

THE GREAT VOICE

by
PETER L. JENSEN



JENSEN

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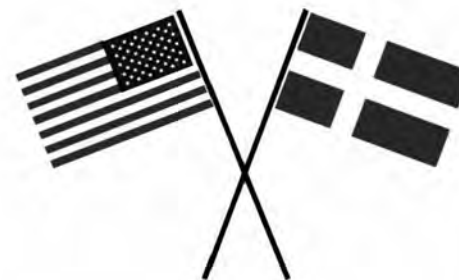
Library
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PETER LAURITS JENSEN

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Peter L. Jensen



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Patricia Ann Jensen Schindler

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PREFACE

The purpose in publishing this book is to preserve and record for my family and relatives the marvelous story of my father, Peter L. Jensen. Also, it is for historians and radio buffs, both professional and amateur, who might be interested in the pioneering days of sound amplification and radio.

My own very small contribution to the manuscript was when my father asked me to research for him from the San Francisco Public Library the newspaper articles which he quotes in the book. Perhaps it was for this reason that he gave me a copy of the manuscript.

A number of people worked on the preparations of this book and I am grateful to them. Of special assistance was our cousin, Karl Sandvig Jensen, my father's nephew, the son of Hans. We learned, with great sadness, of his death, August 28, 1974, in Copenhagen, Denmark. He was unfailingly kind to all his American cousins and his help was deeply appreciated.

Although this autobiography was originally published in Denmark, the title changed to *Jensen*, with great success, it was written first in English, and the English version has never before been published. The words are entirely those of my father, written in his beautiful, precise longhand at the dining room table during the long dark evenings of a Midwestern winter in the early part of World War II. For clarity, I have added a few footnotes.

He writes his own fascinating and appealing story of the young Danish boy born to the sea, who struggled so hard for an education and then, by pure chance, became a worker in 1903, aged 17, in the laboratory of the great

Danish physicist, Valdemar Poulsen. By an equally lucky chance, in 1909, aged 23, he was selected to bring Poulsen's work to the United States and then continued the scientific work in the field of sound amplification and radio. The attendant problems, adventures, optimism and failures, and finally success, are all recorded charmingly in this book.

The book, however, portrays my father as a rather single-minded, dedicated man, and this was not quite true. Actually, he was a much more complex individual than the book reveals. His interests were very cosmopolitan, and for long periods other activities outside the field of science completely engrossed him. A creative man in every sense, he even wrote a complete book on his own concepts of philosophy.

When I remember my father, I think of him in a whole pattern of colors. To me, he was the fount of all wisdom, the family man who often regaled the family with tales of history, adventure, science, sports and even music.

He read constantly, all kinds of books, but mainly in the historical field. He even did some original research in history and a bit of writing, too. He particularly enjoyed American history, especially that of the Old West. As a child, he had devoured books which were in his grandmother's attic in Denmark; many of them, interestingly enough, on the American West. To my father, a European, American history was quaint, picturesque and fascinating.

After coming to California in 1910, he continued with his interest in the West. He enjoyed the story of the Gold Rush and made an effort to know and talk with some of the survivors. He got to know Charles McGlashan in Truckee, California, who had written about the Donner party, and my father, on his own, made the effort to interview and talk with all the then-surviving members of that ill-fated group. Perhaps his interest in the Old West

was one of the reasons for his marriage into a pioneer California family who had settled in the Napa Valley at the time of the Gold Rush. His very young bride, Vivian Steves, whose great grandparents had arrived in California by covered wagon, was a member of the Burrell and Galbreath families of Napa, and the Steves of Stockton.

I remember one story he loved to tell about how, in his research in history, he developed a certain theory about a particular historical event, but he was very unsure of his idea because he could never find any corroboration. Then one day he was reading an article on the subject and, sure enough, the author expounded and agreed with my father's pet theory. My father was elated until he came to the last part of the article and found the authority for this theory was listed as Peter L. Jensen. He said, "It shook my confidence in historians."

He writes in this book about the interest of his father in music, but he does not mention that it was also a great interest of his own. He, likewise, played the violin, no doubt taught to him by his father, and he played it rather well. To this day there are many musical pieces, particularly light opera, which whenever I hear them bring back a flood of very pleasant memories of my father.

He also enjoyed sports of all kinds, but particularly tennis. Although his exploits in the scientific field were quite outstanding, he always remained very modest about these, but he was never modest about his prowess in sports. Wherever he was, he usually joined some sports club and then made it the passion of his life to become club champion.

He was married twice, first to Vivian Steves, the young California girl he met and married in Napa in 1912. They had four children, Jean, known to the family as Nim, was born in Napa in 1913, and in 1914 she was joined by a brother Karl, called Bub. I, Patricia, was born in Oak-

land, California in 1917, and in 1925 Marian, the third daughter, was born. Marian died in 1942 in Stockton at the age of 17.

The marriage to Vivian ended in divorce in 1927; however, my father was given the custody of the children. He had left the Magnavox Company in 1925 and in 1927 founded the Jensen Radio Manufacturing Company. By 1929 that company had grown large enough that it was necessary to move the company, with the key employees, to Chicago in order to be nearer to the materials and markets of the company. He took with him the three older children, and, in a suburb of Chicago, established a home for his family. He met and married Malvena Oppliger, called Vene, a young woman from Minnesota, and they had a son, Peter E., born in Illinois in 1930.

One outstanding aspect of my father's life was really not mentioned in his book at all, and that is that, although he reaped great scientific success, he was not so successful as a businessman. He once told me that creative minds really create only when their backs are against the wall financially. He spoke of his friend, Thomas Edison, "Thomas Edison was very creative while poor, but after he attained success and a beautifully equipped laboratory, he never again had the same touch of genius." My father was really speaking of himself and truly did most of his own creative work when pressured by lack of funds. With affluence he soon lost interest in business affairs and turned his attention to his myriad hobbies. The result was that, although he was moderately successful financially, he could have been much more so with proper attention; but, he would not have been nearly as interesting an individual. He was president of the Jensen Radio Manufacturing Company in Chicago until 1940 when he resigned. He then became a business and engineering consultant to other radio industrial firms, and also served as a consultant in the Radio and Radar Division

of the United States War Production Board in Washington, D.C.

In 1943 he founded the Jensen Industries, manufacturing phonograph needles, and later added the manufacturing of stainless steel sinks. He remained president until 1954 and then retired to be chairman of the board of Jensen Industries. During this period, as he gradually retired from active business, he had an opportunity to spend much more time on trips to Denmark and, when possible, would stay months at a time. In fact, at one time he was offered the job of cultural attaché in Denmark, representing the United States Department of State. He was tempted to accept but finally decided to turn the position down because he said he would not have the freedom to disagree with the United States foreign policy if, in all conscience, he did not agree.

Perhaps the real highlight of his life was when he was chosen as the outstanding Danish-American by Denmark and was knighted by the King. He was honored at the annual Fourth of July celebration at Ribild, in Denmark, in 1956 before an audience of between thirty and forty thousand Danes. The King of Denmark awarded him knighthood in the Order of Dannebrog, Denmark's highest order of chivalry. A historical plaque honoring him has also been placed on his birthplace in Falster.

Although he had been extraordinarily well most of his life, during his last years he had increasing problems with his health; first, the removal of part of his lung for cancer, he had been a heavy smoker all of his life, and later the effects of a small stroke. By the time he was 75 he was rather frail, and on October 25, 1961, while planning to spend Christmas with my family in San Francisco, he suddenly died.

It was truly a great honor to have been his daughter and to have had the opportunity of knowing such an interesting, complex, human and, yes, even loving man.

As of this writing, he is survived by a wife, four children, fourteen grandchildren, and presently eight great-grandchildren, with more on the way. And to all of these my husband, Dr. Meyer Schindler, and I present this published book.

Patricia Ann Jensen Schindler
San Francisco, California
Summer, 1974

It was Christmas Eve in the City of San Francisco in the year 1915, and I stood with a group of people on a balcony of the new City Hall. In the group were Mayor [James] Rolph and many other distinguished citizens.

Below us, in the Civic Center, was a sea of faces, perhaps seventy-five thousand, all turned toward the balcony and all expecting a promised miracle to happen. One-eighth of the total population of the City of San Francisco had turned out to attend the annual Christmas Eve celebration and to hear the "sound miracle."

The newspapers had played up the event days in advance, promising the people that on this occasion a new device would be used which would enable everyone to hear the voices of the speakers, even though they were standing a half mile away. The claim had seemed preposterous, for hitherto the range of man's voice had been limited to his lung power, and to hear a speaker's voice half a mile over the noise of a large city seemed incredible. Loudspeakers and amplifying apparatus were unknown to the public for never before, in public, had a man's voice been reinforced and enlarged by electrical means. The people were skeptical.

The responsibility for success rested squarely upon the shoulders of my friend and partner, Edwin S. Pridham, and me. We had invented and built the apparatus, and were now about to present it to the public for the first time. We stood on the balcony on this so typical balmy California evening, looking across the square with its mass of people, with the crowd's edge lost in the distance. We were uneasy for, though we were confident of success,

the solemnity and the magnitude of the affair was something we had not anticipated.

As the ceremonies were about to begin, I looked at Pridham for reassurance and saw that he, too, was greatly moved. As we went to our respective posts, I couldn't help murmuring to him, "God help us!"

A few moments later, Thomas W. Hickey picked up a microphone connected to powerful loudspeakers, and speaking to the immense crowd in front of him without raising his voice perceptibly, said, "Fellow citizens of the City of San Francisco: Tonight's celebration is unique in that we are witnessing the first public demonstration of a wonderful invention. Although talking in a comparatively low tone and without appreciable effort, my voice is being carried to the limits of this great audience through the agency of the Magnavox, a remarkable invention of these two young men, Peter L. Jensen, and Edwin S. Pridham. Tonight you are participating in its first public presentation. I venture to prophesy that, although their invention will make these young men world famous, nevertheless they will never be more proud than they are this night when it is their privilege to present to their fellow Californians this creation of their own inventive genius."*

The affair was a success. People on the fringe of the crowd and even the residents in nearby streets heard the speeches. It was the first "great voice." It was the "voice" which became the "voice" of public speakers, the "voice" of the phonograph, the "voice" of the film, and last, but not least, the "voice" of radio!

Miraculous though it was that night, still the "great voice" was but an infant when compared with its potentialities, and the years of hard work were yet to be done before it grew up and took its rightful place as one of the important developments of our age.

**San Francisco Bulletin*, Dec. 25, 1915.

I am qualified to tell only the story of my associates and me, and the part we took in the development of the science of sound amplification. As far as I know, we were the only ones in the world who did serious work on loudspeakers previous to 1920, when the art finally broke through on a world-wide scale.

Most inventors encounter hardships in their battle for success. We, too, had setbacks and disappointments, and sometimes little or no money, but we were encouraged by nearly everyone we met, and the romance of our work made it a beautiful adventure.

The American people, as a whole, have encouraged science and invention, and this has made the country great. Had they been less generous, I, a young immigrant, would never have been given the opportunity to be one of the star performers at an important civic affair, hailed by a great metropolis.

It might have been written in the stars that I was destined to be one of the pioneers in a science which was to change many things in the world, but to the people present at my birth no such heavenly signs were visible. I was born in an old straw-thatched cottage on the shore of the Baltic Sea on the Island of Falster in Denmark, where my father* was a pilot in small circumstances.

Attending my birth† was the parish midwife, and probably our neighbor's wife; certainly no doctor was present. Unlike an American mother who hopes that her son may become president, my own mother‡ could only hope that I might someday become a sea captain, an exalted position to her, for only a few of my seafaring ancestors had ever attained it.

The sea had been the field of all my forebears, and I was the first of a long line who was given a chance to break away, although this did not come until I was thirteen years old. Up to that time, I was preparing to follow in my father's footsteps, which meant that at fourteen I was to be mustered out as a cabin boy, and after that, I was to be on my own.

Strangely enough, although I later became interested in engineering, I did not spend my spare time then tinkering with machines, taking watches apart, or constructing perpetual motion apparatus. We had no machines around the house, and my father's watch was an untouchable object.

*Ole Sandvig Jensen, 1854-1901; son of Jens Christian Pederson, 1825-1887; son of Peter Jensen Otte, 1801-1869.

†May 16, 1886.

‡Hansine Jensen, 1858-1929.

The problem of making ends meet from my father's meager income from the sea and from the six acres of land which belonged to our house was too difficult a problem for a boy to be wasting his time. My parents had six children, three boys and three girls, and I was the fourth in line.†

It was the age when children were a great help for they could work. And work we did, almost from the time we could walk alone. Yet, it was a pleasant childhood, very similar to that of pioneer children in the United States in the nineties.

Most of us, and this includes Americans, consider it a privilege to have been permitted to help in the struggle for existence as children and to come up the hard way. We are not so prone to make mountains out of small obstacles and to worry about temporary setbacks.

My father ought to have been a musician for he was an excellent violinist. The family tradition insisted, however, that he be sent to sea at fourteen, and that tradition was too strong to be broken. He roamed the seven seas in the days of the sailing ships, a typical seaman, hardened by the rigorous life and the constant battling with the treacherous Baltic. And yet, underneath, there always remained some of the fineness of the artist, the slightly sentimental softness of the frustrated musician.

At twenty-five, he married, secured a pilot's position, and settled down. As a father, he was a strict disciplinarian, always ready to cuff his sons on the ear, or to use a switch. He wanted to toughen us so that the hardness of the world we were yet to encounter would not find us soft and easily hurt. He knew the life we faced as seamen.

When I was seven years old, my brother Hans, then fourteen, left home for the sea. My mother was sad to see

†Hans, 1879-1929; Marie, 1882-1924; Karoline, 1884-1933; Peter, 1886-1961; Anna, 1888-1959; Karl, 1890-1967.

him go, and yet she had prepared herself for that moment.

"Who will take Hans' place?" she murmured.

My father waved an arm imperiously in my direction and declared, "He will. He's seven years old now, and half a man. When I was his age, I had to work."

"Half a man!" My father's tone left no doubt as to my position in the household from that time on. And so, I became my father's helper on water, and my mother's chore boy on land.

I am relating part of my background merely to show that this world after all is a generous one, and that a lowly origin need not be a deterrent to one who wishes to achieve.

My life has been interesting for I have been permitted to travel with the radio parade for over thirty-eight years. At first, directly in the front rank; later, after stepping out to devote my time to the science of sound, marching alongside the heads of the column, always in close touch with the leaders. And so, I witnessed the remarkable and romantic growth of radio in all its phases.

