great war two years old, and still raging, though the allies cause is steadily winning for humanity and civilization - fighting <u>our</u> battle; while we cravenly snarl at tactics which somewhat inconvenience us - and coin countless millions from their necessities.

"My company prospers although, through lack of better business management than I can give it, still remains small and slowly advancing. Work in the Lab. is as intensely interesting as ever, and more so. We are building various types of 'power tubes'; but have yet to hit the right construction. 125 watts from one unit is yet the limit. I am after ten times that amount. We are installing the first "Radio Concert" at the Columbia Gramaphone Building on 38th Street. (My old, never-relenting hobby, but with the sound business idea thereby to greatly increase our sale of audions and listening equipment.)

"Working busily also on the first airplane sets. Rushing 30 combination audion-altraudion amplifier sets for Australia, another lot for New Zealand, Russia - two field sets for Japan, 185 audion sets for the United States Navy, etc."

Seeking to get equal and possibly wider radio spread, I had interested the Columbia Gramaphone Company in allowing me to install a telephone transmitter in a little office of their 38th Street Building and run my antenna up to the flagpole atop that structure. They were interested because I proposed thus to play each day a goodly number of their new records, announcing the title, and "Columbia Gramaphone Company", with each playing.

This was unquestionably the first "sponsored" radio program service. It aroused a deal of interest on the part of radio fans, not merely telegraph code hams, because now that there was something on the air which all could understand and enjoy, our sales of radio receivers, audions and crystal sets, began to pick up in a most gratifying manner.

Broadcasting coverage from the 38th Street Columbia Building proving no greater, I removed the transmitter back to the High Bridge tower and resumed our testing, taking with me the Columbia phonograph and a goodly supply of records, with which I continued to generously regale all radio listeners. I distinctly remember how now I began to extol through the microphone the merits of our various radio wares; rather shame-facedly it is true, because I still cherished the earlier, quixotic idea that naught but good music and good entertainment, or educational matter, should go out over the radio. And when shortly thereafter the Western Electric Company opened up a radio telephone transmitter for testing purposes on their West Street Building, we heard them announce that "they had no superior quality variable condensers for sale", I felt the implied rebuke so keenly that thereafter all advertising matter was taboo from any radio station which I controlled.

December 6, 1916: "The radio phone concerts going on nightly now since our debut the night preceding election. Election night sent out bulletins from the New York American for six hours, and on that historic occasion I, as the chief announcer, announced at 11 o'clock, just before I closed down the station, the election of Hughes as our next President of the United States! I didn't learn the sad truth of America's choice of four years more of dishonor and 'easy

prosperity' under the shameless, craven W. Wilson, until the next day, when the belated returns from California were registered.

The New York Times of Wednesday, November 8, 1916, contained the following news item:

"The Bronx produced an election night innovation when shortly after dark last evening the De Forest Radio Laboratories in High Bridge began flashing returns by wireless. Amateur operators within a radius of 200 miles had been forewarned of the new service, and it was estimated that several thousand of them received the news, many of them through using the newly manufactured wireless telephone."

That national election broadcast of November, 1916, marked absolutely the first use of the radio telephone for broadcasting news of general interest. This, note well, was just four years before the much flaunted, loudly advertised Westinghouse Pittsburgh station KDKA, under the direction of Dr. Frank Conrad, broadcast the Harding-Cox election returns in 1920.

Just why that company and others which, years behind, have followed my lead should falsely claim, and still persist in falsely claiming, priority in public radio broadcasting is one of those inexplicable, indefensible acts of injustice with which the history of pioneering has been so shamefully replete. The spurious priority claims of KDKA are to me bitterly reminiscent of the equally indefensible refusal on the part of the Telephone Company's officials in 1915 to admit that the audion amplifier played any part in making possible the transcontinental (and trans-Atlantic) telephone by wire and radio.

My diary goes on: "Am now able to get 300 watts out of a 1/4 kw. tube, by forcing it, and out of a 1/2 kw. 400 + watts; but the present construction won't stand this. Can now parallel two and get 500 watts in antenna safely, efficiency about 50%. Learning, learning each day - but terribly expensive. Payroll $900 to $1000 per week. I am gradually getting debts paid off. The Company needs financing to grow as it might, and could. Negotiations on with President Thayer of the Western Electric Company, whose "radio phone" now rivals ours, but hardly excels.

"Judge Meyers' vile and half-baked decision for the Fleming Valve as against the Audion is sickening. That and the appeal set us back $40,000, easily. All my life I have been coining money for lawyers. I am a gold mine for them - like all good inventors!

"Yale wins from Princeton and Harvard - the latter for the first time in seven years, I believe. I didn't see either game. That 36 to 0 two years ago at the 'Christening' of the Yale Bowl was a cure for me! My youthful football enthusiasm has never recovered from the set-back it there suffered."

Just now of especial interest is the following: "Occasional meetings of the American Defense Society's trustees, of

which I am one, are my patriotic efforts. Sad need for such activities now, with four more years of shame and fatuous complacency in Washington, and thence throughout the nation. We are in for awful things if Germany wins the war, as she now threatens to, and if she cares to come and take us or our treasure. Defenseless Virtue stands naked for the despoiler.

"If I can put through my Western Electric deal I will make a genuine sacrifice toward the forlorn cause of preparedness. It's all I can do for my Country, and I owe her that. Sometimes I think this stupid nation richly deserves the punishment she invites. It takes more than broad lands, freedom, and nature's beneficence to make a race and a people."

December 8, '16: "More work on Navy samples and oscillion improvement. Fine 'Radio Concerts' each night."

December 11 '16: "My work last summer on the airplane set is bearing fruit. A cabled order for two from Paris, and today one for 19 from the Navy.' But this piling up prosperity of orders is our bane. We are always hard up for money. Heavier and heavier payrolls, rising, ever rising costs of materials, etc. Then the Marconi litigation bills, $5,000 cash up for bond during our appeal from the Judge's decision, which seeks to rob me of my greatest achievement, the audion. We have caught the Marconi outfit red-handed in infringement, despite their injunction. Capt. Darby is directing our fight for gore. Meanwhile the war rages abroad. The cause of the Allies and liberty looks gloomy enough, and our besotted people purr contentedly before the fire that will some day consume them.

December 12, 1916: "For the past three years I have noted a strange, sad change coming over me. I am more or less a dead man alive - my former eager and youthful spirit has slowly died, due to the struggle for success against great odds; due more than all else to the recurrent sadness and despair of soul which the lapses, ever recurrent, of my wife have caused me. So far from being a mental companion to me, I have lived practically a hermit's life with her here in this home which I built as the little Temple of all my early ideals. I named it "Riverlure, where dreams come true"; and here, month after month, year after year, one dream after another has atrophied and died, with my heart its tomb. Shriveled and withered is my heart, with all its roseate dreams."

As mentioned in a foregoing quotation, it was in the Summer of '16 that I took my first airplane flight, down at Mitchell Field, Long Island, to test out there a small radio telephone transmitter, with trailing antenna. The result was sufficiently interesting to persuade the Army aviation service to order one or two such sets. These were, so far as I know, the first radio telephone sets ever installed in an airplane.

Shortly after the 1914 sale of radio patent rights to the

Western Electric Company a flock of patents began to be issued to their engineers, disclosing circuit arrangements so similar to some I had been using that I began to file applications of my own covering these, and deliberately making their identical claims, for the purpose of interference.

As these interference proceedings were joined and progressed it became more and more evident to the Western Electric patent attorneys that the 1914 deal had not been sufficiently comprehensive, that "that pestiferous De Forest might still have something we will need." So a new, third deal was contemplated. This was exactly what I had in mind when I filed.

But it required lively rumors that a sale of the De Forest Company to the Atlantic Communication Company (the American branch of the German Telefunken Company) was shortly to be consummated, in order to bring a telephone call for a conference from my now good friend, George Folk, chief patent attorney for the Telephone Company. Folk had shown himself to be very fair, and even sympathetic to me, since the 1914 negotiations. He now inquired regarding the truth of these rumors, and I told him frankly that the Atlantic Communication President, Dr. Frank, was then in negotiation with us, and that such negotiations would not be called off unless the Western Electric Company actually meant business and was willing to meet my price for acquiring rights under all pending patent applications, and those to be filed during the ensuing seven years.

After some bickering the price to be paid was fixed at a quarter of a million dollars. It was stipulated that my Company should retain rights in the commercial, foreign and governmental fields. At this stage of the negotiations Folk informed me that he would have to turn the further matter over to President Thayer. Whereupon I decided to let my good friend, fellow director of the American Defense Society, Henry Quinby, one of the ablest attorneys in New York, represent me in the negotiations with Thayer.

My diary reads, "I think we can get together, perhaps requiring a reduction of the amount of cash. I would contentedly see the deal fall through, except that I fear the possibilities of the Cooper Hewitt or the Fessenden undamped-wave patents held valid. In such event it would be impossible for my Company to progress. The annual stockholders' meeting was held - no trouble. I want to enlarge our plant over the new garage space next door; but deliveries and collections of our Government receivers and 185 audion control boxes are slow, in the meantime legal outlays, plus $1200 to $1000 a week payroll, keep us close to the bank cushion. We have received orders for 22 airplane sets, and expect a lot of foreign business in the new field sets.

"Our radio concerts are heard over 400 miles."

That my broadcasting efforts had now attracted significant notice upon the part of other communication interests than the Western Electric Co. is made evident by a written recommendation to E.J. Nally, then General Manager of the American Marconi Co. by his assistant, wide-awake David Sarnoff, who even then was evidencing his exceptionally far-sighted vision. This document, only recently made pulbic, read in part as follows:

"I have in mind a plan of development which would make radio a 'household utility' in the same sense as the piano or phonograph. The idea is to bring music into the house by wireless.

"While this has been tried in the past by wires, it has been a failure because wires do not lend themselves to this scheme. With radio, however, it would seem to be entirely feasible. For example - a radio telephone transmitter having a range of say 25 to 50 miles can be installed at a fixed point where instrumental or vocal music or both are produced. THE PROBLEM OF TRANSMITTING MUSIC HAS ALREADY BEEN SOLVED IN PRINCIPLE, and therefore all the receivers attuned to the transmitting wave length should be capable of receiving such music. The receiver can be designed in the form of a simple 'Radio Music Box' and arranged for several different wave lengths, which should be changeable with the throwing of a single switch or pressing of a single button.

"The 'Radio Music Box' can be supplied with amplifying tubes and a loudspeaking telephone, all of which can be neatly mounted in one box. The box can be placed on a table in the parlor or living room, the switch set accordingly and the transmitted music received. There should be no difficulty in receiving music perfectly when transmitted with a radius of 25 to 50 miles. Within such a radius there reside hundreds of thousands of families; and as all can simultaneously receive from a single transmitter, there would be no question of obtaining sufficiently loud signals to make the performance enjoyable. The power of the transmitter can be made 5 kw., if necessary, to cover even a short radius of 25 to 50 miles; thereby giving extra loud signals in the home if desired. The use of head telephones would be obviated by this method. The development of a small loop antenna to go with each 'Radio Music Box' would likewise solve the antennae problem.

"The same principle can be extended to numerous other fields as, for example, receiving lectures at home which can be made perfectly audible; also events of national importance can be simultaneously announced and received. Baseball scores can be transmitted in the air by the use of one set installed at the Polo Grounds. The same would be true of other cities. This proposition would be especially interesting to farmers and others

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"History of Radio" - by Gleason L. Archer

living in outlying districts removed from cities.

"By the purchase of a 'Radio Music Box' they could enjoy concerts, lectures, music, recitals, etc., which may be going on in the nearest city within their radius. While I have indicated a few of the most probable fields of usefulness for such a device, yet there are numerous other fields to which the principle can be extended . . . . ."

* * * * * * *

"The manufacture of the 'Radio Music Box' including antennae, in large quantities, would make possible their sale at a moderate figure of perhaps $75.00 per outfit. The main revenue to be derived will be from the sale of 'Radio Music Boxes' which if manufactured in quantities of one hundred thousand or so could yield a handsome profit when sold at the price mentioned above. Secondary sources of revenue would be from the sale of transmitters and from increased advertising and circulation of the Wireless Age. The Company would have to undertake the arrangements, I am sure, for music recitals, lectures, etc., which arrangements can be satisfactorily worked out. It is not possible to estimate the total amount of business obtainable with this plan until it has been developed and actually tried out, but there are about 15,000,000 families in the United States alone and if only one million or 7% of the total families thought well of the idea it would, at the figure mentioned, mean a gross business of about $75,000,000 which should yield considerable revenue.

"Aside from the profit to be derived from this proposition the possibilities for advertising for the Company are tremendous; for its name would ultimately be brought into the household and wireless would receive national and universal attention."

Had my ultra-conservative business manager, Chas. Gilbert and his associate possessed an iota of the vision and business acumen of David Sarnoff he would have pushed eagerly forward to develop to the utmost possible extent my early broadcasting work, instead of throttling, contemptuously ignoring and letting it lapse into desuitude immediately the full control of the De Forest Company was turned over to him, when I left to work in Germany in 1921.

December 20, 1916 "Logwood returned this week from Chicago with some fine orders promised. The Drainage Canal Commission will give us our first opportunity to install commercially the new oscillion telephone. A big field for these sets awaits us, with all the chance to really make good, and at last to do what I started out to do there, in that ill-starred year of 1909.

"Poor Mother has been very ill with grippe in Palo Alto Hospital. How glad I am that I was able to give her the best of physicians' and nurses' care. She is rapidly recovering. I must see her soon."

January 24, 1917: "Just back from one day in Washington to appear before the House Committee on the new Radio Act. Made a plea for the Radio Telephone, and against Government ownership of all radio stations." It was during these Congressional hearings that one Congressman from the midwest, after listening to my more or less technical discussion, inquired, "How long is a wave length, young fellow?" This query was typical, indicative of the type of brains and experience which were to be chiefly relied upon in formulating Governmental regulations for the growing industry of radio!

Now the gathering war clouds caused the United States Government to shut down all amateur, and most commercial, radio activities. The lead to the High Bridge antenna was cut and officially sealed, and thereby was terminated my radio concert broadcasting activities for a period, as it later proved, of nearly two years' duration.

And there was lost an unprecedented opportunity for wide-spread propaganda, and to hasten the preparation of the public's mind for the War, now inevitable.

Had the Government been foresightedly wise, instead of closing pioneer broadcasting station it should itself have opened one in every large city in the land, and set large manufacturing companies to turning out for its citizens cheap radio receivers, attuned only to the official broadcasting wavelengths. In view of today's collossal influence of the Broadcast upon public intelligence and sympathies it might be considered that here was overlooked an extraordinary governmental opportunity - quite similar to that enjoyed today by most European governments.

April 8, 1917: "Since last entry much of great import has transpired. Chief of all is the full and final completion of my deal with the Western Electric Company, which has been brewing for a year, on which I had spent much patient, and, as it proved, sapient work, planning and waiting. Quinby went right to work and finally exacted from Thayer very excellent terms. Although the surrender they compelled from me of any radio-for-public-pay service put the final quietus on the ambition of all my struggling years, to achieve trans-Atlantic radiotelephony.

However this will be done thoough my invention, that little Audion and its gigantic development; and I will see if publicity cannot be so engineered that the world shall know whose invention made it possible."

Looking back today after the demonstrated fact that several hundred million dollars have been earned for the Telephone Company as sub-licensees by the inventions covered by the patent rights then conveyed, this price paid seems almost infinitesimal. However at that time, with the war on, all commercial markets cut off, threatened as we were by patent litigation which might well have proven ruinous, my patent attorneys strongly urged me to grasp that opportunity while it was yet open.

To them the deal seemed quite too good to be true. The one feature which I lamented then, and have ever since increasingly regretted, is that Quinby did not definitely hold out for the exclusive rights to license others than the Telephone Company and its dependent organizations. I feel confident that by longer, more determined insistence, we could have retained those rights. Had we done this the royalties earned by those two oscillating feed-back circuit patents, which were later sustained by the Supreme Court, should alone have earned us many millions of dollars.

Away back in '98, in the camp of the Yale Battery, I had met tall, lanky trooper Clarence S. Thompson. We became close friends. In 1915 a newspaper correspondent, he learned with high indignation of the strange unwillingness to publicly recognize, or admit, the essential role played in the drama of long distance telephony by the audion amplifier; and he went manfully to the bat in my defense.

In 1916, keelly sensing the crying need of the United States for preparedness for war, Thompson conceived an organized the American Defense Society. No persuasion was needed for me to become a Charter Member of that aggressive organization. The American Defense Society, officered by some of the leaders of New York civic life, with Theodore Roosevelt our Honorary President, did yeoman service through public meetings and propaganda in arousing America to her peril. I attended every local meeting of the Society. I even appeared as speaker at out-of-town meetings; notably one in Trenton, where I felt bound by politeness to pull some of the punches I had prepared in criticism of the laggard Wilson administration, because next to me I found Secretary of the Navy, Josephus Daniels, whom I was loath to offend. As it was I said quite enough to stand Josephus "on his ear", as his own later remarks attested!

And now, in 1917, one of the controlling factors in urging me to accept the Western Electric purchase contract was my burning desire to be able to contribute a goodly sum to the cause of National Preparedness, by financing the propaganda program of the American Defense Society.

The treasury of my Company, now well stocked, could afford to declare generous dividends. And as I held some 120,000 shares of the Company's stock, I felt, for the first time in my struggling life, rich!

"So at last, after 17 years of hard and unrelenting struggle with never a let-up, never a certainty of success and competency, always with my shoulder to the great stone I was toiling to roll up hill - I have at last reached a safe and secure resting place. No more shall I, as twice before (once in 1906 and again in 1910) see my castle of achievement shattered like a house of cards. No more must I start in at the bottom, broken (but not discouraged), and build on the ruins of Crook's Calamity a <u>fourth</u> fortune!

"Now at last I can give a little, now pay my bills when due, now beautify my home, adorn my pretty wife, gratify her desires for singing, for fair array of gems and gowns - the little luxuries that are not harmful, and which I know my long, hard years of toil and planning and self-denial genuinely entitle me.

"Perhaps the sweetest triumph of all are the words of prideful joy which dear Mother in Palo Alto has just written me. I have invested this first money in stocks and bonds conservatively, and on the careful advice of Quinby and my broker classmate, Tom Moore.

"And meantime the Company thrives, chiefly on 'war orders' from the United States Navy. We are crowded with work and must immediately enlarge the factory. I have had labor troubles, swift strikes and back-to-work again, and summarily fired the Superintendent we had so carefully picked to ease my burden - but before he quite ruined the business I had built up."

"June 24, 1917: That P.M. I went to Akron to test the dirigible radio set with Clark and Lavendar of the Navy. Those tests in the Goodrich Naval blimp were really funny. The buoyancy of that bag was so nearly zero, or negative, when the radio phone with two pilots and myself were aboard the gondola, that we found it possible to ascend or stay aloft only during the two hours immediately preceding sunrise. What the Navy there most needed for spectacular lighter-than-air success was admittedly <u>not</u> a radio telephone transmitter!"

And so the first year of our war dragged on. The United States Signal Corps required radio tubes in large numbers, - far larger than my company, McCandless, and my old assistant, Babcock, (who was now in that manufacturing game) could begin to supply. Moreover they demanded four prong base tubes. We reconstructed and greatly enlarged our tube department, and devised production lines for forming and welding the grid structures, installed automatic stem-making machinery, etc.

General Electric and Westinghouse were soon called upon to supply the ever increasing requirements of Army and Navy. Then it was that the first VT type of audion tubes were manufactured, destined to be famously efficient for years thereafter, for amplifiers and small transmitter purposes.