I was ten years old when [Guglielmo] Marconi first announced his transmission of signals by radio in 1896. Perhaps this invention was discussed in my home for we subscribed to newspapers and periodicals, but I have no recollection of it. Up to that time, therefore, and for some time afterwards, I was still headed for the sea.

The life on the sea was the romantic part of my childhood, and the farming was plain drudgery. The land was cultivated by my mother who utilized every square foot. An odd untouched corner was spaded up and potatoes were planted there. The recollection of lying on hands and knees for hours, weeding beets, makes me shiver yet, and the picking up of bushel after bushel of potatoes in the fall was tedious.

We had one horse, three cows, a couple of sheep, one pig, and some chickens. All these animals needed con-

stant attention, and as the "one-half man" in the family, I had to do my share.

My father disliked farming, and so always managed to be busy with his boats. The heavy land work then, of necessity, fell upon my mother and us children. I am still slightly bowlegged from having transported about a hundred pounds of milk every day on a wheelbarrow from our home to a place a mile away, where it was picked up by a dairy team. Possibly such exercise makes the legs bend a little, and makes the arms a little longer, but it also makes a fellow strong. And so I managed to become strong and healthy, which I have been ever since.

In the summertime, I herded the cows in the forest, and that was a blessing in disguise for it was during these long hours that I did most of my reading. I was an omnivorous reader, and my grandmother had quite a library of old novels. These books were the blood and thunder variety which stir a boy's imagination with their stories of great heroes whom I then determined to emulate.

I loved the sea for here was romance. The Baltic is a treacherous stretch of water, sometimes calm and innocent looking, but often deadly in its fury. We lived at the entrance of a strait called Groensund, and it was my father's job to pick up the ships out in the open sea and pilot them in safety through the strait.

When a ship had to be boarded in stormy weather, it was necessary to have two men in the pilot's boat. When my father's colleague, the other pilot, was not there, I was pressed into service from the time I was seven years old.

Only the few who have actually had the experience will know what a difficult and dangerous task it is to board a ship coming toward you with high speed in a stormy sea. I had known how to sail a boat and to swim since I can remember, but I was always deadly afraid when I saw the big ship bearing down on us, splashing and foaming at the bow.

When the ship was a little way off, we would take down our sail and mast, and my father would take the oars of our eighteen foot boat while I took the rudder.

As we came alongside the ship, my father would quickly pull in the oars and grab the line which was thrown down from the deck above. This he would make fast while I steered the boat clear of the ship and yet close enough so he could reach the rope ladder.

If the pilot boat came in contact with the ship in heavy sea and the ship was travelling fast, the boat was apt to "climb" up the side and capsize. Fortunately, this never happened to me, and I have said many a Lord's Prayer in such situations.

A loudspeaker would have been a great help then for we could seldom hear the captain's orders shouted from the bridge. The strong winds and a high sea make a devilish noise.

I also did yeoman service in the annual fishing for herring. The herring season runs from about September first to November first, a stormy season in the Baltic. It was cheaper for my father to use his own boy than to have an adult partner with whom he would have to split the profits. The pilots used their small open boats for the fishing, although the other fishermen's crafts were larger with decks and cabins for shelter. I was the only boy in the fleet.

We would leave home toward evening and sail six to eight miles out in the Baltic to the fishing banks where we would let out the nets. These nets were woven with a fine thread with openings large enough to permit a herring to get its head through. When the fish started to back out, the fine thread would catch them behind the gills, and they would be stuck. We carried ten nets, enough to load the boat if the herring were running.

We arrived at the fishing bank some time after dark, and let out our nets slowly, letting the wind move the

boat with the proper speed. Getting the nets in the water took about half an hour. After that we would light our lantern and snuggle down in the bottom of the boat and eat our supper.

We naturally had no thermos bottle, and as it was impossible to carry any heating apparatus, we had no hot coffee which is what I always longed for. For liquid I had non-alcoholic beer and my father some "aquavit" — a sort of clear brandy resembling gin or vodka.

I would look over the sea and watch the lanterns about us, and I knew that the fishermen had retired to their bunks. We had none in our boat and had to sleep in the open with only an extra old coat for covers; so it was always cold. How I yearned for a small cabin with a lamp where I could read!

The Baltic is mean water in the fall, especially towards November. Squalls come up suddenly and the sea grows choppy in a short time. In quiet weather, we drifted with our nets out until almost daylight, but when we saw storms approaching we would pull in sooner and head for land.

In high seas the nets must be taken in over the bow of the ship. A single person could not with safety pull in the net when the rough waves might hit the boat broadside and swamp it. My father needed me there to hand the nets to me amidship after he had hauled them in. I would pile them evenly there so the boat had no list.

I was always seasick when the sea ran high, but this happened only when I awoke towards morning and it was time to pull in. It was probably the combination of exposure and the boat's movements which nauseated me, for I was not susceptible when we were under sail.

My father would look up and see me and exclaim, "Sailor!" with great contempt. I did my work just the same and interrupted it only to lean over the side.

But fishing for herring had its bright sides. When it

blew too hard from the east, we would sail into the shelter of the sound and set our nets. Then we would drift in with the winds into smooth waters, in among the islands until midnight when we would be through. Then we would head for the harbor of Stubbekoebing, an old and picturesque town lying on the north coast of Falster.

Stubbekoebing is a typical North-European town. Whenever I see the well known picture in an advertisement for a cleaning powder labeled "The Spotless Town," I always think of Stubbekoebing, for it might have been a photograph of that town.

The fishermen would go to their favorite inns, and I was never prouder than when I walked up the street clad in oilskin clothes with a big "southwester" on my head and my boots making a great noise on the cobblestone. Over coffee and sweet rolls, I would mentally contrast this type of fishing with the other out on the sea with its cold and seasickness.

My home was located in a beautiful spot. On one side was the sea; on the other three sides, which flanked the clearing, there was a solid forest. The clearing consisted of twelve acres of land, six of which belonged to our house and six to our neighbor, the other pilot. (Although there were three houses in the clearing, the third was never occupied during my childhood.)

Our nearest neighbors were more than a mile away, and so we had few playmates. We were not lonesome, however, for we had many intriguing places where we could play.

There was first the old "battery" which was an old rampart located on our land which was built during the Napoleonic wars. It consisted of mounds and moats and had been built in 1808 during the war between England and Denmark, and was erected to guard the entrance to Groensund. At one time, it bristled with cannons, but these had long since been removed and the ramparts gradually became a sort of shrine. We were not permitted to cultivate that part of the land.

Visitors were greatly interested in the historic background of the ramparts, but to us children it was merely a favorite playground. In the winter, we would skate on the moat and go tobogganing down the sides of the mounds. In the summer, we played "Soldier and Indian" games there, although the short thistles hurt our bare feet.

Then, of course, we had the forest for a yard. Here, in among the beautiful beech trees which stretched in dense groups for about eight miles, were deer and small wild life. The forest, together with the beach and the pier, made a perfect stage for a happy, active boyhood.

The school was located in the nearest village, Moseby, about two and a half miles away. Its origin goes back to the Stone Age for the villages in Denmark are generally much older than the towns and cities. In 1460, it was mentioned as Moorsby, an old Anglo-Saxon name, meaning the "village of the Moors."

It is peculiar how conditions which existed nearly a thousand years ago can affect the lives of people living today. There are practically no villages located near the coast on the Island of Falster, for German pirates infested the Baltic Sea in the eleventh and twelfth centuries.

Previous to this time the Danish Vikings had ruled the sea, but when they accepted Christianity they put away their weapons and settled down to peaceful pursuits. The Vends, a heathen Slavic race from the north coast of Germany, took advantage of the now peaceful Danes and attacked the southern island, burning, pillaging and killing the people.

Whether the villages were moved inland during this period or were destroyed, I do not know. I was taught in school, however, that these piratical assaults were responsible for the villages being located a safe distance from the coast, as the inhabitants might be warned in time to rally for common defense.

We had two teachers, both men, for in the Danish primary country schools no woman was permitted to teach. Our education was quite good for when we graduated at fourteen we had about the same knowledge as an American child graduating from grammar school.*

When I was thirteen years old, the senior teacher paid my parents an unexpected visit. No child had ever gone from his to a higher school to graduate from the state university, and he came to suggest that I do just that.

The teacher's recommendations fell like a bombshell in the family circle. When news of it went out, I became

*Equivalent to American junior high school.

the topic of lively discussion in the parish for, while my athletic ability and exploits as a sailor were known, not many knew that I was the head of my class scholastically.

There was the matter of the cost of an academic career. It would be considerable, especially since it had not been planned. My mother had managed the household very carefully, however, and so had accumulated a little money.

I trembled with excitement inwardly, for although I had expected to become a sailor, the prospect of going out into the world beyond the narrow confines of our small village appealed to me. No one in my family had ever broken the sea's hold before.

After much debate, my father, perhaps remembering his love of music which could never be satisfied, announced, "He's going to go and learn something. Maybe it's time for some of us to do it. Anyway, Hans is a sailor."

Shortly afterwards, I was sent away to a boarding school* where I entered into new studies and a new life. With this ended my childhood which had been one of bare feet and wooden shoes, happiness and danger, strict discipline and hard work, with responsibility the world of today would believe beyond the capacity of a child.

My father died when I was fifteen years old. After I had left home for school, our neighbor and he became partners in fishing for herring. One night they were caught in one of the worst storms ever to sweep down on the Baltic. They were given up for lost many times during the day and a half they fought the sea. They suffered severely from exposure and fatigue, and although they finally came ashore, the sea had won again for my father's health was broken and he died six months later at the age of forty-seven.

*A gymnasium, a classical preparatory school for the university.

His death caused great grief, for although he was brusque in his mannerisms, he was also kindly underneath the gruffness, and our whole family loved him dearly. He was known far and wide as an outstanding personality and was called affectionately by his first name only, Sandvig, by those who knew him.

My older brother, Hans, was sailing on the West Coast of America at this time, and we could not reach him in time for him to arrange for his succession to the position of pilot. Had he secured this appointment, my mother could have continued to live in the old home which had been improved by the building of a new house and barn. However, the land and house went with the position, and we had to relinquish them to my father's youngest brother who became the new pilot.

Although we were always welcome in his home, the forest, the garden, the boats, and the old "battery" were no longer "ours." To a boy fifteen of an impressionable nature, there was great tragedy in the sudden upheaval in our lives, and to this day that episode was the greatest sorrow I have known.

An academic career was definitely out of the picture for me now. I had crammed four years' work into two and a half, and so graduated from school at sixteen.

My mother received a small pension, and as she had been very frugal, she had some savings to help her temporarily. I could not be a burden to her, so began to look eagerly for work.

Although I was eligible for positions not open to mere grammar school graduates, there was no time to wait for such a position to open up, and so I accepted a job at a sawmill in the little fishing village of Hesnaes, a couple of miles from where my mother lived. I transported fagots on a wheelbarrow from a woodpile to a buzz saw. The hours were from six in the morning until six at night;

the work was hard and tedious; but I was self-supporting, and that was my main object.

One day the superintendent called me to him.

"Is it true," he asked me curiously, "that you know mathematics?"

"Some," I replied.

"And you can speak German and English?" he persisted.

"A little."

"Well, do you really know the names of the plants in the forest, the history of the world, and physics?" he went on incredulously.

I hesitated, but finally admitted that I had a smattering of knowledge of these matters because I had studied them in school.

"Then what are you doing here?" he burst out.

I stammered that I hoped that when he retired I could have his job which was one of the best paid in the neighborhood.

He laughed uproariously at this. But he quickly sobered down and said, "You don't belong here. Promise me, you'll talk it over with your mother. I'll let you stay here until you get a better position, but you ought to put that education of yours to better use than pushing a wheelbarrow!"

I promised him that I would speak to my mother that evening.

As I went homeward that night, I rehearsed what I should say to my mother. I knew how practical she was, and that although she was clever and wise in her own little sphere, her limited horizon had made her skeptical of the world which lay just beyond her grasp.

"Think twice," she counseled me, "before you give up a self-supporting job for you don't know what!"

"I have thought," I declared, "and I'm going away to

the city where I'll stand a chance. Where can I use the things I've learned here?"

When she realized that I had decided to go away, she sat down and wrote a letter to a prominent man in Copenhagen, Lemvig Fog, whose family had spent a summer vacation as boarders in our old home.

She asked Mr. Fog to help me get a position, and we received a favorable reply from him in a very short time. About the first of January, 1903, I left for Copenhagen and the beginning of a career.

Lemvig Fog was a young man about thirty years old. While still in his twenties he had returned to Denmark with a large fortune after engaging in large undertakings in Brazil. He was an unusual intellectual, a linguist and man of the world. Unfortunately, he died some three years later, still a very young man. In him Denmark lost a citizen who would have risen to great heights in international affairs had he lived. Georg Brandes, the celebrated Danish literary critic, wrote his eulogy.

Talking to Lemvig Fog was an inspiration for me. My mother had advised me to seek a position with the government; Fog advised me to enter the technical field, which, he declared, was in the process of tremendous expansion.

His words were so eloquent that I decided then and there that engineering was to be my future work. The vistas he opened to me were ones I had never dreamed existed.

Lemvig Fog was the financial backer of Valdemar Poulsen, a famous Danish inventor, who had invented a few years before the steel recorder which he had named the "Telegraphone."

The steel recorder is similar to a phonograph except that on this machine the sounds are recorded on a steel wire, steel disc or a steel tape. The scientific world had hailed the telegraphone as one of the most beautiful inventions of all time, and it might be of interest to mention that the Poulsen patent on the steel recorder is the only patent ever issued in the United States by virtue of a special Act of Congress.

Poulsen's filing date in the United States was late, according to the international conventions, but in order to protect the inventor, the whole cumbersome federal legislative machinery was set in motion, and a law was enacted which permitted the patent office to dispense with existing regulations and to grant Poulsen his patent.

Valdemar Poulsen had his laboratory in Copenhagen, and Lemvig Fog arranged to have me enter the service of Poulsen as a mechanist apprentice. My pay was two dollars and twenty-five cents a week, and on this amount I managed to live, most frugally, of course.

My mother helped me a little with my clothes, but in reality I was desperately poor, and it took ingenuity to manage to get enough to eat. However, kind people helped me with a good meal now and then.

My appearance must have amused the more sophisticated city-dwellers, for I wore my father's clothes and shoes which did not fit me. I looked like a cross between a sailor and a blacksmith.