In January of 1918, the coldest in recent history, after ten successive days of sub-zero weather I walked across the ice-bound Hudson from my Spuyten Duyvil home to climb the opposite Palisade. The New York Sun, commenting on this rash excursion, said: "Until this winter no one had ever crossed within the limits of New York City."

To Newport News I took then my latest ultra-compact oscillion telephone transmitter for range tests on Navy sea planes. Installed in the forward seat, with barely sufficient room for breathing between me and the screen shielding the two large transmitter tubes with 1500 volts on their plate terminals, I carried on conversation with the Navy base while we flew west until almost in sight of Washington.

Returning my pilot obligingly flew upside down - my first sight of hugh battle ships floating in the sky directly above me!

Later that winter I took Mother for a week's visit to the boy-hood home in Talladega - my first visit to the old town in 27 years. How changed it all seemed - greatly improved, enlarged, but less impressive than to my boyhood's eyes. The College looked much the same, but now a fine brick De Forest Memorial Chapel stood where I had once gathered and eaten turnips. And the President's house, where once more I slept in my old bedroom, was so covered with ivy devotedly planted by my Father, as to be scarcely recognizable.

Many of the good old darkies were still alive. Pleasant indeed were their sincere, white-teethed smiles of greeting. More of the older generation had gone to join my Father. But the spirit of the place was as sincere and honest as he had endowed and left it. His spirit still was present there. With strangely mingled emotions I stood upon that Chapel platform and recalled to the large audience the primitive days when my dear Mother and I had lived, taught, or studied among those well-loved surroundings.

Strange and welcome change had come over the attitude of the native whites to the black College and its heroic faculty. These were no longer pariahs. Leading citizens were now among the Trustees; and I was actually hailed as a great credit to the City and State, and invited to lecture downtown on this strange novelty of "Wireless Telephony, which Talladega's distinguished former citizen had invented or created"!

. . . . . .

In the spring of '18 the U.S. Signal Corps' need for audions, or radio tubes, (as they now began to be called) became insatiable. Our enlarged forces worked overtime. Government inspectors, notably Miss Alice Davison, daughter of Henry P. Davison, and Lieutenant Frank Eldridge, now Executive Engineer for Westinghouse Lamp Works radio tube Division, were installed at Highbridge, for perpetual inspection of our product.

That summer the Westinghouse Electric Manufacturing Company became seriously interested in a proposition to purchase the De Forest Radio Telephone and Telegraph Company. Vice President H. P. Davis with engineers made several visits through our plant. I then fully acquainted him with what I had done in 1916, and previously, in radio broadcasting; and explained to him the hold on the small but rapidly growing radio public which it had already demonstrated. Davis listened with kind attention. At Pittsburg Dr. Frank Conrad was directly under Davis. It is not difficult to understand therefore where Conrad received inspiration to begin his broadcasting in the fall of 1920.

In October 1918 S. E. Darby, Jr., who for two years now had been handling most of my patent matters in his father's office, embarked with me for Liverpool and London, aboard H.M.S. Carmania. That British ship, one of a convoy of 11 troup ships, carried two regiments of U. S. Soldiers, one of them negro, and a group of American nurses and Y.W.C.A. entertainers. Our widespread flotilla was convoyed by H.M.S. Panther, which strangely camouflaged war vessel traveled always in their midst, entirely surrounded by unarmed merchantmen. Just what our valient Defender would have done in case U-boats had attacked the outer troop-ships was never explained.

The crossing was long and tedious, of gray days - saddened by the grim, and daily, sight from our decks of the sea burials of many a poor victim of the flu aboard the other ships. All portholes were darkened; not a cigarette could be lit on deck.

Darby and I discussed patents and the patent suit in London to which we were travelling as legal aid and fact witness, against an effort on the part of the British Marconi Company for a prolongation of their unholy Fleming valve patent.

I spent much time in reading and memorizing war poems of that young American hero, Alan Seeger, slain on the fields of France, whom I greatly admired. Then, delighted with the vivacity and charm of a Dixie "Y" girl passenger, I undertook to compose a poem in tribute. Upon the back of this Carmania letterhead on which I had scribbled the poetic fragments I had sketched several circuits and descriptions of proposed methods for photographically recording sound on film. Darby had witnessed and dated these sketches. That paper, thrust into the book of Seeger's poems, lay therein completely forgotten for years. Its existence later proved decisive evidence when introduced in a bitterly fought interference proceeding five years thereafter, as establishing a decisive priority date of conception of my invention for recording sound by means of the glow-light tube.

Never may I forget the termination of that war voyage. As we approached the Irish Channel a small black dot in the Eastern sky gradually grew to a huge observation blimp, sailing to meet us, and spot any submarines. Soon one, two, three - then eight black spots on the sea, enlarging as those U.S. destroyers churned the waves to surround our fleet, cutting circles and figure eights of incredibly short radii - a thrilling sight indeed, and intensely reassuring. All day and into the calm moon-lit night the flotilla slowly advanced up the Irish Sea to the Mersey. About midnight all the ship's company below, playing poker or quietly discussing plans for the morrow's landing, a dull booming thud which shivered our massive ship from stem to stern. Calm consternation, the bugle's shrill blast - the hastening, non-panicky rush to staterooms for life preservers, the sharp order, "All up on deck" - "When the bugle blows again it will signal, 'Abandon ship'". The remainder of that calm night we spent on deck awaiting the listing of the sinking ship. The hours waned. Dawn revealed the mouth of the Mersey, and our protecting "Father", stealing out from our midst and safely joining a sister warship ashore.

Just why we didn't founder was never explained. The Carmania seemed a little lower of bow, but steamed herself into Liverpool dock. We heard later rumors to the effect that the subsequent faint muffled sounds we had heard were from "asdcans" heaved overboard by the accompanying destroyers, which had settled that "sub".

Darby and I, forewarned regarding British rations, landed with out pocket well stocked with lump sugar, and caught the first train for London. I had brought with me a small battery-driven radio telephone transmitter for trench service. This I undertook to demonstrate to the British Army officials on Hempstead Heath. Darby did manfully his legal work on behalf of the British Government.

We planned later to visit Paris, and I hoped to be permitted to prove my trench phone at some spot near the Eastern front, which was now in rapid daily advance towards Berlin.

But it soon became evident that we must hasten if we were to get across the Channel before it was too late. My little radio 'phone proved an "Open Sesame" at the French consulate, and passport visas were easily obtained. We landed in Cherbourg on the morning of November 10th and sped on to Paris. Nervous excitement was in the air, suspense everywhere pervading. I found the Place de la Concorde jam-packed with captured German cannon; in the Tuilleries Gardens tangled masses of wrecked "Zep" frames. The city was festooned with tri-color and the Stars and Stripes.

Dawned the memorable 11th, Armistice Day in Paris! Early throngs stormed the magasins, departing carrying flags and bunting homeward. Ed and I reserved box seats at the Folies Bergere; for we sensed that there was about to transpire a celebration the equal of which had never been known in history.

Perhaps the subsequent events of that memorable day can best be described by quoting from a letter which I wrote to Darby on November 11, 1932:

"Los Angeles, Cal.

Dear Ed:

This morning from the upper balcony of "Ciolita Linda" there gleams in the bright California sunlight a small but historic American flag which, just fourteen years ago today, you aided me in pulling down, purloining, and otherwise stealing or appropriating from the second story casements of a distinguished banking establishment in Paris; while various more or less subconscious members of the rank and file of the American Expeditionary Forces stood guard at our behest at either end of the street, against further raids of the French Gendarmerie.

You may have a hazy recollection of the occasion to which I refer; also how it was my duty upon that occasion to unhook from the top spikes of those lofty wrought-iron palings the rough, woolen overcoat of one of the doughboys, who had volunteered in my place to scale the parapet to seize said American flag; but who, losing his hold and his nerve, hung thereafter limply and helplessly from the top of the fence and went to sleep in that position. However it was that a mere stripling like myself was able to dislodge and lower to the ground this bulky Yank passes the human understanding; but the fact remains. And also how we thereafter went with this flag, or its predecessor which the French Gendarmerie had taken away from me on a shortly preceding occasion when you in your best Parisian French, amply justified my wisdom and foresight in having brought with me to Paris for Armistic Day my American Lawyer - thereafter, I repeat, we two, having the characteristic foresight and prescience to preserve a having the characteristic foresight and prescience to preserve a banque table in a highly advantageous location in the Cafe de la Paix, and having also previously enlarged the number of our company

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to three by the addition of Victoire, enjoyed to our fullest capacity that historic and never-to-be-forgotten Celebration of the Night of the First Armistice Day! x x x x x "

Shortly after the wild joy of Armistice Day in Paris had subsided and the triumphal march down the Champs Elysees of the gay-costumed fugitives of now restored Alsace and Lorraine had thrilled us, Darby left for New York. I lingered on in an endeavor to dispose through Elwell of my remaining French patent rights.

"My brief visit to Elwell's villa at Nice gave me the intense desire to live like him upon those glorious headlands above the Cote d'Azur, amid the brave and glorious French people to whom the world owes so much, so much more than it realizes today. Close to the art and music centers of France and Italy, thrilled and inspired by the beauty of those lands, close to a gripping intellectual inspiration which I have never felt anywhere in America. If I could establish a European business, an outlet and incentive for my constant inventive activities, so that I could work at the same time as I played and rested, and breathe deep all those inspirations which France and Italy aroused within me - I feel that I would make no mistake in selling Riverlure and discovering a nest near Nice."

I returned again on the old "Espagne" by Bordeaux and the River Gironde; but now no French destroyer was needed for safe convoy, as had been the case three years before. And once again, as on the old Majestic in 1904, I landed in New York City on New Year's Day. What things had transpired between those two disembarkments!