My stringent circumstances did not bother me for I was really learning something now. I was absorbing the rudiments of mechanics, and mechanics is the foundation of all things technical.

It was my ambition to be an engineer, for although I knew I would never have a university diploma, I realized that many men had reached top positions without one. Both Poulsen and Lemvig Fog were known as engineers and yet neither had graduated from a university. Still they were the top men in their fields. This greatly heartened me.

My apprenticeship was to last four years, after which I was to become a journeyman mechanist with a wage which permitted a decent living. So I centered all my efforts on getting through the four years. During this time, I learned to understand and to handle tools and machines, an experience which later proved to be invaluable.

It was in the latter part of 1903 that we in the shop began to hear rumors of a new invention which Poulsen had made while experimenting at his private laboratory at home.

I was told that an Englishman, named [William du Bois] Duddell, had tried to generate electro-magnetic waves by means of an electric arc, which was to take the place of Marconi's wireless spark transmitter, but that Duddell's experiments had proved unsuccessful. However, Poulsen had taken the Duddell arc and, by letting the arc burn in an atmosphere of hydrogen, had succeeded in doing what Duddell had set out to do. Poulsen had also made another great improvement which was to let the arc burn in a strong magnetic field.

It was predicted that the device, which was later known as the "Poulsen Arc," would prove to be a great advance in the art of radio, a prediction which turned out to be true.

These were all rumors which trickled down to us, but they meant little to me. My job was then learning a trade, and I didn't speculate on matters about which I knew so little.

However, one day it was announced that an arc laboratory was to be set up across the street from the "Telegraphone" shop, and some of the mechanics were to move to the new laboratory.

When it came to picking an apprentice, I was chosen, for the foreman mentioned that I always knew where to find things.

It was early in the year 1904 that we moved into the new quarters, and I consider my entry into the realm of radio as of that date.

I was still an apprentice, but, fortunately for me, the Poulsen Arc was then a very temperamental device. It was necessary to keep the arc burning at a constant length in order to obtain maximum efficiency, but the arc had a tendency to jump, get thin or thick, short or long, and all too often go out.

I was chosen to regulate the arc, probably because I was cheap labor, but as practice makes perfect, I was soon the only one to whom Poulsen would entrust the task. The arc was equipped with an adjusting screw and as I soon learned the idiosyncrasy of the sputtering flame, I could almost anticipate its behavior.

My new job brought me closer to the inner circle of engineers, and I learned from their conversations that the Poulsen arc emitted a continuous stream of electromagnetic waves, whereas Marconi's spark transmitter emitted a badly interrupted stream of such waves, and, therefore, the Poulsen principle was supposed to be much superior. The Poulsen principle also permitted sharp tuning where Marconi's did not. This was all true, as I learned later.

There was also much discussion about the probable distances which we might reach, and as I visualized the foreign countries over which our waves would travel and be heard, I began to sense the romance of radio. However, another year went by before the first station was built and real work on communication began.

Most of Poulsen's work during 1904 consisted of developing tuned circuits. The Marconi spark could be heard all over the scale, but Poulsen's continuous waves could be tuned into channels which meant that many stations could operate simultaneously, without interfering with one another. This was, of course, a great stride forward, and Poulsen succeeded in building a transmitter which was made to send out twenty-eight separate frequencies, all sharply defined.

In fact, he built a device by means of which he could punch a typewriter in one place and by means of radio have a distant typewriter write down the message. Each key was tuned to a different frequency, and, as the Danish alphabet has twenty-eight letters, he had to use twenty-eight different channels, which was quite an accomplishment in 1904.

In 1905, the first Poulsen station was built in the town of Lyngby, about six miles outside of Copenhagen, which became famous in world radio history.

I was told to go out to assist in the building of the station and to help in putting up the necessary apparatus. This was, of course, a break for me and my promotions came rapidly after that.

Fortunately, I had taught myself the Morse code for when the station was completed I was the only one on the staff who could send and read telegraph signals. This must have impressed Poulsen for he immediately gave me the title of "Assistant" and a salary better than a journeyman's. How I blossomed out with my new munificent salary! I bought a beautiful new suit and visited my old pals in Copenhagen.

They were delighted with my promotion and said they had been pulling for me. I was only nineteen at the time and overjoyed with my good fortune.

We were very optimistic about the distances we thought we would reach with the new wireless system, for the Poulsen system which was superior to the Marconi system theoretically was also superior practically. However, the beginning of our distance communication was very disappointing. For a detector we had only the coherer, a device invented by the Frenchman, [Edovard] Branly, which Marconi had adopted as a detector for his spark system.

We had a transmitting antenna about one hundred feet high, and a portable receiving antenna about twenty feet high. However, even under the best conditions, the greatest distance we could reach was two and one-half miles. Our prospects did not look too bright, and I blamed the coherer.

I have said the coherer was the invention of Branly, but we came to consider it the work of the devil.

The coherer itself was a clever invention. It consisted of a glass tube into which were inserted two electrodes; between the electrodes were placed some loose metal filings, and when the very minute electrical impulses, caused by incoming radio waves, passed through these filings, the coherer became suddenly a good conductor. This characteristic made it possible to operate a relay or a Morse code printer.

Whenever the coherer had been excited, it had to be hit immediately in order to be restored to a state of non-conducting again. For this purpose an automatic hammer device was employed. However, one could hardly breathe, cough, sneeze or talk when a coherer was in operation for it was extremely sensitive to physical vibrations. It would go "click" on the least provocation, and one never knew whether the "click" was caused by radio signals or by something else.

It has gone down in history that Marconi transmitted the letter "S" across the Atlantic in 1901. For reception he used a coherer and as the letter "S" consists of three dots, he must have heard three "clicks" from his coherer. I have no right to doubt that Marconi succeeded in hearing in Newfoundland signals from Europe, but I know that three sneezes could easily have produced the three "clicks."

When our distance communications proved so disappointing, we concentrated all energy on a radio controlled boat. The radio station was built on a small hill, and immediately below this hill, about one hundred and fifty yards away, was a good sized lake.

We purchased a fifteen foot boat and loaded it down to the gunwales with storage batteries to provide power for propulsion. Two radio receivers were mounted aft in the boat, each tuned to a different frequency. When one receiver was agitated, the boat would steer right and when the other was receiving, the boat would go left. On top of the transmitter house were mounted two signal keys which would flash either a red or a green light on the wall inside the station.

For the important demonstrations, Poulsen would always handle these signal keys himself, flashing to me inside the station which frequencies were wanted. Sometimes it worked well, but often the coherer proved unreliable, and Poulsen was often teased for his uncanny ability to guess which way the boat would turn next.

I am sure that these were the first experiments ever conducted with a radio controlled vessel. In fact, they may have been the first attempts to control distant objects by means of radio or remote control. That Poulsen should be the first to do this was natural since his was the only system at that time which was able to transmit sharply defined frequencies.

Suddenly, a new day dawned, for Poulsen produced his famous ticker. The ticker was a radio interrupter,

built on the door-bell principle. When it was connected in the receiving circuit we could hear the sound of radio signals in a pair of headphones.

So — all coherers were quickly and enthusiastically thrown in the ashcan, and tremendous and startling developments followed.

Before many months had passed, we had increased our distance to 175 miles. A complete sending and receiving station was built in the town of Esbjerg on the west coast of Jutland which was as far as we could get from Lyngby and still stay within the boundaries of Denmark.

At this time, the few radio men then living knew that the undampened continuous waves such as were generated by the Poulsen Arc were superior to the damped waves generated by the spark, and at Lyngby we had a stream of visitors from many countries. The best known men came to see for themselves, except Signor Marconi, and they all went away convinced that Poulsen had made an important step forward.

All radio and all broadcasting is today done with continuous waves, and while it is true that today we generate waves by means of vacuum tubes, for many years the Poulsen system was the leading system of the world. It had been adopted on practically a universal scale during the First World War when nearly every warship including the United States Fleet was equipped with a Poulsen Arc.

The United States kept in touch with our Expeditionary Force in France by means of two Poulsen stations, one at Arlington near Washington, and the Lafayette Station at Bordeaux, France.

There was one exception to the universal adoption of the Poulsen system and that was in the English Navy which continued to use the Marconi system.

It has been charged but not definitely proved that the English Grand Fleet failed to destroy the whole German Fleet in the battle of Jutland because of imperfect radio

communication between the various English ships, whereas the German ships, all equipped with Poulsen arcs, were able to extricate themselves by virtue of a more perfect radio communication.

It was clear to Poulsen and his engineers that continuous waves provided the vehicle over which the human voice could be transmitted by radio through space, and they searched eagerly for the exact ways and means of solving the problem of wireless telephony, now generally referred to as broadcasting.

In view of present knowledge the solution looks extremely simple, as do nearly all other inventions. But it must be remembered that in those days the only detectors known to Poulsen were the coherer and the ticker, both incapable of responding properly to a speech modulated radio wave.

I assisted Poulsen and his engineers in most of their experiments with the wireless telephone. I saw them connect a microphone in series with the antenna of the transmitting station and in other parts of the circuits. We all took turns shouting into it.

A ticker was always used as the detector because it was the only device we had which would create a sound in the headphones at the receiving end.

The experiments were usually carried out over a distance of a few hundred feet, but we were never able to hear even the faintest semblance of speech. All the experiments with the ticker proved futile, and, as a matter of fact, the very nature of the ticker made it impossible for it to respond to speech reception. The reason, however, for this failure was not clearly understood at the time.

It is not my intention to claim any credit for what was shortly to happen. I might explain my own position by relating a famous story.

There was in Denmark in 1820 a physicist, a professor at the University, by name of Hans Christian Oersted.

One day, as he was experimenting with electricity and sending a current through a wire, his assistant, whose name has been forgotten, noticed that a magnetic needle, accidentally placed close by, would swing forward and backward whenever the electric current was made to flow through the wire. He called Oersted's attention to the peculiar phenomenon, and Oersted immediately realized that a certain relationship existed between electricity and magnetism, a relationship which was unknown up to that time.

Oersted immediately made a piece of iron into a magnet by means of electricity and laid the foundation of what is known as electro-magnetism, a science upon which the whole structure of the electrical industry is based.

Oersted became immortal, but his assistant is forgotten. My role in the development of the wireless telephone is similar to that of Oersted's assistant.

One day, Poulsen's chief engineer, Mr. Schou, brought out to the station a little gadget which he called a crystal detector. It was a piece of galena upon which a thin wire rested lightly. He connected it up in series with the ticker, and we found that the dots and dashes in the earphones now sounded like a succession of pure musical notes, while using the ticker alone made the dots and dashes sound hissing. However, the sensitivity of our receiving sets suffered somewhat by the inclusion of the crystal, and although the crystal produced a more pleasant sound, for all practical purposes it was better to use the ticker. So we put the crystal aside temporarily.

The prospect of being able to speak through space by means of radio was an intriguing one, and I racked my mind day and night over the problem. At last, I had an inspiration, and not wanting to let it cool, I acted on it immediately. I invited two friends with whom I shared an apartment in town to come out to the station and assist me with my experiment.

On our way out, we got a lift from the local butcher and I briefly explained what I had in mind. My friends were brothers, Axel and Olaf Vosbein Jensen. Axel, the older owned a hardware store, and Olaf was a student at the University in Copenhagen.

When I told them my plans, they were amazed, and my own optimism waned a little on the way to the station, for I realized that many experts had been unsuccessful with the problem I was tackling.

My brilliant inspiration had been to connect a microphone in the ground circuit of the transmitter station, and for a receiver use the ticker and crystal detector combination on which Mr. Schou and I had been experimenting.

I had reasoned that it was wrong to use a ticker alone in the receiver for speech had to come through a continuous flow of energy in order to be intelligible, and the ticker would only interrupt it. The addition of the crystal having produced a musical note, I hoped it would make a more continuous reception.

Arriving at the station, I quickly connected up a microphone in the transmitter circuit as I had planned, and in another shack, a couple of hundred feet away, I set up the receiving set equipped with a ticker and crystal detector combination.

I started up the arc and told Axel to watch the ammeter, which indicated that waves were going out and then count to ten into the microphone until I shouted back to him to stop. Then I went out and tuned in the receiving set.

No matter how intently I listened, I heard nothing but a continuous note and there was not the slightest trace of speech. Hurried trips were made back to the transmitter to see if all were well.

Olaf stood halfway between the houses to relay instructions, and I remember asking him if his brother was

still counting. His answer was, "He's counting his head off!"

Finally I called Olaf in and told him the experiment was a failure. I pointed out that we could hardly be expected to invent the wireless telephone.

I casually reached out and stopped the ticker—and then I nearly dropped dead! For into my ears from the headphones boomed Axel's voice, "Eight, nine, ten, can you hear me?"

It was as simple as that.

Olaf is now the senior partner of a large firm of valuation engineers in Ann Arbor, Michigan, so I see him often. His brother, Axel, made a trip to the United States several years ago, and we had a reunion in Chicago.

It was the first time the three of us had been together at the same time in nearly thirty years, and our conversation naturally drifted to the subject of radio and the experience we had had together that evening in Denmark.

Axel said that after we had talked, played music and sung over the wireless telephone for several hours, I gave them a lecture which seemed fantastic then. He said I pictured a world where one man could sit at a radio station and talk to millions of listeners all over the world, that great concerts could be sent out, and that famous singers could be heard by everyone who possessed a receiving set. However, we all agreed that no matter what I might have said then, it could not possibly have been more incredible than that which was to happen fifteen years later. Our imaginations could not possibly grasp the tremendous powers in the toy with which we played.

Early the next morning, I went to Copenhagen to inform Poulsen about my experiment the previous night. After that, future experiments were placed in the hands of more experienced engineers. I was only twenty at the time, and I had had nothing to do with the development and construction of the apparatus I used. It was only a

lucky accident which revealed the secret to me, and within a short time after this experiment, news of the Poulsen wireless telephone was spread over the world, and the science of wireless telephony became common knowledge.

When I first heard the human voice thrust through space, I believed it was the first time it had been heard. In order to satisfy my curiosity, I delved into the past trying to find the very beginning. These are my findings.

Up to the invention of the Poulsen Arc in late 1903, all radio waves were generated by means of an electric spark, and as the "spark" waves were intermittent, they can be compared to an electric current which is badly broken up. In fact, the duration of a spark impulse is so extremely short that the interval between sparks is thousands of times longer. The sound from spark transmission sounds in a pair of headphones like the rat, tat, tat, of a rapid firing machine gun, and this sound is always present because the radio waves come in clusters. However, it was possible to superimpose a semblance of speech upon spark waves, and, at the receiving end, it was possible to distinguish words.

One of the first, if not the very first, to modulate and send a semblance of speech through space was a seventeen year old boy in San Francisco, Francis McCarthy. His father was a well-known character in California, known as "White Hat McCarthy," who had been head coachman for Senator Leland Stanford, founder of Leland Stanford University, and who had been in charge of racing horses at the local race tracks.

Young Francis was a cash boy at the Emporium Department Store in San Francisco, and while experimenting with radio during his spare time, had invented a very clever way to modulate, or superimpose speech upon spark waves. He actually succeeded in sending words for about one mile across the sand dunes near the Cliff House in San Francisco. His experiments remained a local

affair, and I have never seen them referred to in any book on radio history.

Radio lost what might have been one of its future great in the tragic death of Francis McCarthy, for the boy was killed by a runaway horse in San Francisco in 1906 at the time of the great earthquake. I know of no one in Europe who had accomplished what he did until the advent of the Poulsen Wireless Telephone.

However, spark telephony could never have been the answer, and G. G. Blake says in his *History of Radio Telegraphy and Telephony*, published in 1926: "Duddell (the inventor of the singing arc) realized that the production of these pure sinusoidal waves would, if means could be found to increase their frequency, solve the problem of wireless telephony. As we shall see later, the problem was solved by V. Poulsen."

The only other man in the world, so far as I know, who was able to send out continuous waves suitable for telephony, besides Poulsen, was Reginald Fessenden in the United States. Fessenden had constructed a mechanical alternator which was capable of transmitting a radio wave of fifty kilocycles, which is well above the human audible range, and, therefore, well suited for the transmission of speech and music. Fessenden has published the results he obtained with this alternator in transmitting music and voice during the period from 1906 to 1909, and his results were comparable to those of Poulsen. However, Fessenden's system lacked the practicability of Poulsen's because his alternator was expensive and the frequency could not be changed readily, whereas the Poulsen arc was comparatively inexpensive and the frequency could be changed by the simple motion of a condenser or by switching a connection. The historical fact remains that the Poulsen system became the universal method of wireless telephony for the next decade. It was then that the De Forest vacuum tube began to take the

place of all former apparatus for transmitting and receiving purposes, and a new era opened which culminated a few years later in universal broadcasting.

As I look back upon this period of my life, I cannot help but feel grateful to Poulsen and my other superiors for their kindness and the freedom they gave me in doing as I pleased at the Lyngby station, for I would often go out there at night and broadcast. By this time, we had a phonograph and some records which we used for our experiment. I would light the arc and turn on the phonograph; although the ether was filled with my music covering almost the whole of the small county, I had but a few listeners. The few ships equipped with radio could hear me, but radio was a government monopoly, and no private receiving sets were allowed.

It is a pity that radio should have been so tightly controlled in all of Europe, for it tended to strangle all development. As late as 1908, I had only one private listener in Denmark, a young boy, Einer Dessau, who is now a prominent man there. He broke the law and with my help built himself a small receiving set so he could hear my concerts. I have yet in my possession a postal card he sent me in which he said he enjoyed my music. It may have been the first fan mail ever sent to a broadcasting station.

Military service was compulsory in Denmark; so in March, 1909, I reported for duty in the Navy as wireless operator, and my service lasted until October of the same year.

It was while I was in the Navy that I received a letter from Poulsen asking me if I was willing to go to the United States. During the summer of 1909, Poulsen had given an option on all his United States radio patents to two Americans, Mr. Coburn and Mr. Elwell.

They had ordered complete equipment for two stations, and it was necessary for someone to go along and super-

vise the installation of the apparatus. Needless to say, I was more than willing to go; in fact, I was the happiest man in Denmark for such an opportunity comes only once in a lifetime.

The stations were to be erected in California, which meant a journey half way around the world. All my expenses were paid, and I received the princely salary of \$125.00 per month, which I later learned was a princely sum even in the U.S.A. in 1909.

I left Denmark December 9, 1909, in company with a mechanist by name of Carl Albertus, who had previously spent several years in Chicago. Albertus was to help in the building of the stations in California, and, as it turned out, he became my close associate for many years; in fact, almost to his death which occurred in 1927.

We arrived in New York, December 21, 1909, and I had my first thrill of steaming into New York harbor. The Statute of Liberty was to me only a conspicuous monument toward which I had no sentimental feelings. I was no political refugee trying to escape tyranny; I was on a glorious mission. Yet, in later years, after I became an American, whenever I have come into New York harbor again, I am as sentimental as the next one when I see that symbol, that rock of liberty, on our left as we slowly glide past it to the dock.

I was no immigrant, so I cannot boast of the distinction of having had to go to Ellis Island, and to come into this country the hard way. I was permitted to go ashore directly and to take a cab to a hotel.

My first impressions of the United States were mixed. I was twenty-three years old, and, of course, immature. Denmark had been clean and orderly with no extremes of rich and poor, but here, and all the way to California, I found a most peculiar conglomeration of the best and the worst.

New York and Chicago were magnificent cities in spots; in others, the most squalid. People — the most

beautifully dressed; others, the most ill-clad. Some parts were scrupulously clean; others indescribably dirty. Some people were exceedingly kind to us; others exactly the opposite. Never had I seen such contrasts.

One idea left me immediately, and that was the old notion that all Americans were millionaires. This was in 1909, and, of course, many things have been greatly changed for the better since then; except that not all Americans have become millionaires.

On my trips to Denmark later I have read old letters I wrote to my mother about my impressions of this country, and I am happy they were never published for they were generally just as false as the reports I have read many times since written by casual visitors.

In one of these letters, I wrote, "In the United States is found the best and the worst, all mixed up."

All northern countries, including my native Denmark, look sordid in early winter; so the semi-tropical brightness of California made the deepest impression upon me. I had never seen palms and tropical fruit trees before, and the weather as we rolled down into the Sacramento Valley was sparklingly bright.

We crossed the bay from Oakland Pier in the late afternoon, just as the sun was setting behind the fabulously renowned city of San Francisco. I felt that I had arrived at the end of the world and found that end most glorious.

An American company had been formed which was called the "Poulsen Wireless Telephone and Telegraph Company" and I became an employee of that firm. Our Danish apparatus arrived shortly afterwards, and within a short time, we had erected two complete stations in the San Joaquin Valley, one in Sacramento and one in Stockton, fifty miles away.

These stations were equipped for wireless telegraph communication, and as something new in the United

States, we also installed an automatic telegraph sender and receiver by means of which we could transmit over 300 words per minute in Morse code.

Commercial wireless communication was carried on in the United States in 1910, mostly between ships and shore by spark systems, and the "United Wireless Company" was the dominating concern in the field. Only a few investigators had experimented with the Poulsen system, and chief among these was Dr. Lee De Forest, who in 1908 had equipped the American fleet, which sailed around the world with wireless telephone stations. At the time, De Forest was reluctant to admit that he used the Poulsen Arc System, but now, I think, he will not deny it.

Many radio enterprises had started in the United States prior to the introduction of the Poulsen System here, and most of them had been in the hands of wildcat promoters whose only purpose was to sell stock to a gullible public. I discovered that the firm I was working for was following about the same policy, and it came as a shock to me, for although I knew Poulsen had given demonstrations in Denmark, to certain wealthy people, in order to interest them in his undertakings, in California we gave demonstrations to everyone who looked as if he had ten dollars to invest.

We, therefore, had a stream of motley looking people coming to the stations for demonstrations, and they were all subjected to high pressure selling arguments, by smooth talking stock salesmen. It was before the existence of any blue-sky laws, and anything was fair in war and stock-selling.

Mr. Coburn was the sales manager and he was a promoter of the G. Rufus Wallingford* type. He had started out as a school teacher in Indiana, but had gone to Alaska during the gold rush and had become the first postmaster

*A clever, unscrupulous schemer, the hero of many novels by George Randolph Chester.

of Nome. I discovered many years later that his real name was Wright, but to me and the others, he was known only as Coburn. While in Alaska, he made \$110,000.00, so he told me, by selling a claim on gold-bearing property situated on the beach close to the city of Nome. This easy money started him on his promotional career, which he clung to until the "blue sky" laws caught up with him. Later in his life, he went the way of many of his "get-rich-quick" contemporaries, and became a "knight of the road." In his palmy days, he sported a gold knobbed cane and always had his own private chauffeur and automobile.

Coburn represented a phase of American life. His type flourished during the period of rapid building of this country. Although he and his contemporaries later had to leave the scene, probably never to return, I cannot help but feel that these often unscrupulous promoters served a certain useful purpose. They would have been considered dishonest by present day standards, and they undoubtedly caused some people to lose hard earned money, but if we were to go back to the beginning of many of the largest and most successful of American corporations, now cloaked in the mantle of white respectability, we would find that they got their start by virtue of glib-talking promoters who stretched the truth beyond all limits, but who succeeded in selling the first shares of stock and thereby helped to start these concerns toward their present career of useful service to the public.

Coburn never failed to mention to a prospective buyer of Poulsen Wireless and Telegraph Company stock the tremendous benefits accruing to the first stockholders of the Bell Telephone Company.

He would place the prospect with a pair of headphones over his ears and let him listen to wireless speech and music originating fifty miles away. After the prospect had smiled and showed his amazement, Coburn would say, "You have heard talk coming through the air from

fifty miles away. You could understand what was said better than what you hear over your own telephone. No poles, and no wires, to get the voice here. Think of the savings! You know of the money made by the Bell Telephone Company. They have made theirs and plenty of it. But it won't be long before all telephone talking in this great country will be done by wireless. That's as true as I am standing here!"

Then he would make his lip protrude, bang on the table with his fist, which incidentally always knocked our crystal detector out of adjustment, and say, "By the gods, man, we are letting you in on the ground floor of a proposition which will make the Bell Telephone Company look like two bits!"

I remember this sales talk for we used to mimic him, and in spite of the preposterous claims he made, I do not believe the investors actually lost any money if they held on to their stock, for the company became a success later.

It was at the Sacramento radio station that I first met Pridham.* He had secured employment by the American Poulsen Company shortly before I arrived in the United States, and was well versed in radio. I immediately took a strong liking to Pridham for he seemed to take a keen interest in me, a green foreigner. I was unable to speak English well, except for a few simple words, but we managed to converse to a limited degree by using French, German or even Latin words which we both knew. Within a month under Pridham's tutelage, I was able to speak English fluently.

Pridham told me he was born in Downers Grove,[†] a town located a short distance west of Chicago. His father was English and had owned a drug store in Chicago at one time. The store burned down during the great fire of 1871, and his father went to work for the Pennsylvania Railroad, where he stayed until he retired.

Later the family moved to Sierra Madre in California, where they spent the rest of their days.

After attending the Lewis Institute in Chicago for a couple of years, Pridham enrolled at Leland Stanford University in California, and graduated from there in 1908,[‡] majoring in electrical engineering under the famous Professor Ryan. He had earned his way through Stanford by cleaning bricks. It so happened that many of the university buildings were heavily damaged during

*Edwin S. Pridham, 1881-1963. Jensen always called him just "Pridham."

[†]Actually Maywood, Illinois.

[‡]*Who's Who in the Pacific Coast*, 1949, indicates that Pridham graduated in 1909 with an AB in physics.

the great San Francisco earthquake in 1906, and huge piles of debris, including thousands of good building bricks were left to be salvaged later. Pridham secured a contract for so much per thousand bricks cleaned, and he soon had a group of students working for him. Undoubtedly, a great many Stanford men earned their own keep and paid for their education during this period of rebuilding.

In Pridham I found my ideal of a real American. During the next fifteen years, which was the period of our closest association, he never ceased in his efforts to change me from a foreigner into a true American, and I hope he was satisfied with his product. He was first and foremost a scholar and a gentleman, a good engineer and a philosopher inspired by the loftiest ideals. He schooled me in American lore and traditions, and he was so successful that American history, especially that of pioneer days, became my hobby and has been ever since. We formed a friendship which is as close today as it was then.

There were at that time a few crystal sets in use in Sacramento and Stockton, and our experiments and demonstrations constituted almost a form of broadcasting for we would receive many telephone calls from amateurs who were listening to our proceedings. Peculiarly, the idea of general broadcasting of news, information, entertainment, and music was seldom discussed. It was probably due to the fact that our main sales argument was centered on the superseding of all wire telephony.

In Sacramento, I stayed at a small hotel about a mile from the station. In going back and forth from the station to the hotel, I never ceased to marvel at the tropical winter which I was experiencing for the first time. The air seemed to be so clear and balmy. More than a hundred miles to the east, I could see the snow-capped Sierra Nevada. They were awe-inspiring and majestic to me, reared in flat country.

The Sacramento radio station was built on the southeast corner of the race track, a couple hundred yards outside the enclosed track. This track is still there, and I believe it has also become the annual California State Fair Grounds. In 1910 all horse racing had been abolished in California a few years earlier; so the track was idle and deserted. When I last visited the place some years ago, I was unable to locate the exact spot where the radio station once stood. The whole section had been subdivided and built up with all old landmarks obliterated except the race track — now come into its own again with greater splendor.

Immediately east of the race track was located the Sacramento County Hospital. Walking to the station, we had to pass through the grounds of the institution.

The year 1910 was still largely in the "horse and buggy days" and California had not changed much from the pioneer days of the Gold Rush era. The County Hospital in particular looked as if it had not been improved since the days of the "Vigilantes." There was then as now a steady influx of vagrants into the "promised land" of California. The only difference was then that these itinerants came on foot or horseback. They did not arrive in dilapidated cars as did the Okies. They presented a problem for many were old. Some were habitual down-and-outers, and others were simply sick. These human derelicts were gathered up and in the Sacramento area were dumped into the County Hospital.

Although the people in California were individually kind and helpful, the social conscience was not highly developed. I doubt if the county commissioners were interested in running a charitable institution in their hospital. Their job was to spend as little of the taxpayer's money as possible. The hospital looked so gruesome it made a deep impression upon me for I had never seen such disregard of humans whether they be alive or dead.

Walking through the grounds, we would see the inmates huddled together in small groups, as if for protection. They were a sorry looking lot. A few of them would always stand and look through the windows into what we called the "chamber of horrors." This was an old barnlike structure, equipped with plain glass windows, through which anyone who had the nerve could look and get a full view of the inside. The building enclosed only one large room, which was used as a dissection or perhaps autopsy room. On the wall of the room hung in neat rows were saws, axes, hatchets, knives of all sizes, hand drills, and other paraphernalia used by doctors in dissecting bodies.