"My company, thanks largely to the skillful guidance of Gilbert and Superintendent Curtis, did surprisingly and gratifyingly well last year; so that at the January meeting of stockholders a return of capital assets was voted which netted me a little over $100,000. Now if we can carry through our plan of licensing the Government under all our patents, there will be another big dividend; and then I can feel justified in spending a generous sum in experimental development of some of my 'darling ideas', notably the new phonograph invention. For never do I listen in vital joy to the music of opera or orchestra without feeling a keen ambition to record and reproduce it (for my own thirsty ear, if for no other) in all its manifold beauties and volume. For the best of our phonographs today give merely crude, barbaric suggestions of the music they have assayed to record. And quite naturally so, for their basic principle - carving and cutting into a resisting solid, and then forcing and wriggling a stiff and crackling diaphragm - are fundamentally and hopelessly imperfect.

"No! Light, photography, selenium or photocell, the audion (always the audion!) and 'sounding board', or reproducing

bulb flame - these are the elements which can catch and release music in all its beauty - and of practically unlimited duration. For I want to hear in my home at any time at my command entire acts of Grand Opera. So give me the money, a laboratory and skilled assistants and artisans near my villa at Nice, and I can begin to combine a work and life which will be indeed my Ideal."

February 12, 1919: "Sierra Madre, California - After a month in New York, leaving Riverlure for a month in a downtown hotel to escape the dreary isolation of all preceding winters on the Hudson, we two have journeyed once more, after six years, on a new honeymoon to our well loved California!

"All I lack to be happy is work, my own work, now so far away. My soul is uneasy; for always I feel the time is flying and I am letting others do my work, or worse that no one is doing it. The oscillion and the phonograph call me always. I invent a little, sketch circuits and frame patents, but that is all, and all so easy that I am not quite content. If I could build a home here, one on a hillside by the sea, and at the foot of these mountains, with a laboratory nearby, then my dream of Nice would, I fear, soon vanish away! Which should it be? Which shall it be, California or France?"

March 11: "At the Yale Club on a short business visit to New York. - Beloved, beautiful California, home of the gods and sanctuary of happiness, thrice beautiful now to me since you are there. Last night I slept but ill, what with the clang of trolleys, the honk of autos and all the harsh roar of a city's streets, and the dear subway! I contrast the bleak canyons of these cliff towers with the verdant smiles the flowers cast up through those hills where we have motored, or galloped side by side, so many happy hours; and I pine to flee from this 'City of Dreadful Night' back to the soft lights of the eucalyptus logs burning in the big hearth of 'Italia Mia'.

"The Moorhead agreement at San Francisco solved, for a time at least, the patent problems of the audion, and should open long-shut avenues for trade and income.

"I have loafed and rested far too long. Yet I do not relish the return to the city, noisy and crowded." I had conquered New York. Let that suffice.

During my absence from the laboratory I had sought by mail to direct Coyer to build, and Logwood to test, various types of glow-lamps for sound-recording purposes. For I was now determined that the time had arrived when I could, and should, devote much of my attention to that problem. More and more, as I pondered the problem, had I become convinced that the talking motion picture was a practical idea, technically and economically. I had now pioneered in wireless and radio for 19 years. The field

Note after para. 3 of Tyne p. 276. Reference to a home in the hills and another at sea level prophesies what he exactly did years later, when me move to California, to live at 8190 Hollywood Boulevard, Los Angeles.

Feb. 12, 1919, he writes diarywise:

" Again the yellow an gold of poppy petals gladden the table, and again after six years has Mary come to see them. My old stamina of Tamalpais and the Frisco hikes is fast returning to my lazy limbs, and my next attempt should win Mt. Wilson

was becoming somewhat crowded. The war had aroused lively interest in the new art on the part of such large concerns as the Telephone Company, General Electric, and Westinghouse. The Radio Corporation of America had been formed; and soon a hundred engineers would be making a smooth and beaten road out of what had been a wild and fascinating trail.

If I was to work along new paths I must seek a new frontier. The Talking Motion Picture - not as Edison and Webb had attempted to solve it, (by synchronized phonograph) not with the steel telegraphone wire, as I had assayed to do it in 1913 - but as I had envisioned it in 1900 - and now for the past five years - by light recording of sound directly upon the photographic motion picture film. So through that hot summer I toiled in efforts to record sound, first upon large circular discs cut from glass negative plates, mounted on a metamorphosed Edison disc phonograph machine and recorded in a dark room. Next I purchased a German motion picture camera in wooden case, cut a hole in its rear end for insertion there of my tubular "glow light", at a point where the film would be moving continuously, instead of in step-by-step motion, and added an extra sprocket to properly propel the film past that aperture.

The light from the glow lamp (at first I had experimented long with the "speaking flame" and tiny incandescent filament, as my sources of voice modulated light) reached the sensitive negative film through a mechanical slit of adjustable fineness.

Looking back today, (or even in 1923) when this type of photographic voice recording is so simple and so sure a process, the long and patient experiments through which I toiled before I succeeded in recording and reproducing even the first few intelligible words seems incredibly difficult to understand. But the fact remains that I tried every variety of film then obtainable, every possible type of developer. My notebooks, which were scrupulously and painstakingly kept, record literally hundreds of experiments and tests. True, I was frequently called away from my little dark room and developing laboratory to my radio duties and obligations - too frequently for my liking - for business conferences and directors' meetings. For I was now obsessed with the consuming determination to force this new thing into birth. I toiled incessantly days, nights, and holidays; so much so that on the latter occasions Mary Mayo literally "raised hell" with me, as when she had to drive down to the Sedgwick Avenue Lab on Thanksgiving Day morning to drag me, reluctant and expostulating, back to the elaborate turkey, cranberry sauce, and fixins she had prepared!

Yet it was not all work that summer long. In June I was delighted to take time off to go with Ed Darby back to his Alma Mater, Syracuse University, where good old Chancellor Day, and Dean Graham of the Engineering Faculty, presented me with my first Honarary Degree, Doctor of Science.

And before that, in May, Charles Logwood and I had gone with Capt. Charles Culver, former Signal Corps Radio Expert, a man of sterling intelligence, a wizard in radio communications problems - up to Toronto. There a Canadian, A. C. Wissner, had contracted with the Ontario Power Commission to demonstrate, (for the first time in radio history, I believe) the ability of Radio to transmit clearly intelligible speech by high frequency carrier waves, voice modulated, over long stretches of power wires.

Wissner was a friend of General George Owen Squier, Chief Signal Officer during the war. The latter was undoubtedly the real father of "Wired Wireless", as he first styled this novel type of communication. General Squier had convinced Wissner of the feasibility of such voice transference over the power wires of the Commission, and had recommended his lieutenant, Capt. Culver, as ably qualified, in cooperation with the De Forest Company, to conduct such experiments and demonstrations.

Upon my arrival I found that Culver and Logwood had already a good, practical set-up, and there was little I could do but serve as advisor and observer. The demonstrations were successful, the Commission's experts seemed convinced; and this novel, historically important equipment was put into permanent form and left for them to operate.

Eagerly I returned to my experimental laboratory. But not to labor exclusively upon the talking film problem. There were too many other absorbing irons in the radio fire.

My staff had now been greatly strengthened by the addition of two young men of outstanding ability. Robert Gowen had joined us during the war; and shortly after his discharge from the Army radio forces, William Garity. I had joyfully learned that I could unload upon Gowen's slender shoulders an immense amount of care and detail regarding audion manufacture, testing, and the perfection of oscillions as well. Here also, "Brad" Bradford, quasi-chemist, was proving himself of real value, as best qualified to turn out the very best of oxide-coated filaments for our power tubes.

Now I set Garity at the absorbing task of aiding me to construct an improved type of "buzzer radio telephone", using a 6-volt storage battery as the only immediate source of power. As I have already here recounted, I had taken one of these with me to London and Paris the preceding year, but too late to test in actual field operations.

How we developed this Buzzer Radiophone to a quite dependable, practical form, I find it illustrated and described in the rather compendious and versatile Catalog D of "Trustworthy

Radio Receiving Apparatus" issued by the Company in 1919. I soon had the Telegraph Department of the New York Central Railroad much interested in the possibilities of using such instruments for engine-cab-caboose communication on their long freight trains. Garity and I made many demonstrations between the Central's down-town offices. But authority to test out on the trains was not immediately forthcoming. Nothing definite resulted from these efforts. The Spirits of the Dark Room summoned me back to High Bridge, where I soon made Garity my chief helper in my further "phonofilm" experiments.

That 1919 "Catalog D" possesses today unique historic interest. For example, the then total lack of adequate Federal Radio Regulation is indicated by such catalog pages as the following, describing the "De Forest Radio Telephone & Telegraph Oscillion Transmitters, Type O":

"The wave length range depends to some extent on the antenna capacity. The set radiates well on wave lengths from 200 meters to 600 meters, or an antenna capacity of .0007 mf. capacity. It radiates more energy on longer wave lengths. We recommend first tuning up the set on the longer wave(!) * * * *

"Next reduce the ground condenser to a point where the articulation sounds the clearest as heard in the receiver wave meter set close to the instrument and carefully tuned to the wave length you are using. This will also inform you what wave length you are using. (Italics mine) If no wave meter or receiver is at hand, you must rely on reports from the distant listening operator (!). * * * *

"Continue this process over the entire range of wave lengths at which the set will oscillate. Tabulate and preserve these various settings for the wave lengths used, so it will be possible thereafter to go quickly to any desired wave length if required.

"It is recommended however that the set be kept fixed at one wave length, as affording the utmost reliability in communication between two stations."

Inasmuch as I must plead guilty to personal responsibility for the above instructions, I now stand ready for such sentence as the Federal Communications Commission may today see fit to impose!

To radio men, and especially to manufacturers, this old Catalog D would prove exceedingly interesting. Every then type of De Forest receiving apparatus and "radio kit" parts is described, e.g. the first "honey-comb" wound inductance coils and their use - for "amateur, commercial, Navy calling, Arlington time, foreign

and press"; for wave lengths ranging from 150 to 20,000 meters! For this pronounced advancement of the early honeycomb coils and couplers over the old style loose coupler, the radio hams were chiefly indebted to Robert Gowen.

This catalog goes on with Galena detectors (dust proof); anti-capacity key switch; variable air condensers; loading condensers; "the new De Forest VT audion, similar in shape to the VT-21 tube, of which the De Forest Company made many thousands for the Signal Corps during the war. Price - today's tube manufacturers note well - $7.00. (And we sold "rafts" of them at that choice figure!) Tube receptacles; upright and inverted types; variable or fixed grid leaks; filament rheostats; the then famous "Beginners Receiving Sets", which proved immediately popular with impecunious amateurs for installment acquisition and gradual assembling; amplifying transformers; "loud speaking receiver"; a Baldwin telephone receiver with large "morning glory" horn (Price, $35.00).

Of special interest are the items, "Jewelers' time receiver"; utility time receivers". An astonishing number of these were sold to jewelers for obtaining the exact noon time from Arlington; sold, "without tube or A battery, for $27.80."

Our balanced primary circuit Multi-Wave Tuners and "HF500 Commercial Receiver" would rank, in efficiency and neat appearance, with many of today's radio telegraph receivers. Then there were audion detectors; ultra-audions (Autodyne); one and two step amplifiers; a wave meter and several types of radio 'phone transmitters, with microphones mounted on an arm extending from the upper part of the bakelite panel, with rectifier tubes for AC supply and "remote control" (this term actually used) switch for throwing from speaking to listening.

All in all, this was a catalog of which we could have been justly proud at that early epoch.

But excessively busy as I was through those months of 1919, I could yet steal an occasional hour for reverie from the Hudson-facing verandahs of Riverlure.

"I love the West wind, for it urges northward the graceful schooner with shadowy sails drifting up the stream of golden twilight, when slender masts are silhouetted dimly against the darker shadows from the curtained palisades. For it draws across my errant fancy the glamour of forgotten pilgrimage, the lost years' Argoses of youth.

"I love the West wind, as it comes wooing through my windows at night, musical with the hum of insects' voices, bringing the lap of little waves upon the bank below me, bearing soft oblivion and dreams."

Riverlure, July '19: "Without are the night voices, a rhythmic song and the whisper of a breeze. Above in her chamber sleeps the dear wife, with the mystery of the new life nestling warm beneath her heart; another heart, so tiny still, beats fast now in rhythm with the song of the cricket! And soft thrills of life, silent and mystical as the night's breath, come and pass.

"Then I come down to my desk to my work before sleep overcomes me - to read or to invent a little. I am working now on the task which fascinates me more than anything since early audion days, the phonograph - by-light; the many problems, electrical and mechanical, which it involves.

"The second goal of my life's ambition calls me now, to reproduce real music, free of scratch and falseness, and to be heard in ecstacy and comfort, not by the few brief minutes but by the half hour or hour, entire acts of opera, long musical compositions, replayed as originals, not brief make-believes of 'reproduction'. If I can succeed in this the sheer joy of listening to such echoed music will be full reward for all my efforts. I want to hear this play before I die."

In explanation: I had already built an experimental model of an endless-film machine for recording and reproducing a spiralled sound track of several hours duration. With such a machine I hoped to realize that high ideal. Long before I could complete the invention the more insistent commercial demands upon my time for realizing the talking film for the cinema intervened. So that even unto this day this now readily realizable ideal for the phonograph has never been worked out, by myself or any other. Yet the need for it, by lovers of fine music, musicians and composers, is almost as insistant as it ever was. My Hungarian friend, engineer Mihaly, has recently come nearer than any other of whom I know to producing such a type of film phonograph. His model is strikingly like the one I built in 1919. But today the practical solution demands, not the ingenious inventor, but the engineering staff and the unlimited financial resources of the Western Electric Company, or the RCA. I trust I may live to enjoy such perfection of symphony and opera in the home as that device alone will make reality.

August 30, '19 "I have been all afternoon out on my wide western verandah reading my old diaries of '05 to '09, read with a constancy and a re-awakening of vivid memories, of sentiment which (as usual with those old diaries) took me so intimately in spirit across the gulf of the past ten years that - almost in body and reality - I endured again those sorrows, those hopes, the struggles, the heart-aches, ah! the futile, futile hopes for happiness.

"October 1, 1919: Here at last can I write of the consummation of that dream of happiness which for so long beguiled my youthful years, which so deeply consecrated the first weeks of my life and love with Mary, my wife, and which like a mocking

phantom became gradually more faint and more unreal, to be then despaired of, never to be realized, never possessed.

"For last night at eleven, up in the little maternity hospital of Yonkers, after a day and more of heart-breaking agonies, our daughter, Eleanor, was born!

"We both had wished for a boy; 'Lee, Junior' was long anticipated, and many a fond plan for his future had our loving fancy pictured. But after the first shock of surprise the dear little girl was welcomed with all the overwhelming love which the years of mother yearning had pent within her lonely heart.

"I returned to sleep alone in the home so suddenly lonely, to wake suddenly in the early morn to the first glad realization of our great happiness -to feel the thrill of parenthood - so long denied that my mind can still scarcely grasp the gladness.

And now, Fall of 1919, the war ban on non-commercial radio transmission was at last lifted in Washington. The war had resulted in training many thousands of young radio telegraph operators, and awakening in the minds of all acquaintances of such, an interest in the marvels of radio communication never before experienced. Therefore I lost no time in again opening up my High Bridge broadcasting station. Bob Gowen's enthusiasm thereover exceeded even my own. He and Bill Garity took alternate nightly turns at the microphone as Announcers, for the "radio concerts" were now once more made a five-night-a-week affair. Phonograph records were, of course, our main standby, with an occasional radio talk, and once or twice an alleged humorist supplied.

In 1916 we had staged the first "radio dance" for a friend's house party down near Elizabeth, New Jersey, which had been so novel and complete a success that we now, upon request, occasionally repeated such performances; and dance music was frequently heard on the air.

I distinctly recall the genuine satisfaction I experienced when Mr. Folk, my friend, head of the A.T.&T. patent forces, informed me of the great pleasure he was then obtaining by listening nightly to our High Bridge programs.

Gowen, living away up in Ossining, and tiring of the late, long night trips home, began construction of a little radio 'phone transmitter for installation at his house. And soon there were two programs on the air.

Coverage of that Ossining station, mounted high above the Hudson, was soon surpassing that of High Bridge; and just then, as a friend in need, E. J. Simon, whose powerful commer-

cial radio telegraph station atop the "World's Tower Building", 38th Street and Broadway, was in daily communication with Cleveland and Chicago, kindly offered the night facilities of his antenna for my broadcasting station.

I lost no time in accepting his offer, and without for a moment thinking that a new permit should first be obtained from the New York Federal Radio Inspector, transferred our transmitter to that more favorable downtown location.

And now, be it duly noted, Richard Klein, our sales manager, who possessed a fairly wide acquaintance among Broadway show people and scores of artists, became the first Radio Impresario, or Program Director. Under his enthusiastic control our broadcasting programs rapidly assumed a lively interest, impossible before. Listeners by the hundreds now began to sit up and take notice.

In December Klein introduced to the radio audience an artist who could justly claim, and who today does rightfully maintain that claim, to be the First Lady of Radio, Miss Vaughn de Leath. I shall never forget her first appearance up that narrow, winding stairway to the tiny broadcasting "studio" - scarcely eight feet square, where no musical instrument larger than an accordian could have been accommodated; and whose brick walled "acoustics" were awful, but very "live".

Vaughn de Leath was an instant success. Her voice, her cordial, unassuming microphone presence, were ideally suited to the novel task. She seemed without instruction, to sense exactly what was necessary in song and patter to successfully put herself across. A flood of fan mail (many of which she still retains and justifiably cherishes, as first of all the millions of radio fan letters since received the world over) now testified as to the important broadcasting success which she had here suddenly achieved. Thereafter she appeared frequently before that early microphone.

But alas, our popular success, our new high volume level and its wide coverage, were to be our undoing. That New York Federal Radio Inspector, doubtless urged on by incensed Navy and commercial telegraph operators (and perhaps by other more jealous interests), suddenly clamped the lid down upon that first Manhattan Broadcasting Station. I was officially notified that, having illegally transplanted my transmitter from its duly licensed bailiwick in the Bronx, I should at once and forthwith cease, desist, and terminate my radio telephone activities.

Pressed for an explanation, Mr. Inspector informed me, among other things, that interference with commercial communications by the radio telephone could no longer be tolerated; that "there was no room in the ether for entertainment"!

A sorry world indeed today would ours be had that ruling been made universal and eternal!

And thus it was that that historic radio broadcasting transmitter was snaked out of the "World's Tower" and began to accumulate dust in the High Bridge Laboratory. And Bill Garity, as First Engineer of that 1919 broadcasting station, was without his nightly overtime. Gilbert, to my deep disgust, was all smiles. He begrudged that overtime, and despite the widely published interest and promised increased demand for our receivers, could see no business sense in what I had been doing, through 1916 and again now.

Had I been officially permitted to continue that world's first pioneer broadcasting station, or to have had my Bronx station license reinstated, that franchise and the premier fame which would ever after have attached thereto would unquestionably be worth today several millions of dollars.

. . . . . .

"Saturday, January 3, 1920 - Six weeks or so ago I spoke, 'One, two, three, four,' several times into a tiny lamp of my creation, before which was revolving a photographic plate of my finding. Today for the first time I heard these, my very words, repeat themselves from their photograph on that plate. And thus at last I have realized a dream which I first dreamed in Chicago in 1900 - only by methods undreamed of by me, or any man, at that time. And thus, more especially, I have this day of 1920 proved the correctness of the last step in a chain which I carefully mapped out in 1919, and towards which I have steadily worked since last May. Thus all the foundation stones of my new structure - the "Phonofilm" are laid. The great task of perfecting every step now begins."

January 15th, "My Paper (on the Audion and its evolution) before the Franklin Institute at Philadelphia was a success and well received. (For that work the Institute honored me by the award of the Elliot Cresson Medal.) Next day went on to Washington and saw Gen'l. Squire and showed him the new 1 kilowatt oscillion tube. Secured his verbal order for three, at $150 each."