On a slab in the middle of the room lay a partly cut-up corpse, sometimes wrapped in a sheet, but often without any covering. We frequently speculated on what the inmates thought as they peered through the windows and saw their old friends lying there partly dismembered, knowing that sooner or later they would occupy the ghastly slab.

The path to the station curved along the eastern fence enclosing the race track. Between the path and right up against the fence, a long row of graves were dug by a Negro who looked as if he were in the last stages of syphilis. He was digging when we came to work in the morning, and when we went home at night, he was filling up the pits.

As this was in the winter and the rainy season, the graves were partly filled with water. As we passed the open graves, we could look down and see the bodies lying there, wrapped in sheets, and enclosed in open crates made from unfinished lumber. The bodies would be partly submerged in the water and their final miserable resting place.

Pridham, in his philosophical way, said, "They don't know the difference; so why should we worry? Some

day everything will be better, and these horrible conditions will be done away with."

He was right as usual.

People now visiting the famous Fair Grounds of Sacramento sit in the stands totally unaware that close by in a great semi-circle are many people buried, many of whom helped to build the great state of California. No crosses, no flowers, and not even a slab mark the graves of these poor people, for this was not a Potter's Field, but simply a dumping ground for human refuse.

About May 1910, we started building a new radio station in San Francisco. This station was located on the ocean beach about a mile south of the Cliff House. Its two towering masts became a landmark of the city for many years thereafter. As a radio station it became famous. After it was completed, we carried on our tests and demonstrations between San Francisco, Stockton and Sacramento. Our wireless telephone transmission from the beach station was now heard by many more listeners for San Francisco was full of amateurs equipped with crystal sets.

Again, we failed to see the possibilities of limited broadcasting. The drawback was, of course, our inability to see how any benefit or income would accrue to our company from broadcasting. Perhaps we could have started manufacturing crystal sets and gained an income by selling these to the public. I am sure no one thought of selling time for advertising then. General broadcasting was still ten years in the future, and many technical developments such as loudspeakers and amplifiers were yet to come before the radio receiver became an indispensable part of every home.

A much shorter road towards a commercial business was chosen by the company, namely, the transmission of ordinary telegraphic messages between cities. In those days before the establishment of the Federal Com-

munications Commission, anyone could start a new telegraph company and begin to accept messages from the public. With this in mind, another station was built in Los Angeles, where Pridham and I were sent to supervise the installation of all apparatus.

The station was erected on a farm in an open field just outside the built-up part of the city. The station stood there for several years, but the location is today unrecognizable as it is now practically in the center of the great metropolis.

Los Angeles had in 1910 a population of 319,000 people, and San Francisco considered it a village. The center of attraction was Jim Jeffries' saloon on Spring Street which was always crowded even though Jeffries, himself, was not there. He was in training for his memorable fight with Jack Johnson which took place in Reno on the Fourth of July of that year.

Jim Jeffries was the idol of the sports world, and had come out from retirement to prove the supremacy of the white race. I had been brought up in a country where there was no race problem; so I was puzzled by all the excitement which this impending fight created. I was interested in it only from a purely sporting angle, but when I stood outside the newspaper office in Oakland during the fight with a crowd which was reading the reports of the rounds, I began to sense that this was more than a prizefight between two men.

The temper of the crowd around me became more and more ugly as it became evident from the reports that Jeffries was getting the worst of it. When Johnson finally scored the knockout blow, the crowd was in a rage.

Uncle Charlie, who was with me, said, "Look at those black blankety-blanks run. Let's get out of here before trouble starts." All the Negroes in the crowd were scurrying away quickly to their own haunts in West Oakland.

Uncle Charlie, my father's brother, had once been a

young Danish boy, but had been in this country about thirty years, and, so, he felt like the rest of the white Americans. He said I would feel the same way some day. He was wrong, for I never did, and Americans are growing more tolerant, themselves. We are proud of Joe Louis and consider him our own.

We immediately established perfect radio communication between San Francisco and Los Angeles as soon as the latter station was put into operation. It was quite a feat to establish an uninterrupted day and night communication between the two cities almost four hundred miles apart.

Daylight reception has always been more difficult than night reception, especially when using the longer radio waves, and we were transmitting on about a 2000 meter wave which corresponds to 150 kilocycles. As I said before, no government regulations were in effect; so we could use the air as we saw fit. No one else in this country was using continuous undamped waves with the possible exception of Fessenden in the east. The ship or shore stations then in existence, whether private or governmental, were all spark systems. We merely chose a channel for our frequency, and if we did not like it, we merely changed to another.

We were unable to establish wireless telephone communication between San Francisco and Los Angeles in the daytime, but during the hours of darkness, we often succeeded in hearing each other. However, wireless telephone communication between Los Angeles and the Stockton station was quite good both day and night, in spite of the nearly 400 mile distance between them. We assumed the superiority of the Stockton station was due to the swampy and moist ground upon which it was built. The San Francisco foundation was pure sand.

The status of the radio art through the world in 1910 was about as follows: Radio was used almost exclusively

as a means of communication between ships at sea and between ships and shore. Improved spark transmitters were employed in nearly all cases. These were comparatively cheap and simple to operate, and a certain degree of tuning had been developed. Crystal detectors and headphones were used almost universally for reception, but distances covered by this system were very limited — in daylight hours seldom exceeding a couple of hundred miles.

Static was the bane of all operators, rendering reception often impossible. Yet, with this imperfect system, radio had become a blessing to all seagoing traffic. Nearly all passenger liners had been equipped with radio, and the safety of these ships had been greatly enhanced by doing away with total isolation while at sea in distress. International regulations had been agreed upon among the various nations and a standard distress signal had been arranged. The naval fleets of all nations had been equipped with radio, simplifying commands and making the fleets more efficient. News was received from shore stations and posted immediately for the information of passengers on larger liners. Even small newspapers were printed daily on many ships. People felt we had come a long way compared with the previous ten years. And so we had.

The two outstanding radio companies in 1910 were the Marconi Company in Great Britain and the Telefunken Company in Germany. Great Britain was the most fertile radio field because it possessed the largest merchant marine and the largest fleet in the world. Marconi's interests were centered in London under the commercial leadership of the capable Gotfrey Isaacs. The Marconi Company enjoyed a virtual monopoly with regard to all British shipping, and Gotfrey Isaacs cleverly maintained this position for many years.

The Germans, who possess a high degree of technical

skill, began intensive radio research immediately after the first Marconi success had been announced. The Germans liked to say that radio originally came from their country, basing their argument on the daily researches and successes of Henrich Hertz who was the first to produce and detect radio waves. The Germans sold radio equipment to most of the smaller countries, especially for military purposes.

A German firm, the Lorenz Company, acquired the Poulsen Arc patents at about this time and the German fleet was completely equipped with the Poulsen system of wireless communication at the outbreak of the First World War. In this connection, I shall relate a story which has been told many times by German and Danish radio engineers, but which the English, to my knowledge, have never mentioned.

During the great naval battle between the German High Sea Fleet and the English Grand Fleet at the battle of Jutland, the English had the Germans bottled up, and total destruction of the German Fleet seemed certain. At this critical point, the Germans laid down a radio interference barrage which completely paralyzed all English communications between their own ships. The English ships used spark sets, and these sets were, therefore, more easily rendered useless than the German stations which employed continuous, undamped waves. During the confusion, Admiral Jellicoe lost contact with most of his ships which were widely dispersed, and the Germans, by executing certain maneuvers, succeeded in escaping and saving most of their forces.

Commercial radio activity in the United States in 1910 was on a somewhat smaller scale than in England and Germany. This was probably because the United States had a comparatively small merchant marine and a fleet smaller than that of England. The Radio Corporation of America was not to come into existence until some

ten years later, and none of the larger electrical and communication companies, such as General Electric, Westinghouse, and the American Telephone and Telegraph Company, were yet seriously interested in the new art. The English Marconi Company was acquiring interests in the United States, and the American Marconi and the new Poulsen Company in California seemed to be headed for commercial eminence.

There was no dearth of serious radio experimentation in the United States by various scientists and amateurs. Foremost among the scientists were Reginald Fessenden and John Stone Stone. The United States Patent Office is full of patents taken out by these two men. They both made important contributions to the art, but most of their activities were confined to radio matters of interest to the United States Navy.

Besides the commercially minded radio companies and the seriously minded scientists, there were in existence throughout the United States a number of so-called "Wild Cat" companies. These concerns would sometimes demonstrate a wireless telephone. Sometimes these "wireless" telephone demonstrations would be given between two adjoining rooms. The transmitting as well as the receiving apparatus would include a very large coil and the speech would be transmitted through the wall by induction, which was clearly a fraud as it had no connection with radio.

The main object of the promoters was to sell their stock. They wanted to make money quickly and, as late as 1912, stock was being sold in San Francisco by a company which was demonstrating a wireless spark telephone based upon the invention of Francis McCarthy.

Without casting any aspersions on the name of my good friend, Dr. Lee DeForest, and especially after reading his biography in *The Saturday Evening Post*, "The Magnificent Failure," I can now confess that most radio men

considered DeForest and his various companies of that period as "Wild Cat" undertakings. We all knew De Forest had invented a little bulb which was supposed to take the place of the crystal in a receiving set, but the little bulb had not yet proved to be such a success. The wiseacres failed to see that in that innocent looking little three-electrode vacuum tube, which DeForest, himself, thought of as only a detector of radio signals, were to be found the secrets which, as they gradually unfolded themselves, became the foundation of all future radio and electronics.

It was getting into the fall of 1910. A new company called the Federal Telegraph Company had been formed in San Francisco and the new concern took over all the assets of the old Poulsen Wireless Telephone and Telegraph Company. New money became available, and Poulsen was being paid for his patents. I began to think about going back to Denmark for I considered my mission in this country as finished. When I left, I had understood that my work in America was of a temporary nature, and that I was to return to my old job with Poulsen when the work here was done.

While I was speculating upon how to phrase a letter to headquarters in Denmark, Coburn dropped in to see me. He first told me he had personally made over seventy thousand dollars on the American Poulsen venture, which was unquestionably true. It represented a neat little sum as there was no income tax to pay in those days. He then put before me a fantastic and grandiose plan.

He explained that a group of San Francisco capitalists had tried to buy into the new Federal Telegraph Company, but had failed, and they felt they had missed out on one of the great opportunities of the time. Coburn had been in touch with this group, and between them they had decided to send Coburn over to Copenhagen to buy the Poulsen patent for the entire world. The United States

patents naturally were excluded, but these could be acquired later. Coburn envisaged a world-wide radio concern which would control all international and inter-oceanic radio communication.

He wanted me to sever my connections with the Federal Telegraph Company immediately, and go with him to Copenhagen to put through the deal with Poulsen, himself. Being only twenty-four years old, I was naturally greatly impressed for the names of Coburn's backers were bywords in San Francisco, and I quickly found out they were sincere. Practically an unlimited amount of money was available. I was promised a large block of stock in the undertaking for nothing, and I was to be chief engineer.

Coburn had probably built me up in the eyes of his backers for I was really far too young and inexperienced to fill the job of chief engineer of a world-wide radio undertaking which had for its purpose the annihilation of all competition, including Marconi. However, it was not for me to object, and I kept my apprehensions to myself.

I was afraid that I would be more of a detriment than an asset when it came to trying to purchase the Poulsen patents. I had known him personally for years, and I recalled that he was imbued with the old European conception of suspicion towards young upstarts, especially of a lowly background, and I had been the least important person in his own shop only a few years earlier.

I knew Coburn had impressed Poulsen and his associates by his apparent affluence, his gold knobbed cane and his liberal manner. I also knew that Coburn had barely enough money with which to pay his passage to Copenhagen and back the first time. Nevertheless, he obtained Poulsen's signature simply by a bluff and a promise. I was afraid that the word of an American would carry more weight with Poulsen than mine. Dr. Cook had shortly before announced the discovery of the North Pole in Copenhagen — and most Danes believed him!

I disliked leaving Pridham with whom I had formed a fast friendship. I believed he would be a valuable help in Denmark and he and I had dreamed about the great things we wanted to do together in radio. Coburn quickly agreed to take Pridham along to Europe, and I immediately radioed all particulars over our private airwaves to Los Angeles where Pridham was stationed. He agreed to come with us, and we both resigned our positions with the Federal Telegraph Company.

Events moved swiftly. Pridham arrived in San Francisco one morning at nine o'clock and at ten twenty the same forenoon, we were on the ferry boat headed for Oakland Pier and the Overland Limited which took us east. Pridham had had no time to fit himself for a trip to Europe in San Francisco; so he bought his wardrobe at Field's in Chicago during a short stopover. Coburn was unable to leave with us, but promised to meet us in London a few weeks later, leaving it up to us to open all preliminary negotiations with Poulsen.

I often wonder what would have happened to subsequent radio history had we succeeded in our mission. Our backers had unlimited money, and were willing to gamble. Pridham and I had some technical knowledge, but our greatest asset was probably an abundance of youthful imagination. We had our minds set on building immediately large transatlantic radio stations which would compete with the cable companies for commercial business. As was proved a few years later, this could have been fairly successful with equipment of the 1910 vintage.

We knew more powerful transmitting stations were needed, and how to increase the power was well-known at the time. It merely meant a greater expenditure of money. The largest Poulsen stations up to then were limited to about ten kilowatts. We had in mind using one or two hundred kilowatt stations.

While in London, we sought official permission to erect a large station in Ireland and one in Canada, and

the Secretary of the British Post Office assured us we would have no difficulties in securing such permission.

It, therefore, came as a great blow to us when we learned that Poulsen had recently given an option on his patents to an English syndicate, headed by the munition king, Lord Armstrong. This option had still eighteen months to run. We learned of this in London through Poulsen's financial agent, Christoffer Hage, but, still hopeful, we went to Copenhagen to see Poulsen in person.

I still remember vividly walking into the grill at the Palace Hotel in Copenhagen where Poulsen and his partner, P. O. Pedersen were sitting at a table, having lunch. They were both world famous and their renown was increasing. P. O. Pedersen was a great scientist and he became one of the greatest of all authorities on radio. Later, he was appointed president (in Danish, director) of the Polytechnic Institute of Copenhagen, and was given the gold medal by the American Institute of Radio Engineers for his contribution to the art of radio.

It is from one of P. O. Pedersen's published statements that I have quoted the episode of the German radio barrage during the battle of Jutland. In his position, he could hardly afford to be inaccurate or untruthful.