"January 24th, the night of the Class Dinner at the Yale Club. Only 18 members present. Prohibition made it difficult to be as jolly as usual, but Hupfel's six bottles of sparkling red, and some 'red eye' surreptitiously brought in, made four pitchers of a good punch.

Under date of February 2, 1920, my diary records:

"Some fine publicity in all the New York City papers on Cowen's work from Ossining to Chicago."

Thus this broadcasting station, a bud from the parent stem at High Bridge, was still functioning, and establishing enviable records. The World's Tower station had reached as far

west as Buffalo, but when Gowen's phonograph and vaudeville programs (he also was a "natural" when it came to showmanship) were heard in Chicago, that was a record indeed deserving public comment. And note that this was in February, not in November, 1920!

February 11, 1920: "Newspapers of late have been full of accounts of Bob Gowen's broadcasting from Ossining to St. Mary's, Ohio, and to Chicago.

"Were it not for the damnable injunction holding us from the commercial radio 'phone field, we could not be doing $10,000 worth weekly in that field, in addition to this like amount in our amateur line.

should "not" be elided? Ed.

"Feel rather discouraged at the slow progress made on the 'photophone.' Fear I may have to give up this method of recording and devise some sort of mechanical shutter, which I have thus far sought to avoid.

"Having great trouble at factory to find cause and remedy for repeated short-life burnouts of filaments of 1/2 kilowatt oscillion tubes. Believe pure tungsten wire will be a remedy.

"Spent today with Ed Darby and on witness stand in the Marconi accounting proceedings - finished that job.

"March 11th - Caught the Century for Chicago with Klein en route for San Francisco. Arrived there we immediately set about incorporating a California corporation, "Lee De Forest Inc." opening a tube factory for manufacture of oscillion or transmitter power tubes. Vacuum pumps were purchased from the East, and Coyer's most skilled tube man, Huking, was rehired to take charge. For I was determined to escape from two burrs underneath my saddle - that New York Federal District Injunction, and that New York Federal Radio Inspector's authority! And to get back as quickly as possible to my pet project, radio broadcasting.

Now in cooperation with Shaw of the A & P Company, who for years past had manufactured bakelite bases for our VT tubes, and was now opening a similar plant in San Francisco, an alliance was made with Elmer P. Cunningham and his struggling Remler Company to take over the control of the Morehead Company, long licensed under the Fleming valve patents, thus untying a very knotty patent situation. I was now very busy with Shaw and the rest, getting the Morehead Laboratories into operation.

Former Naval Lieutenant, Ellery Stone, today Vice-President of the International Telephone & Telegraph Company, now joined our forces, and San Francisco began to rival New York in radio manufacturing activities.

"April 9, 1920 - We have completed arrangements with the California Theater and the Humboldt Bank Building for the installation of a real radio telephone demonstration to send broadcasts of excellent music from the California Theater's orchestra. Involved a deal of running around and interviewing architects, etc." William Heller, the energetic leader of that fine orchestra, was all enthusiasm when the project was outlined. Two microphones were suspended in the orchestra pit. The High Bridge radio transmitter was installed in the flies of the theater, and a long antenna was strung from there to the top of the Humboldt Bank Tower adjoining.

At once we begun to broadcast each week-day matinee, over the entire Bay District, that notable orchestral music, and very little phonograph reproduction. Later that spring, as a special attraction, Charlie Logwood, who was soon again with me in California as assistant, arranged under Klein's direction for the personal appearance of pretty little Mary White (now, as charming Mrs. Henry Wallance, one of my neighbors in Hollywood) to occasionally sing and patter over our microphone back stage.

Each Sunday morning Heller played an hour's special program of fine music. This became a real event among coast radio listeners. In one isolated community, far back in the Coast range, one opulent rancher installed a receiver and loud speaker; and for miles around his neighbors would journey each Sunday to hear that marvel coming out of the air from 'Frisco.

Thus this California offshoot of my pioneer New York broadcaster kept alive the fine tradition. After I had returned to New York Shaw took over the management of the station, and when the Humboldt Bank people, many months later, objected to the continued use of their tower, removed the transmitter to Berkeley. And there, although now unhappily divorced from that fine orchestra music, it was nevertheless maintained for a year or more, for the avowed and common-sense purpose of inducing the sale of increasing numbers of home receiver sets, kit parts, and audion tubes from the revamped A & P - Moorhead factory.

My stay in San Francisco, beloved of old, afforded me prized opportunities for again visiting with Mother in Palo Alto.

"Letters from Mary Mayo indicate that she is again hard at work on her music, learning the part of 'Santuzza'. Of this also I am glad. I have made many sacrifices in the past to give her rare talent culture and opportunity."

April 12, 1920: "Tying up the last of loose ends of the newly started enterprise, Lee de Forest, Inc., 451 Third Street, San Francisco, with R.M. Klein as Vice-President and General Manager. Prospects excellent. We could sell our entire New York factory products here for the next two months at least.

"Tonight at 10:20 cross the great Bay to take the train for Seattle. A picture of bright lights calls to me, beckoning me back to that fast receding shore. Hope, health, joy of existence, memories of earlier years, of struggle whence grew success - flowers - our flowers, and green mountains, and perfect roadways - call me back.

"Let me live; and that means let me live in California!"

April 24th: "Snow storms and rain all day. Telegraph wires strung heavy with snow and ice, broken into long messages of dots and dashes, as though the Morse had frozen and stuck upon the wires - strange and fascinating code words, messages of the storm gods to us upon the passing train. But none could read or decipher."

April 21st: "I find affairs of the Company in pretty good shape. Horle, Chief Engineer, is just the man for the place."

April 22: "A few hours now with Charlie Logwood before he starts for 'Frisco on the 24th. He has been my mainstay since he came to the little old laboratory in September, 1913. I have depended on him in countless ways, on numberless occasions. He rarely if ever failed me. Men of his stamp are rare in any line. He has exceptional gift in radio inventive lines. Relying on him to work out some problem, merely suggested by me, or to delve into oscillion circuits or discover some genuine improvement has become a habit with me. I shall miss him now. His being in San Francisco is another tie to draw me to that land of full life, where I first found him."

"During my trip East I invented a substitute for the heterodyne detector which will give a musical note at the receiver for continuous wave reception." Later a patent issued on this invention, No. 1478029.

August 23: "On this day I made a photographic voice record on film, which actually spoke to me words which I had forgotten were thereon. 'One, two, three, - nine, ten, August 23rd! I needed and deserved this encouragement. I believe I am on the right track. I await Case's thallofids cell. This Kuntz photoelectric cell is too insensitive.

August 26, 1920: "Not since August 26, 1873, have I been idle! I have worked on this, my 47th birthday.

Insert after para. 6 of Tyne page 287

April 22 1920. This first p.m. I first saw my Mary Ma'o act-in a re-
hearsal at Massell's studio of Cavalerria Rusticana. She shows surprising
talent. Her marvelous voice has a well-needed companionship. The two,
added to her beauty of face and personal charm, will carry her to great
heights of artistic achievement--if she will only work, work hard--veryhard/

Insert after end of para. 8 of Type page 287

Aug. 23: Tonight Mary sang three songs at the University Forum. My faith
in her voice, my sacrifices to give her lessons through the cast years,
to spur her ambition, begain at last to bear fruit.

In the Spring of 1920, C. S. Thompson and John F. Hubbard organized the Radio News and Music Company and made systematic efforts to sell to various newspaper owners our radio telephone transmitters, as then standardized. Their panels mounted four or eight VT type hard tubes in parallel, or push-pull circuit, as oscillators, with two rectifier tubes in the plate supply circuit when AC supply was available. For direct current supply a small motor generator was used.

Thompson finally succeeded in interesting Mr. William E. Scripps, owner of the Detroit Daily News.

"The thought struck me," said Mr. Scripps, "that it would be most interesting for readers of the News if we installed radio broadcasting equipment in the office and sent out news. The more I thought about it the more convinced I was that the Detroit News must be the first newspaper in the country to have a radio broadcasting outfit."

Mr. Scripps presented the idea to his associates and it was decided to appropriate funds to erect such a station. The original apparatus consisted of a De Forest Type OT-10 transmitter. It could be heard about a hundred miles when WWJ began broadcasting experimental programs, August 20, 1920 - the first commercial radio station in America to broadcast regular daily programs.

The interest of William E. Scripps, son of the founder of the Detroit News, was shared in turn by his son, William J. Scripps, now Director of Radio of the Detroit News.

From that pioneer founding (months ahead of Station KDKA) sixteen years of uninterrupted broadcasting have brought America's oldest radio broadcasting station, WWJ, a rich background of memories and accomplishments. Men and women prominent in every field have broadcast from its studios, some of them gaining their first radio experience there. Outstanding figures of modern broadcasting likewise began their careers with WWJ. This station was the first to broadcast a symphony orchestra; participated in the first national broadcasts of football and baseball games; was the first to broadcast full seasons of football and baseball; was among the very first to bring news bulletins to its listeners, and the first to organize its own orchestra for broadcasting purposes.

Today Station WWJ, one of the finest plants in America, having been on the air consistently since that premier beginning in 1920, operating from its fine new studios on Lafayette Boulevard, Detroit, directly across from the Detroit News, where the Station began its broadcasting career, offers uncompared facilities to a huge audience comprising the City of Detroit and the great area surrounding it.

September 4: "The last film, made Wednesday, talks better than all preceding. I feel much encouraged - the deepest mental happiness of which I am nowadays capable. But oh, could I really again feel happiness!"

October 5: "The affairs of my company are not well - soon I may have to sacrifice heavily my personal fortune to keep it from disaster. Meantime expenses here at home are terrific - far in excess of my salary or income. May refuses to submit to the 'great hardship' of riding to and from town by train so we can save the cost of auto and chauffeur, $200 per month. This I would gladly spend on her music, but she, though working hard at last, is totally unwilling to sacrifice for her voice. Shades of heroic women! So we must have four in help, and lavish hospitality once a week, frequently in large numbers. She will not economize. She will not help. Soon we must leave beauteous Riverlure for a dingy bug-infested flat. She says she prefers that to economies out here. - Great God, what women are in cities!" ← !!!

Tuesday, November 2: "I voted today for Harding, as I did 24 years ago for his prototype, McKinley. The electors of the nation are today administering an emphatic and final rebuke to the greatest egotist, the most selfish man that America ever put in a high place. Today we put the quietus on Wilsonism, and all that his name represents.

"Unlike four years ago, there will be no broadcast from High Bridge Station tonight for the election returns. I think Bob Gowen has undertaken to do this at Ossining. The ban on our High Bridge radio station had not yet been lifted."

November 10: "The 'Phonofilm' is a good name for my 'talking film', also 'Vitaphone' or 'Viaphone' or 'Cinephone', or 'Cinefone'. So it seems I named them all, before them all!

"Old Manning Stires, of Herman and Yale, introduced me to Rinock of Loew's. I am trying to interest him and Nicholas Schenck in the possibilities of talking motion pictures." (Six years too soon!)

November 11: "Ed Darby and I were in Washington together today, as we were in Paris just two years ago."

November 19: "This morning's newspapers told me the sad news that my factory was destroyed last night by fire! I found the tower standing, and the walls. Only the glass department was completely destroyed. The total loss will exceed $35,000. The delay in again starting the oscillion manufacture will be a big blow. Keator showed the true stuff he is made of.

Insert before first para. of page 289 of Tyne series:

Tonight a perfect one of midsummer, a full moon beaming down thru the trees of Columbia's campus where sat an audience of over 10,000, where, accompanied by Goldman's concert band, Mary, my sweet voiced wife, mother of Eleanor, made her first debut with orchestra. She was radiantly beautiful. I debated whether she was more lovely or her voice more beautiful. It rang out clear and true and with that rare natural sweetness which I have never heard save in one or two (professional) singers. Which did she delight the more, the eye or the ear? She was an instant success, and violently applauded.

Sept. 2 1920. Mary again sang in Goldman's band in Central Park Mall, the same two congs as before. Clear, sweet, rich and powerful, wondrous quality in the open air. Again I am proud of her and happy at her success.

Sept. 3 The last of the Goldman concerts at Columbia Campus, the same program as last night. After, we drove to the home of Mrs. Hamber ans met some other singers, musicians, etc. We are beginnin to get in with a circle of such friends as we have been awaiting.

Oh, yeah???? GHC

Sept. 9. Mother arrived from the East. It is sweet to see mother, wife and daughter , three dear ones all together. Another 'dream come ~~thr~~ true' in Riverlure. Mary is working hard on Tosca/

Today he was on hand, in undershirt and overalls, to shovel bricks and hammer nails, putting up the temporary partitions in the machine shop. My work on the talking film progresses through all these troubles and distractions."

"Had I been wise I would have closed up the Company in January, 1919, invested my money, and tried to live on the income therefrom, after selling Riverlure and building therefrom a home in California. But then from that income I could have done very little on my film; and I'd have stagnated."

Thursday, November 25th: "Thanksgiving Day at 'the flat'. I worked all day at the lab. on the talking film. Our carpenters and some of my force worked on the burned building and in salvaging the materials."

November 27th: "If I'm a hero I don't feel it, and my family certainly has made no hero out of me. I plug on doggedly day after day. Sundays, Saturdays, holidays, on the film, on the film! I try to keep out of a rut. I believe I can win out, at least to the capitalization point. My soul is encrusted with toil, the mind cells are poisoned with this cursed zeal for work, to solve my problem, and grasp the reward."

January 3, 1921: "Patent suit under that Armstrong patent began. I went on the stand Friday. Beal of Federal Telegraph Company, on here especially, made a good witness of my April, 1923 dedemonstration of the 'true beat note' with the audion.

"We had in Darby's office quite a reunion of old Federal men - Fuller, Archie Stevens, Beal, A. Y. Tuel, and myself. How they brought back to me those 'good old days' at the little Palo Alto laboratory, and down by the Beach Station; where for the last time I was alive with youth's enthusiasm, and fires, and desires, and aspirations, and free thoughts and hopes!"

Early in January, 1921, I was compelled to make another brief trip to San Francisco for conferences with Shaw, Williamson, Stone and attorney Miller, relative to the Cunningham injunction.

Returned to New York, that Spring dragged along, as I busied myself chiefly with patent suits and my talking film experiments.

"Judge Julius" now showed himself to be as keen a friend to Armstrong as he had been to Marconi, five years before. His strangely evidenced bias, exhibited at the Columbia University tests, and in the High Bridge Laboratory, where Prof. Pupin, Armstrong's mentor took him by the arm and walked off in most confidential intercourse, abundantly presaged the way his Decision was headed.

But the consistently encouraging Phonofilm experiments served then as my Balm of Gilead. I actually began to combine voice and picture (Garity's) on the same film; and what was more significant of an early appreciation of the future value of the new universal "dubbing process" - described a method for recording sound on one film synchronized with a separate picture film.

March 6, '21: "Returned last night from a pleasant visit in Baltimore with Prof. Robt. Wood at his laboratory at Johns Hopkins. His 'end-on' hydrogen tube, used as a glow-light, may aid me in my talking-film problem. I have already built, and burned out, several other types of 'photions'."

March 31: "Last Monday in Chicago - a flying trip to clinch an order for Radiophones for the Police and Fire Departments. How Chicago has developed in the 20 years since I began my radio work at Armour Institute! I passed by the Lakota and Lexington Hotels, scenes of two of my primitive 'triumphs' just 20 years ago. That night, at the Studebaker, where I first learned to love Opera, and where my heart attained its greatest depths. To feel again, under any spell or stimulus, as I felt in those balcony seats during the winter Saturday nights of 1901 - would be to be born again - and to live anew!"

Armstrong had now licensed a number of manufacturers under his issued regeneration, or feed-back, patent. With another, broader patent application of his, my own two applications, together with those of Irving Langmuir and the German, Meissner, had been engaged in bitterly contested interference proceedings since 1915. The Examiner of Interferences and lower Patent Office officials had in turn held Armstrong, then Langmuir, and again Armstrong, to be entitled to priority claims, as the four applications proceeded upward through the process of successive appeals. My application had been consistently defeated. But Ed Darby, ever valiantly fighting, finally carried the matter up to the Court of Appeals of the District of Columbia, the final Patent Office tribunal where, to my boundless satisfaction, as an almost forlorn hope, it was eventaully declared to be the winner over my three rivals.

But this happy event occured in 1924, and most certainly could not have been foreseen at the time of which I am now writing, 1920.

Consequently, faced with another of Judge Mayer's typical anti-de Forest decisions, and another typical affirmation by dour, de jure, Judge (Rough) Hough, it became clear that, in order to continue to manufacture and sell ultra-audion and feed-back circuit devices, we must class among the Armstrong licensees. The

Westinghouse Company, which now controlled this issued and sustained (although eventually to be invalidated) patent of Armstrong, now refused to license my company. Whereup we bought up a small corporation owning such license, and proceeded to thus mark our regenerative receivers. The earned royalties we proffered to the Westinghouse Company.

To may amazement that large corporation instead took legal steps to declare that particular license in effect non-transferable by corporation purchase, to have it declared null and void. Ensued more wearying months of legal fencing, expanded legal expenses, and loss of revenue. We arranged however to get this suit before a New Jersey Chancellor; and there, for the first time, we began to get "some of the breaks" at court.

For it was now become more and more evident that the De Forest Company simply could not obtain any shadow of justice from the Federal Court in the Southern District of New York. Ours was a Delaware Corporation; and in realization of the all too evident fact that we were ever to be stymied in New York, Darby now began to maneuver so that our future litigation should be in New Jersey, Delaware, or Philadelphia - beyond the pulverization processes of the Mayer-Hough (and later, notorious Manton) judicial steam-roller.

June 25: "Back to Old Yale and New Haven for our 25th Class Reunion - As reporter for the Yale Alumni Weekly I outlined in full detail the glorious time had by the Class, under old Bill [illegible]immond's splendid leadership."

And now, during this season, was bestowed upon me the Honor I have prized most of all - the award, by the Consul General of France, of the Cross of the Legion of Honor; in recognition of what the audion, detector and amplifier, had accomplished during the World War for the Military and Naval Services of the Republique.

July 9: "Today I made my first 'talking movie' picture-of myself, very hot and somewhat flurried - talked too loud, and the photography was poor, due to white 'back drop' and bad placing of the light! But it was at last made, despite all 'jinxes' and hoodoos - two months behind schedule, and after two years of hard work in preparation."

In June, 1921, we were visited by two engineers from the firm of Eric Huth G.M.B.H. of Berlin, an active and growing rival in Central Europe of the Telefunken and Lorentz Companies. These stolid Herren desired to acquire all of our patents and rights to file in Germany, Austria, and Czecho-Slovakia. For these they offered a modicum of dollars and a bale of German paper marks.

Darby and I dickered at great length. The contract was finally drawn up, and after we had generously regaled these gentry on prohibition near-beer (spiked until large beads of perspiration mantled their wide, pale foreheads), this involved document was duly signed. Whereupon I suddenly decided to accept their invitation to visit their Berlin plant.

July 20, '21: "Sailed with Deutch and Rottgardt from Hoboken on S.S. Rotterdam. The trip up the River Maas to Rotterdam, a three-hour voyage among lovely flat Dutch landscapes, dotted with slow-turning windmills and checkered with fertile and well-tilled fields cut through with little canals, a slow voyage in the bright sunlight of the late afternoon, was one never to forget. A more picturesque approach to a seaport I never saw, as unlike to that of our great metropolis as can be imagined. We passed many outgoing steamers, British tramps, rusty old hulks manned by Dutch seamen in grotesque costumes, queer, narrow-hulled tugboats, canal craft, all of a type strange to my ken. As we approached the Holland-Amerika Docks, the ramifications of canals and river outlets multiplied. Shipyards crowded docks, and docks pushed against warehouses and landing wharfs. All of stone or brick, all spelling industry and commerce with the round world, and all bespeaking a great prosperity for these solemn-faced, plodding Holland burghers. As we first approached the mouth of the Maas, past the sandy reaches of the Hook of Holland, we could see the cream-tinted outlines of Scevedengen, the famous watering place of Holland.