As I approached their table, Poulsen saw me first. He leaned over and said to Pedersen, "There is Jensen."

I was unable to tell at first whether or not I was welcome. They knew very little about my mission and my motives, and so seemed quite reserved.

At a meeting with them later that same afternoon in their office we had a heart to heart talk. I told them the story of our exploits in the United States, and about the success of the Poulsen system. They gradually became friendlier. Poulsen regretted that he could not do business with us and verified the London report that he had given the English option.

Finally, he asked me what I intended to do. He seemed to understand that the United States presented greater

opportunities for me than my native Denmark and accepted my decision to return to America and become a citizen of the United States with understanding and concern for my future.

When I left, Poulsen escorted me, his former apprentice, to the door. He shook my hand and said, "Goodbye, Mr. Jensen."

Only a European could appreciate the title "Mr." under the circumstances. It meant recognition and respect to an adult.

Pridham and I stayed in Copenhagen three days, and I had an opportunity to visit my mother. She was resigned when I told her that I was leaving Denmark for good, for she knew that all her children had the wanderlust.

We left for London, via Berlin and Paris, and I did not visit my native land again for twelve years.

We crossed the English Channel back to London in one of the worst storms I have ever known. We were supposed to make the crossing from Calais to Dover, but because of the fierce weather, we were compelled to go to the Boulogne-Folkestone Route. Nearly everyone on the steamer was deathly seasick.

Pridham excused himself, saying he was going to lie down for a while. I later found him lying on a coil of rope down in the bottom of the ship. When I asked him how he was feeling, he answered weakly, "I am just alive, that's all."

He tried to smile optimistically for he never believed in admitting defeat, but this time the elements were too much for him.

We finally landed on English soil six hours later, and it was three o'clock in the morning when we checked in at the Picadilly Hotel in London.

Here we were met by Coburn whom we had not seen since he had left San Francisco. We were shocked by his appearance for he seemed to have gone insane.

A hotel detective with him whispered in my ear, "He is

on a drunken spree; he has caused a great deal of trouble, so be careful!"

I had never seen anyone affected by liquor as Coburn was. His pupils were dilated, and his eyes had a peculiar stare to them as if they were unable to focus on any object. He walked without staggering, but his speech was high pitched, and at times irrational. He gave me the impression of an insane somnambulist or zombie. It was very eerie, and Pridham, who had not yet recovered from his seasickness was thoroughly disgusted.

Coburn was constantly calling for some man named Scanlon, but as we did not know who Scanlon was, we finally left Coburn with the detective and went to bed. We had passage on the *Lusitania*, and were scheduled to leave London at noon that day.

We had only a few hours sleep for Coburn called us early. I learned later that he never slept during one of his sprees; time ceased to exist for him when he was in this condition. Although he never mixed his drinks, he would follow his whiskey with chasers of milk. He kept this up until he would collapse completely. He would be deadly ill for a week or so, but after that would regain his good health and would stay on the wagon for several months.

When he called us, he was quite drunk. We had to be on the *Lusitania* by noon and did not have enough money with us to reach San Francisco; so Pridham accompanied Coburn to a Theodore A. Cook office to cash a letter of credit. I, meanwhile, checked us out of the hotel and took all our luggage to the Euston Station where we were to catch our train.

My fellow travelers had not shown up when the first section of the boat train left at noon. I had engaged a porter to stand by and help me throw the baggage on the train the minute they would appear. When the next section left, I had visions of never getting back to the United States.

Just as I was beginning to believe I might have to stay in Denmark, they appeared. Our train was already in motion when the last piece of our baggage was thrown in after us.

We propped Coburn up in a chair, but the excitement had proved too much for him and he collapsed, not regaining his composure until we reached New York.

We were interested in finding out why Coburn called so persistently for a person named "Scanlon" and we learned that he had made a short trip to Paris, where he had started his drinking orgy. Coburn knew from experience that he would soon be irresponsible so he had hired an American Negro prizefighter, Bob Scanlon, to act as his bodyguard. Coburn paid him for this and also bought him a ticket to New York. Scanlon had abandoned Coburn as soon as possible. Ironically enough he was aboard the same ship. He was apologetic when we confronted him with his negligence.

Coming again into New York harbor, this time on the *Lusitania*, which was to be sunk later by the Germans, the Statue of Liberty made a far greater impression upon me than the first time I had seen her.

It is strange how quickly one can become an American, not a hyphenated or pseudo-American, or even the acquisition of American citizenship. To be an American is to arrive at a certain state of mind.

It has nothing to do with naturalization papers. One becomes an American only when he feels an emotion of pride and possession which is deep, and which makes one say, "Right or wrong, my country."

Some immigrants arrive at this state of mind quickly. Some never feel it, no matter how long they live here.

I had already come a long way towards becoming an American for when I saw the lady, holding the torch of Liberty high over her head, this new and strong feeling of patriotism swept through me. I knew this country would be mine, forever.

San Francisco, at the end of 1910, had been almost completely rebuilt after the earthquake and fire in 1906. It was by far the largest and most important city on the Pacific Coast. The inhabitants were proud of their achievement in rebuilding their city so quickly, and the spirit was one of aggressive adventure, pride and optimism.

Hiram Johnson had just been elected Governor, and he represented at that time the reckless progressiveness of the state. The smallest unit of money was a nickel; pennies were unknown; and no paper money was in circulation. Everything above a silver dollar was a gold coin; five, ten and twenty dollar pieces. The stories of the large fortunes made by the railroad and mining kings had become legends. Told also were stories about fortunes made by shipping and lumber magnates, and by the fortunate ones who owned real estate or farming land in a rapidly growing and prosperous state. Money was free and easy and everybody was ready to take a chance. Gambling seemed to be in the air.

It was fortunate for us that we should come back to this environment, for Pridham and I had only vague plans about what we should do, and we were not at all sure we could get money with which to start. However, our misgivings were quickly dispelled.

Coburn brought us in touch with Richard O'Connor, who was the spokesman for the group of capitalists who had been willing to underwrite our world-wide radio venture. O'Connor became our financial backer, our best friend, and our closest associate until his death in 1924.

Whatever success we achieved, we owe in a large measure to him.

Many old timers in San Francisco will remember Richard O'Connor. He was a very important figure in the political life of the city, and, although he often did his work in the background, he was always leading the forces which fought for better government.

O'Connor was born in Brooklyn in 1854, but his parents, who had been Irish immigrants, moved to San Francisco when he was only a few years old. As a boy he sold newspapers in the financial district. It was in the days of the mining and railroad booms. He saw the city in the raw, as this was only a few years after the advent of the Vigilantes, and it was during the most colorful and hectic days San Francisco was to know.

He became, in true Irish tradition, a fireman when he grew up, but as he possessed a very keen intellect, he soon started in business for himself, and as he prospered, drifted into politics.

In later years, I would often sit for hours and listen to his tales of early San Francisco, and to the inside stories of the political life of the city.

One of his stories concerned Denis Kearney, who was the leader of the dreaded "Sandloters" in the late seventies. Denis Kearney was a labor agitator, the kind of which California had not seen before nor seen since.

Writers of California history have speculated upon what made Kearney quit his agitations at the age of forty, and it is generally believed that he was bought off by certain interests who wanted to remove the dangerous leader.

I asked O'Connor if he knew what actually had happened in that case for I knew he was close to the inner circle of local politics.

O'Connor leaned over, and whispered into my ear, "Denis Kearney was paid off with a two flat building in

Alameda, a team of horses and a wagon!" I will leave O'Connor's statement for future historians to ponder.

Another story dealt with the inside of the famous graft prosecution immediately after the fire of 1906. The state of the municipal government of San Francisco had sunk to such low levels with the supervisors selling the same franchise to different companies and pocketing the money as individuals, that those interested in better government decided to take action.

Mr. O'Connor, or Dick O'Connor, as he was always called, led the spearhead of the better government crusaders. They first looked around for a dependable district attorney whom they would put in office at the next election.

According to Dick O'Connor, it was not easy to find a capable and fearless man who was willing to put his neck out in a life and death struggle with the entrenched city machine.

Dick finally decided with his friend, Matt I. Sullivan, on the man they wanted for the job. He was a young attorney and his name was [William H.] Langdon.

Dick O'Connor went to see Langdon to whom he outlined what they had in mind. Langdon was at first reluctant; he knew it would be a battle to death and he was sure he had not the slightest chance of being elected. O'Connor said he would take care of the election; all Langdon had to do was familiarize himself with all the shenanigans of the present city administration for he was sure to be the next district attorney.

The rest of the tale is history. Langdon was elected and Francis Heeney was chosen as chief prosecutor. During the trial, Heeney was shot in open court and it was up to Dick O'Connor and Matt Sullivan to find another prosecutor equally capable and courageous. They decided to offer the job to a young attorney in Sacramento, who was in business with his father, and who was known

to be afraid of no man. His name was Hiram Johnson.

By skilful and forceful prosecution, Hiram Johnson brought the trial to a successful conclusion. Only the political boss, Abe Rueff, was convicted, however, and sent to San Quentin for fourteen years. Yet the political situation was much improved.

Hiram Johnson gained such a reputation that in 1910 he was elected governor of the state. He is today the senior senator from California.

Dick O'Connor owned a concern called the "Mission Soap and Candle Works" but most of his time was divided between our venture and his politics. He was deeply religious and a man of high principles. He was the ideal type of politician in the best sense of the word.

He had the politician's memory for faces, names, and figures. He was charitable to a fault and was especially a soft touch for a cripple or a down-and-outer. His acquaintanceship was one of the largest of any man in San Francisco, and his friends included people from all strata of society. Fortunately for us, he also possessed the gambling instinct of old San Francisco, and he stayed with us through thick and thin until we made good.

We organized a company called the Commercial Wireless and Development Company with Dick O'Connor as president and treasurer. Pridham and I were the engineers, and the purpose of our company was to make researches in radio, which was a virgin field, and to take out patents, if we invented anything.

O'Connor, Coburn, Pridham and I each received a block of stock in the company as the promoters of the enterprise. I might mention here that Coburn sold his interest for seventy-five hundred dollars a short time afterwards, and he thereby passed out of the picture as one of our associates.

O'Connor provided some capital, and on Washington's birthday, 1911, we went to the city of Napa, which is

some thirty-five miles northwest of San Francisco, and bought a small bungalow and a good sized lot.

It was O'Connor's contention that we should be out in the country where we could work undisturbed and free from the annoyances which go with a large city. The purchase price was \$2500.00.

We bought some machinery, and set up a small machine shop to be used for our experiments, and we secured the services of Carl Albertus, who had accompanied me on my first trip to America, and he became very valuable to us as our expert machinist.

As I look back upon our inconspicuous beginning, I think it was well that such an isolated place as Napa was chosen for us. It permitted us to work along with a single purpose in mind, undisturbed by "expert" technical advice, and by "experienced" businessmen who certainly could predict nothing but ultimate failure for our new adventure. No one was wise enough to tell what was ahead, but the "great voice" was first heard throughout the beautiful Napa Valley.

We built a Poulsen Arc, and erected a complete radio station. We had secured several DeForest three-electrode tubes, and were investigating the behavior of these in conjunction with the arc. We might have discovered the oscillating properties of the tube which made it suitable as a radio transmitter and a supplanter of the arc. Or we might have found the amplifying properties which were inherent in these tubes and which made it possible to amplify an electric current. These discoveries we might have made for we were on the track of them, but the fact remains that we didn't. Instead, we turned all our energies into a new direction.

This sudden change in our course was brought about by a discovery we made a couple of months after our arrival in Napa. It came about in this way: among the various apparatus which were brought over from Den-

mark was a recording device which would photograph the incoming dots and dashes on a photographically sensitive tape. It was used as a rapid receiver of telegraph messages, and would respond perfectly up to three hundred words per minute, which was the speed limit of the transmitting device.

This rapid receiver consisted of an exceedingly fine wire suspended tightly between two poles of a magnet and is known as an Eindhoven galvanometer. When the feeble current, caused by the incoming signals, passed through the wire it would jump and it was this movement which was photographed.

It showed a wavy line which could be read as dots and dashes. Pridham and I were discussing one day the uncanny rapidity with which this wire could move, and it struck us that it might be fast enough to respond to voice vibrations, in other words, it might be used as a telephone receiver.

We, therefore, quickly constructed a similar piece of apparatus, but substituted the very fine wire with a heavier one. In order to get sound out of the device, we connected the middle of the wire to the middle of a diaphragm by simply gluing an ordinary wooden match between the two points. The object, of course, was to transmit the movement of the wire to the diaphragm which was acting as the sound reproducer.

We then hooked up an ordinary telephone circuit, and spoke through a microphone, but instead of using the telephone receiver, we substituted the string of wire in our apparatus. To our surprise, we heard speech coming out of our device with exceptional strength and clarity.

We were more dumbfounded than elated by our discovery. This was such an obvious way to reproduce sound that we did not dare to think the method was new. We carefully looked through all our books on physics, and, although we found many references to thermo telephones

which operate on the heat principle, condenser telephones, which operate on the principle of attraction between two plates, and, naturally, the magnetic telephone, invented by Alexander Graham Bell, we could find no mention whatsoever of a moving string conductor or a moving coil telephone. At our first opportunity we made a careful search through the large technical Mechanic's Library in San Francisco, but with the same result.

We came to the conclusion that we were the original discoverers of a moving coil telephone, and it was fortunate we were under this delusion, for we immediately bent all our energies towards improving our device, and in a surprisingly short time, we had evolved a telephone which in our opinion was superior to all others.

Had someone told us at first that the method was old, and had been tried many times, we would not have taken the course we did in our ignorance.

We knew the various laws governing electrical phenomena, and we knew we had to make the string long, and the magnet strong, in order to increase the efficiency of our new telephone. Michael Faraday in England, almost a century before, had formulated most of these laws; he was one of those rare individuals who not only knew the answers to the questions of his contemporaries, but also knew the answers to questions asked after him, so long as it had to do with electricity.

So we made our string longer by making it into a coil which we inserted in a small airgap of a strong electromagnet. I remember when we tried our first moving coil instrument. It was so surprisingly good that Pridham said: "Well, I'll be damned! Say it ain't so!"

Now Pridham seldom swore, and he never used incorrect grammar, but what he meant to convey was that it seemed incredible that such an excellent telephone receiver could have escaped from being developed and known to all the world before this.

We continued to make experiments with various forms

and shapes of diaphragms, and soundboxes, and after a while, we had an instrument which, when we connected it to our telephone, was much better than the then regular standard receiver, both for local and long distance conversations.

We filed a patent on our invention, with high hopes. The patent office was just as slow then as it is today, and it took months before we received our first reply.

While we waited, Pridham and I sat down one day to take stock of our new situation. Here we had invented a telephone which operated on an entirely new principle; it was a principle which we believed superior to the magnetic principle which Alexander Graham Bell had utilized in his first telephone and which was still standard and considered the best throughout the world.

There was no doubt in our minds that our method would ultimately supersede all others for telephone reception. Today more than thirty years later, the total number of moving coil telephones, which includes loudspeakers, in existence, probably exceeds the number of all other types of telephone receivers put together. Our principle is considered by all the more perfect principle, over 100 million in use.

So in our enthusiasm we thought our new telephone principle merited a name, and a good name. Bell's telephone was always referred to as a magnetic telephone, and we wanted to call ours something else.

After some discussion, back and forth, we finally decided on a name which was a happy choice. We named it the Electro-Dynamic Principle.

Henceforth, we wanted the method we used to be called the "electro-dynamic principle" and a telephone receiver built on this principle to be known as an electro-dynamic telephone. The term has since become general. It has gone through the states "electro-dynamic loudspeaker" to "dynamic loudspeaker" until today when all simply say "dynamic speaker."

The term is used in every language in the world, and when I see in foreign radio journals the term *dynamic*, I cannot help but think back to our little bungalow in Napa where the baptism took place. The world may disagree as to the value of our contribution, but, at least we gave the baby the name which stuck.

I have often been asked what made us decide on the term "*dynamic*." My answer has been that, although it has no exact scientific meaning, we picked it because it sounded good to us.

Dynamic, of course, means "forceful"; it is derived from the Greek word "*dyne*" which means power.

In due time, we received our first reply from the patent office. That communication nearly floored us, for it revealed the whole prior art, and our method patent was rejected.

It was a sad blow to our hopes, but luckily we had progressed so far that we could not think of giving up our further developments, patent or no patent.

We brought the news to Dick O'Connor in San Francisco, and to his everlasting credit, I must say he took it like a good soldier. Being a master of human psychology he knew we needed encouragement at this moment, for we were certainly bitterly disappointed and sadly dejected. He gave us every assurance that money would be forthcoming as before, and he sent us back to Napa to continue our work.

I have personally studied all the patents taken out on moving conductor telephones, antedating our entry into the field, and I have made it a point to investigate the work done by all earlier pioneers. Some of the famous figures in science had at one time or another dabbled with the problem.

The earliest pioneer was Siemens in Germany. He was a German Edison, and his name appears in Germany in names of corporations, such as Edison's does in this country.

The American public has read recently in their newspapers that the extensive plants at Siemens and Halske have been bombed, and that the large Siemens Shuckert Works have been destroyed.

This man, [Ernst Werner Von] Siemens, had a finger in everything. In 1877, six months after Bell's announcement of the invention of the telephone, Siemens obtained a patent on a moving coil telephone. A moving coil telephone is built on the same principle as a galvanometer, and I have been told that Siemens at one time, prior to Bell's invention, had two galvanometer coils hooked up in series, but spaced a distance apart by being in separate rooms.

As all technical men know, if the galvanometer coil in one room was being vibrated, the coil in the other room would vibrate in unison. All the prerequisites of a telephone were present in this setup, and if Siemens had happened to shout close to the coil in one room, and told an assistant to put his ear close to the coil in the other room, the famous words by Bell, "Watson, are you there?" might well have been "Heinrich, bits du da?" That is, provided the assistant's name was Heinrich.

Siemens came that close to being the inventor of the telephone, but he missed his chance for he never tried this experiment until after he heard of Bell's accomplishment.

Another famous name among the early pioneers was Oliver Lodge in England. He filed some patents about 1890, and was probably unaware of the early work done by Siemens; and then there were others, such as Dudley Field, who became president of Western Union Telegraph Company in America.

It was an imposing array of "old masters" but none of them ever perfected the device to a point where it became a commercial product, for no *dynamic* telephone had ever appeared outside of a laboratory. This is probably the reason why they were never mentioned in textbooks.

In a patent suit filed by the Magnavox Company against the Majestic Radio Corporation in San Francisco many years later, the whole history of the development of the electrodynamic loudspeaker was brought out and it is now a matter of record.

The judge in the Federal Court of the Twelfth District ruled that the patents issued to Pridham and me were fundamental and basic, and that we were entitled to full protection for although we had utilized an old principle, we had succeeded in developing an instrument which had become universally commercial and a benefit to mankind. However, the decision was reversed in the Circuit Court of Appeals and the case was never carried to the Supreme Court of the United States.

During the next couple of years, we worked on reducing the size of our instrument. We could see no other field for it outside of ordinary telephone service and our device was much too heavy and far too expensive to compete generally with the small standard Bell receiver which weighed only one-half a pound, or less, and which could so easily be held against the ear. However, during this period, we invented and developed the "speaker" transformer and the "bucking coil."

By using a transformer as an integral part of the dynamic telephone, we raised the efficiency of the instrument and made it more versatile. Today, such a transformer is universally employed and is known to the trade as the "speaker transformer." The "bucking coil" is a name given many years later by radio engineers to a neutralizing coil which we developed and patented. The coil serves the purpose of minimizing the hum in a speaker. It, also, is an integral part of many types of speakers. Strangely enough, it remained for some unknown person to give it the snappy name "bucking coil" which is so appropriate.

Late in the year 1914, Pridham and I went to New



Ole Sandvig Jensen (left), as a child, with his brother, his father, Jens Christian Pedersen, and his grandfather, Peter Jensen Otte, circa 1860.



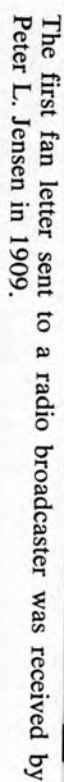
Hansine and Ole Sandvig Jensen, probably at the time of their wedding in 1878.



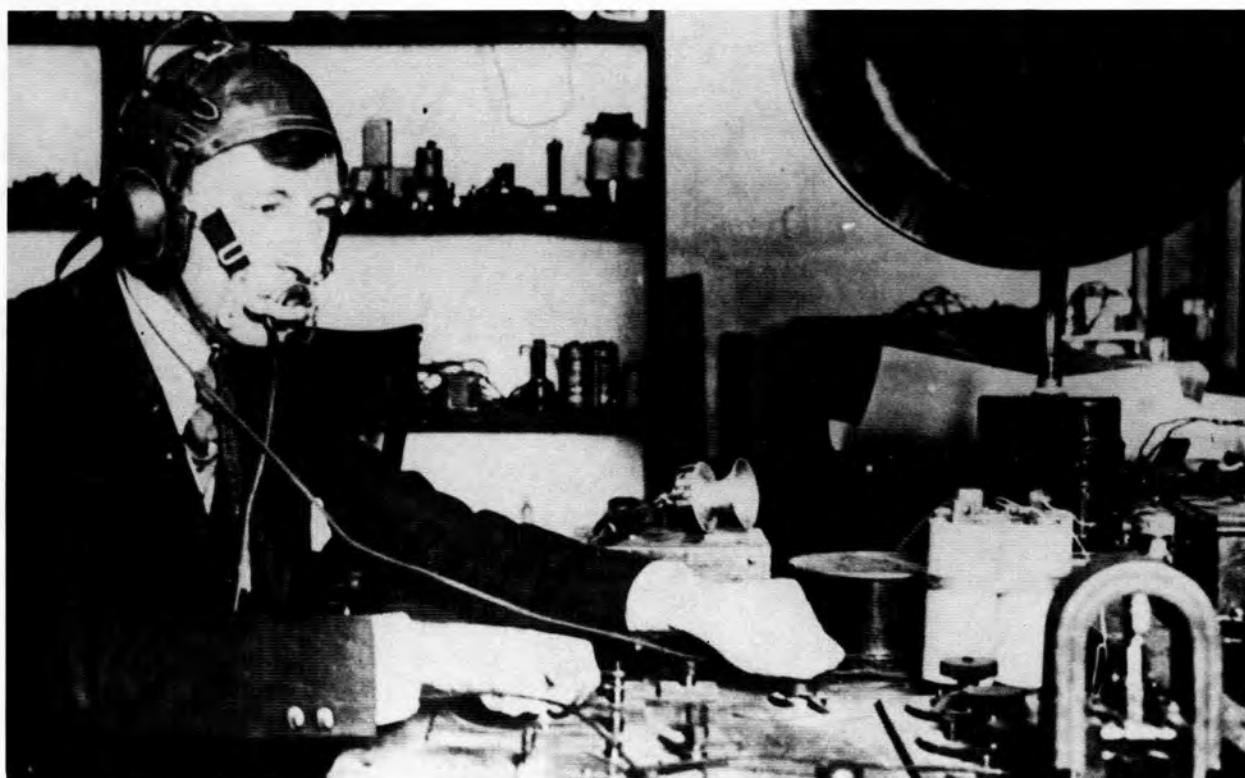
The Ole Jensen family, circa 1895, standing (left to right), Marie, Peter, Karoline; seated, Ole, Karl, Hansine and Anna. Hans had left for sea.



The Jensen family on the occasion of Hans' wedding to Petrea Jensen, April 26, 1907, standing (left to right), Hans, Peter, and Karl; seated, Karoline, Anna, Hansine and Marie.



Edwin S. Pridham (left) and Peter L. Jensen in their laboratory in Napa, California, 1915.



Peter L. Jensen in his laboratory in 1917. The noise neutralizing lip microphone which he is wearing was invented and patented by Jensen and Edwin S. Pridham.



The Ole Jensen children who immigrated to the United States in Oakland, California, 1918, (left to right), Peter, Karl, Marie and Anna.



The Jensen and Jacobsen families in Oakland, 1918, standing (left to right) Peter L. Jensen, Karl K. Jensen, Christian Jacobsen, Marie's husband, Carl H. Jensen, Anna's husband, and their daughter, Karen; seated, Karl William, Peter's son, Vivian Jensen, Peter's wife and their daughters, Patricia Ann and Jean Marie, Marie Jensen Jacobsen, Anna Jensen (nee Jensen) and her son, Robert S.



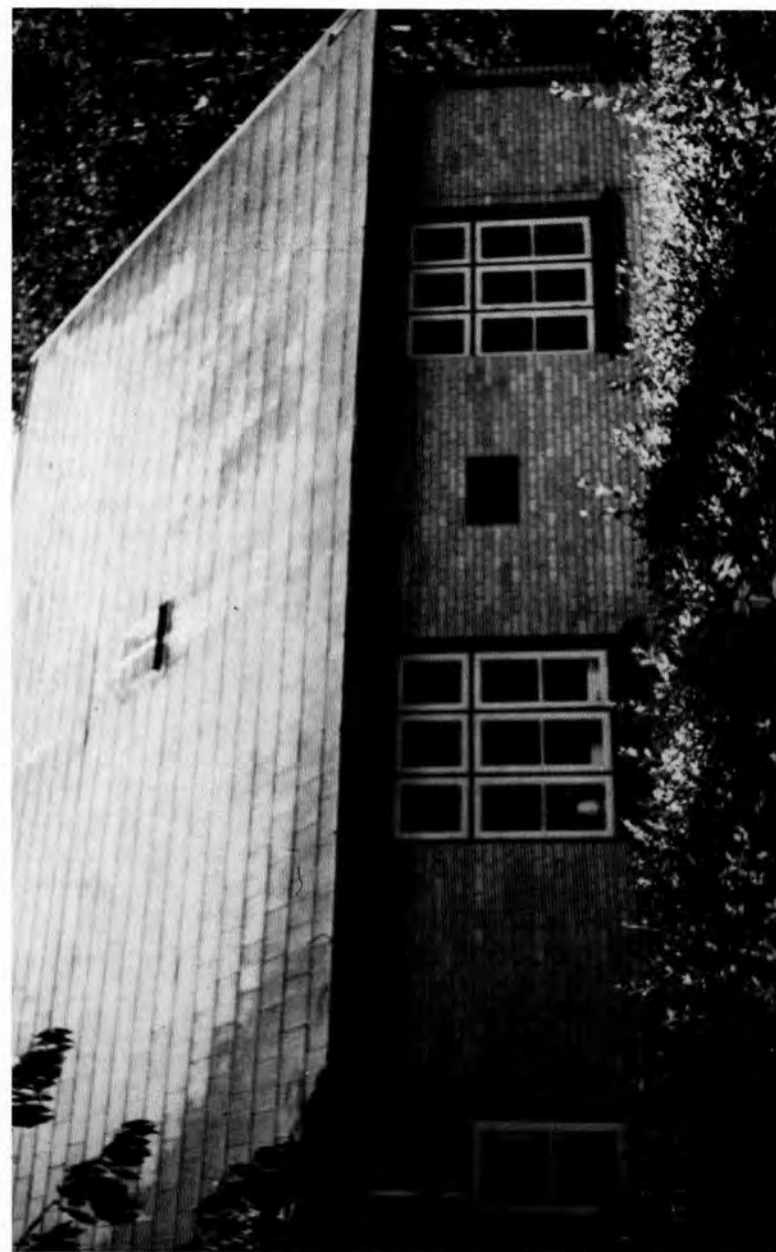
Woodrow Wilson, the first United States president to speak to an audience over a public address system. His talk was delivered using equipment invented by Edwin S. Pridham and Peter L. Jensen in San Diego on September 19, 1919.



Peter L. Jensen and his wife, Vivian, in Oakland, California, in 1921, with their children (left to right) Karl William, Patricia Ann and Jean Marie.



Inside the church in Falster, Denmark. The model of the ship which hangs above the aisle was made by Peter L. Jensen's grandfather and great-grandfather. The ancient paintings were uncovered in modern times as the ceiling of the sanctuary had been covered with whitewash during the Black Death in 1347-48.



Peter L. Jensen's boyhood home at the Battery near Moseby and Stubbekjøbing on the Island of Falster, Denmark.



Plaque on the Jensen home near Moseby. It reads: "The Danish-American inventor, Peter L. Jensen's childhood home. He was loyal to old friends and loved his native land."

York to try to sell our invention to the American Telephone and Telegraph Company. Our instrument was still far too bulky to be incorporated in ordinary telephone sets, but it performed so well and showed such great promise, that we believed the telephone company would buy it.

We had obtained a patent on our particular construction, and as we now had something tangible to offer, we felt we had a good chance of disposing of it for a considerable sum of money. The telephone company was known to have bought promising inventions from individuals before; so we went to headquarters at 195 Broadway in New York City with high hopes.