I spent an hour or more in the famed Reiks Museum, where are several acres of wall space covered with the works of old Dutch masters, known and unknown. Some Rembrandt's, Hals, etc., I tried to look en passant at every one, and I saw less than six which I could admire. Those old Dutch artists loved most to paint dead bodies, either of dadavers or slaughtered beeves, or shot rabbits and birds. A hugh bunch of slaughtered game suspended over platters of fruit or salad seemed most to exact their artistic industry. One gallery contained only large canvasses of dissection rooms where around a ghastly corpse, stood a score of stolid looking Dutchmen, each choked by a gigantic white stock, their blank, self-conscious countenances betokening only wonderment as to why they were there, or what the painter could possibly be doing!

"We left Amsterdam early Wednesday morning for a 14-hour ride to Berlin. All the way through Holland and Germany we passed through a fertile, level country bearing every evidence of native wealth. This part of Europe is unquestionably prosperous this year. As far as the eye could see were fields of golden grain, for the most part just harvested, or green with cabbages, beets or

~~July 29 1921~~

Insert after para. 3 on p. 293 of Tyne series.

One huge canvas depicts a properly cleaned carcass of an ox, red and gory, with two small boys in the darkened background quarreling over the inflated bladder of the beast. How any but a sto kyward butcher could have considered such as "works of art" I cannot imagine. Also the Naval battles, in which hundreds of Dutch vessels and thousands of English or Spanish , each with full blown sails, countless banners, innumerable conflagrations, water teeming with drowning seamen, also appealed to these tempermantal interpreters of terror. I laughed aloud at the scene of Adam and Eve being expelled from Eden, while a wicked-faced monkey made affectionate advances to a gray tabbycat beneath the snake-infested Tree of Knowledge. I suppose these treasures are useful in keeping the Dutch satisfied with their quiet life, and satisfied to stay in the Low Country.

No one can visit Berlin and not realize the awful mistake the Allies made in declaring Armistice short of Berlin. Had just a few of those proud old buildings been razed, just a few large holes been blown in the streets of this capitol, a few thousand Huns and their governors slaughtered at home, their stolid, pig-like brains might have realized what they now will never admit, that they lost the war and it will not pay them to attempt to renew it. Unquestionably these Prussians are playing possum and will sometime, unless the Allies remain awake and relentless, spring again to arms, to gas, to rob, to ravish, to murder.

The younger generation will never be allowed to know that they were defeated. They will firmly beleive that they were only cheated, cheated largely by Wilson

gardens. The dwellings are all neatly kept and in good repair. We passed hundreds of rusty locomotives after crossing the German frontier, which Rottgart said were all captured from Russia or Belgium or France. Yet he complained bitterly that the Allies had compelled Germany to give to France and Belgium hundreds of their newly built locomotives. He fumed whenever he saw a map of present day Germany and Austria, pointing out in wrath the sections taken to give to Denmark, Poland, France, or Rumania. "How can we be content until we get all those back?" he said. "Wait ten years more, we shall see"! He has three small boys ("boche" they call them now themselves in pride!), and he expressed perfect willingness to sacrifice them all in a war of revenge against France. Americans they almost like, English they tolerate; but French! Bah! Those they hate, and hate, and hate!

"No one can visit Berlin and not realize the awful mistake the Allies made in declaring Armistice short of Berlin. Had just a few of these proud old buildings been razed, just a few large holes been blown in the streets of this capital, a few thousands of these Huns and their governors been slaughtered here at home, their stolid, pig-like brains would have realized what they now will never admit, that they lost the war and it will not pay them to attempt to renew it. Unquestionably these Prussians are 'playing possum', and will sometime, unless the Allies keep awake and relentless, spring again to arms, to gas, to rob, and to ravish and murder.

"The younger uprising generation can never know, will never be allowed to know, that Germany was ever defeated. They firmly believe that they were only cheated, cheated largely by Wilson out of a victory, or at least out of a drawn battle where they should have lost no land or mines. As it is, their one underlying determination and dream must be to regain, to recover what was "unjustly and unfairly, cheatingly" taken from them, not by an overwhelming force of arms by an outraged civilization. Force alone can they understand, and force those who lived here and who will live here have not known, and cannot acknowledge.

"Yet in my opinion the French are making a great mistake to further goad these people to hate by their futile efforts to give upper Silesia to Poland, to compel the Germans to pay (as I am informed) millions of unnecessary occupation expenses where, for example, in Mayence hundreds of fine houses of stone and brick have been erected for the use of French officers and their families, as though they intended to remain east of the Rhine forever. France should seek rather to conciliate, as the British are doing to make less galling the yoke which the Germans now (deservedly but so irksomely) are bearing.

"The Germans with whom I am dealing are friendly and cordial enough. If they hate me they well conceal it, and my stay here is made agreeable enough. I have done considerable here and will be quite busy all next week, going thoroughly through the Hough plant, consulting with their engineers, and arranging to take back to New York certain improved designs which I think we might to advantage embody in our own products."

I returned to New York in mid-September on the 'Berengeria", after seven long weeks of separation.

"The observations I made of Berlin's conditions, living and monetary, have made a deep and significant impression upon me; and if business arrangements can permit, and if Mary can realize the relative present advantages of living there contrasted with New York, I believe we may spend most of the next succeeding years in Europe. Here both of us could be both busy and happy, and free from the ever harrowing spectre of debt, of large income spent faster than received, and with scarce anything but the bare necessities of home life in return.

"Given an American income and a German out-go, with prices so scandalously low as at present, with the mark at about 100 to the dollar, ones with our taste for music, art, comfort could surely live in Berlin for a long time happily, busily engaged, and deriving far more than could in any way be possible in New York City, for any expenditure of money.

"Every day of my visit, every night when I attended the Opera or The Winter Garden, the Ice Palast or the like, every time I took counsel on the subject with friends who know conditions, I came again more and more fixedly to the same conclusion. It is by far the wisest thing for us to do, and we should do it quickly."

Most impelling of all was the idea that away in distant Berlin I could be completely free from all business distractions, all radio problems, experimental and of manufacturing - free to direct my every thought and energy to the ever pressing problem of perfecting the Phonofilm, to the stage where I could make public demonstrations and seek financial backing, to work a needed revolution in the motion picture industry.

Moreover, on account of the greatly reduced costs of material and skilled labor, I could expect to make faster progress on my necessarily limited budget than would be possible in New York

To enable me thus to be free to concentrate on the talking picture problem, and to insure free and efficient operation of the De Forest Radio Company during my European sojourn, I made a generous contract with Gilbert and Keator whereby these two were to have full and undisputed control of the concern, and one half of any dividends earned by my stock. The single restriction was that they could not dispose of my, or the Treasury, stock without my explicit consent. My salary, in reduced amount, was to be sent me in Berlin.

"September 25, 1921 - These are busy, nervous days of getting all in readiness for our departure to Berlin, to lease the house, sell the car, pack up the laboratory and home, a thousand things to do before sails the George Washington, October 4th, for Bremen."

"Plymouth Harbor, October 12, '21 - After an ocean crossing, even one as smooth and peaceful as this has been, how peace bringing and grateful is the sight of the quiet land. Here for an hour of morning contemplation we lie moored, the same green hillslopes, flecked with groves and lined by hedges, rise before me as this time two months ago. Over that topmost grove the twin spires of the stone church appear, like the upstanding ears of a wondering rabbit. Far beyond the breakwater, half hidden in the mists of morning, the town of Plymouth drowses sleepily on its reclining hillside. There is a rounded promontory, purple cushioned, holding as a crown the still stone wall, and like a cushion into which are thrust two projecting needles, the wireless masts.

"October 30th, Hotel Adlon still - My German disillusionment has already begun. Fretting about getting a permit to dwell in an apartment. Eleanor is already learning German words."

"November 20, '21, Hotel Adlon - after five weeks of it. It is now certain that this American family will not have a Thanksgiving Dinner in a home of our own, much as we had counted on such happening. The apartment matter is still unsettled. The verdampt Wohnungsampt is very hard to deal with, very deliberate, very grafty, and very unaccommodating to foreigners.

"My fifteen Kisten (chests) are at last at my Lab, by Dr. Seibt's, and I am ready to begin real work on the film. The Lab walls are heavily hung with stoffe, and in this echoless room I believe I shall make real voice pictures.

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Oct.2 1921. My last Sunday in Riverlure. I am not sad as these many years at Riverlure should make me. This life of concentration, of rush and responsibility, has dulled so far the finer sensibilities, that I cannt feel or speak or write as would befit one who leaves (perhaps forever) this lovely home he has for ight years cherished to his heart.

"Such damnable weather as this in Germany! Scarcely has the sun shone since November 1st. It is cold and dreary, day after day, a damp, penetrating, dismal cold, requiring all one's fortitude and good will to remain cheerful. The nights at Opera are our brightest hours. Last week I heard Tristan and Boheme, and the 'Christ Elflein' for its first time in Berlin. Already I have heard more Opera here than in all my years in New York City, and for about the total cost of four visits to the Metropolitan. A good suit of clothes and overcoat, tailor made, cost me about $25."

But we finally were permitted to celebrate our first German Weinacht (Christmas-tide) in a sumptuous, too huge apartment, in Kurfurstendamn #224 - none too festively. For the loneliness and the strangeness of it all, the few American or English friends we could find in Berlin, were already proving too harsh an experience for Mary Mayo.

I began well to realize the gravity of the mistake we had made in this transplantation to Germany. But now I felt we should fight it through, at least until I had achieved sufficient progress on my problem to justify the effort involved. And thus dawned, in bitterest cold and many privations, the year of 1922.

This ends de Forest's Book II, The Era of Radio.

He has als o prepared Book III, The Era of the Phonofilm

and Book IV, The Era of Television-to 1940