Here, we had a pleasant interview with Mr. J. J. Carty, chief engineer of the Western Electric Company, and he turned us over to Mr. G. K. Thompson, who took us in hand. Our instrument was delivered to Mr. Tanner and Mr. Benson of the Western Electric Laboratories, later known as the Bell Laboratories, on West Street for engineering tests and thorough investigation. Then we waited.

During this waiting period, we visited Dr. Lee De Forest several times at his laboratory at High Bridge in New York. De Forest had been employed by the Federal Telegraph Company in San Francisco in 1912 where I first met him, and when he left that concern he took Charles Logwood with him to New York. Logwood had been our colleague at Federal in 1910; so he was an old pal of ours. We gleaned from conversations that De Forest either already had disposed of, or was about to dispose of his invention of the three-element vacuum tube to the American Telephone Company. And, as I later discovered, it was about this time that he sold his patent, or patents, to them for \$140,000.00. Of this amount, \$90,000.00 was for all wire telephone rights, and \$50,000.00 was for all radio rights.

The telephone company had in its laboratory at that time all the fundamental requisites from which was to grow commercial broadcasting, home receivers, electric phonographs, talking moving pictures; in fact, practically all which we now call the electronic art.

No man was then smart enough to know what was hidden in a little three-electrode tube, and in a moving coil telephone. De Forest was probably very pleased with his \$140,000.00; we might have accepted half of that amount.

Paradox though it seems, De Forest was happy for having sold his invention for a sum which he believed to be adequate, but which later looked like a mess of pottage compared with its real worth. And we were shortly to become unhappy because we were turned down. But it proved in the end that De Forest was really the loser for he lost ownership of one of the most valuable inventions of all times, and we were permitted to keep ours and reap a much larger reward from the commercial success which we later received. Besides, and what was much more of a pleasure, we were permitted to do the job alone.

Yes, we were turned down! After about six weeks of waiting in New York the fatal letter arrived. We nervously opened it with great hopes.

The letter simply said: "We regret . . . not interested." No reason and no further explanation was given. The letter had a tone that was the ultimate in correctness and also the ultimate in finality. "You may obtain the instrument submitted for test by applying to the Shipping Department," it ended.

Pridham's hand shook when he opened the envelope, and when we had read it, short and precise as it was, he threw it on the table and said: "Well, that's that."

I was just as disappointed and angry. I said, "Those blankety-blanks wouldn't buy a twenty-dollar gold piece for five dollars. Come, let's go."

The telephone company was, of course, justified in

refusing us. They could not see, any more than we could see, that in our instrument lay hidden the world's future loudspeaker. They could judge it only from its possible application as a telephone receiver. And as such it was impractical because of its shape and weight. It is only in the last few years, with the remarkable improvements made in permanent magnets that it has become possible to make superior earphones constructed on the electrodynamic principle. In later years, the American Telephone and Telegraph Company became one of my best and fairest customers, and it amuses me to think how angry I once was with them.

We went back to California, feeling quite worried about our future prospects. We had devoted our entire time towards this single development and we had no other irons in the fire. We discussed the possibilities of having to close up and dissolve our partnership as we rode home on the train. We might both go back into radio which had made some strides since we had left the field. These radio advances had not been of a revolutionary character as yet. These were to come shortly afterwards. We had hopes that our former experience in radio might help us secure positions in that field.

The real fact of the case was that our position was more critical than we suspected in our youthful ignorance. Our stockholders in California had been altogether too hopeful of our selling our patent and our pending patent applications, so the blow they received had a crushing effect. Only O'Connor was undaunted.

We had formed a fast friendship with this remarkable man, and he promised to carry on even if he had to carry the whole financial burden himself. However, the country was in the midst of a serious depression. We had to tighten our belts, for money began to come to Napa in smaller and smaller amounts. The Napa venture had cost our stockholders a total of about thirty thousand dollars up to this time.

Foghorn Murphy was an institution in San Francisco during the decade 1910 to 1920. He was a large and ruddy Irishman whose real name was James Murphy, but everybody, including the sports-writers, always referred to him as Foghorn Murphy. The foghorns which give warnings to ships entering the Golden Gate during dense and famous San Francisco fogs were the ultimate in loudness, and every citizen has had the experience of being kept awake nights by their penetrating monotony. Foghorn Murphy's nickname was given him because of his profession and his voice.

During the baseball season, he would ride on a white horse through the Bay Cities and in a stentorian voice proclaim, through a giant megaphone, that a baseball game would be played at Recreation Park in San Francisco, or at the Oakland Ball Park. At game time, he would be back at the park, and would start the proceedings by making the familiar announcement through his megaphone: "Batteries for today's game," etc. He was one of the famous baseball announcers in pre-loudspeaker days.

Foghorn Murphy was one of the last of his clan, and, ironically, he indirectly helped to eliminate it. When I say his clan, I mean it in a broader sense. He personified and with him ended the long lineage of men who used to be a part of all communities where information to groups had to be given.

Primeval man was the first to improvise the speaking trumpet by simply cupping his hands in front of his mouth and shouting a warning or a command through the forest. During Roman times, and even before them, cour-

iers were dispatched to run through towns and settlements to shout to the populace a warning or an order by the king or emperor. The clan reached its peak in importance with the town crier of the Middle Ages. It has always been important and sometimes vital that the spoken word be heard by as many people as possible. Therefore, an old tradition was about to come to an end. The personal element was about to be eliminated for people were beginning to learn to use the great servant, electricity, to strengthen the voice of the puny and to strengthen it far beyond the natural power of human lungs.

By a chance mentioning of Foghorn Murphy, an idea was born, which, as it grew, ultimately doomed his profession to oblivion. It eliminated him, and others like him, from being individual and personal attractions. No change took place immediately, but five years later, the handwriting was clearly on the wall. For then it became obvious that the types of figures, such as Joe Humphries, famous old fight announcer in New York, and his equally famous counterpart in California, the great Billy Delany, were destined to disappear from the traditional life of the United States. It became evident, also, that the days were numbered for the silver-tongued Fourth of July orator whose mark of distinction consisted of holding spellbound throngs of people by the power of his voice. And by 1920, plans were beginning to be laid for the building of huge structures with over twice the seating capacity of our older buildings. By 1920, the drastic changes began which altered many things in the United States, and which had such a great effect upon our daily habits and our mode of living. The changes were caused by the introduction of loudspeakers and the development of the art of sound amplification in general, and the greatest of these changes was caused by the introduction of the modern radio set.

It was at the very beginning of the year 1915 that a man by the name of Ray Galbreath* happened to pay us a visit at our laboratory. He was a blacksmith by trade, and his technical knowledge was possibly limited to the heating and bending of iron. I think he was an expert horseshoer. But Ray was what is often called a practical man; so when we had shown him our new telephone and let him listen to it, he shook his head and said, "If you can't sell it to the telephone company, what chance have you? But now, if you can make it talk a little louder and put a horn on it, like Foghorn Murphy's, and if you put enough of them around a ball park, maybe we can understand what is being said a little better, and maybe they don't need Foghorn Murphy any more. That's the only chance I can see for you."

Ray Galbreath gave us a new slant on things. Like the rest of the radio and telephone engineers of that period we were strictly "communication-minded"; we thought only in terms of transmitting and receiving intelligence over a distance, whether by wire or radio. While we had occasionally mentioned the idea of a loudspeaking telephone among ourselves, the field for such a device was infinitesimal compared to the limitless field of ordinary telephone communication. We thought we might make our dynamic telephone talk across a small room, but beyond that our imagination failed us. When Ray, however, mentioned a possible commercial field, the idea hit us squarely, for we were about washed up, and anything which might look like a way out of our predicament certainly had to be investigated.

Pridham and I stayed at the laboratory after Ray had left us until late in the night, discussing the use of our device as a possible loudspeaker. The term "loudspeaker" was not used or known at the time. Everyone would have assumed the word described a person. We used the

*Uncle of Peter Jensen's wife, Vivian Steves Jensen.

term "loud speaking telephone." Americans have a knack of quickly coining and applying names and phrases to conditions and things, and these pungent terms, so appropriate in a graphic sense, rapidly become part of our common speech and eventually find their way into the dictionary. I am not personally responsible for the word "loudspeaker" which I think is an ugly-sounding word.

We both realized the market was very limited; perhaps it could be used in railroad stations for announcing the arrival and departure of trains, and at baseball parks for making announcements. We also discussed other uses, but at best it did not look as if it could be built into a large industry. However, it was a free field, and not like the telephone industry, which was controlled by a few companies, all of which prohibited telephones not of their own manufacture from being connected to their systems. So we were shut out from the telephone field and the loudspeaker was our only way out. Never was it more truly said that "necessity is the mother of invention."

We decided to make a loudspeaking telephone that night, and to make our first model as efficient as possible. Our regular dynamic telephone had always been equipped with a flexible tube which served to convey the sound from the diaphragm to the listener's ear. Now, of course, we had to use a horn which would throw the voice some distance, and having Foghorn Murphy in mind, we decided to use a large horn right from the start.

In our laboratory, we had an Edison cylinder phonograph which was equipped with a large gooseneck horn, a type of horn well remembered by many oldtimers, and we designed a fitting for our dynamic telephone; so this horn could be put on it directly. The next day, Albertus made the fitting in a few hours, and, in the meantime, the stage was all set by the rest of us.

We had on hand some "heavy duty" powerful microphones which Pridham and I had bought in Berlin in

1910, and which we later used in our wireless telephone experiments. These had been put away, but now were resurrected. They were mounted in a cluster of six, but were connected to a common mouthpiece. We had a proper transformer on hand, and we decided to use a twelve-volt storage battery because we knew the microphones would carry about ten amperes before they would burn up. In fact, we tried to use as much power as we thought was safe for the instruments, and with this setup, we hoped to talk at least across the room.

When Albertus brought in the loudspeaker with the horn nicely fitted in its place, we were all waiting for him: Pridham, Hugh N. Sym, our mechanic, my brother, Karl, and I. Everybody was always interested when we tried something new.

We put the loudspeaker on the table next to the microphones, and began connecting the various pieces of apparatus together. Without knowing it, we had on our hands a ten to twenty-five watt sound system by present standards, and up to this moment, all sound systems, such as telephones, had been on the scale of microwatts, or at most milliwatts, which meant ours was thousands of times more than any put together heretofore. We had no suspicion that this was the case, but we soon found out.

When the final connection was made to the terminal of the storage battery, a crack like the report from a gun came out of the horn, followed by a screaming howling noise which was ear-splitting and terrifying.

Pridham shouted at the top of his voice: "Disconnect the battery. . ." At this point, the connection was broken, but Pridham was unaware of that, and he finished the sentence by hollering in a deadstill room ". . . before the house blows up!"

We didn't even laugh at Pridham's peculiar sounding warning. We were too perplexed and mystified by the

phenomenon we had just witnessed. Every radio and sound man today will immediately recognize that we ran into the feed-back phenomenon. We had placed the microphone and the loudspeaker too close together.

We also knew what we had run into, but not until a few minutes afterwards, when we had had time to regain our composure. We knew the phenomenon of feedback; all telephone engineers knew it, and many ordinary telephone subscribers had heard it. It was sometimes brought about unintentionally when a subscriber held the receiver too close to the mouthpiece of his transmitter. It is heard as a "singing" note in the telephone, and it immediately ceases when the receiver is moved further away. Feedback has always reminded me of a dog turning around, faster and faster, to catch his tail. With a sound system it is this way: A sound from a loudspeaker hits the microphone; here, the sound is picked up, amplified and fed back to the speaker; out comes the sound again, louder than ever before; into the microphone again with more power, it goes around and around. In telephone parlance, it is known as "howling," but in radio and sound circles, it is now universally called feed-back.

What made us fail to recognize the phenomenon immediately was the terrific intensity of it. The "howling" was probably thousands of times louder than any we had heard before, and it burst upon us so unexpectedly that we were amazed. We knew what to do to eliminate it — simply place the loudspeaker a safe distance away from the microphone. As yet we had not heard a voice through the system for in our eagerness to disconnect everything, no one thought of shouting into the microphone. After collecting our wits and getting our courage back, we decided to connect the battery again, howl or no howl, just to see what it would do to the voice.

We were prepared for anything by now, and sure enough our voice came thundering out of the horn. It

was a giant's voice, such as we had never heard before, but it was grotesque and indistinct due to the mingling with the feed-back howl. We disconnected the system again, but we knew now we stood on the threshold of something great. In the shortest possible time, we ran a line up to the roof of our bungalow, and we placed the loudspeaker on top of the chimney, with the horn pointing northwest, out towards the open country.

Albertus and I were outside listening while Pridham did the talking from inside the house. My brother, Karl, sat on the chimney, holding on to the horn, for we feared the violent shouting coming through it would shake it off its lofty perch. Pridham's voice, now without the feed-back howl, sounded to us like a voice not of this earth. Had I closed my eyes it would have been easy to imagine that a supernatural colossus was shouting up the chimney.

Then Albertus and I started to run across the open fields. It was no longer a question of hearing the voice across the room; it was a question of hearing it for hundreds of yards, or perhaps miles. I was young and in good condition from playing tennis, whereas Albertus was unusually tall and far from robust. Consequently, I was far in the lead in the running, and when I stopped a mile away, Albertus was struggling along far behind. I had stopped to listen now and then, and Pridham's voice did not seem to diminish in strength until I was about a quarter of a mile away. At about the half mile mark, the voice was still loud, but when I was finally a full mile away, I had to be standing still in order to understand what was being said. There was a slight crosswind blowing, and the voice came to me varying in strength, sometimes strong and sometimes weak.

Presently Albertus caught up with me, and as our further cross-country run was barred by a fence and grain field beyond, we decided to hurry back, and report on our results. We had been waving back to my brother

on the roof as long as we could see him, and from Pridham's continual conversation we knew he realized we could hear him as long as we were running away. He told us when we disappeared from sight, but he said he would keep on talking until we came back.

So, we started back across the fields again, and the first thing Pridham said when I returned was that he was sure I had broken all speed records for the mile on my outward journey. He was a great track fan and was always interested in that magical four minute mile, even at that moment. Before Albertus returned, I had taken up the job of talking, and Pridham was on his way to hear for himself. But he used his bicycle, and although he went as far as we did, he was much fresher when he returned.

There was naturally great jubilation among us that day. We felt sure we had taken part in history in the making, for on that winter day in Napa we had heard a human voice which was far louder than any ever heard before anywhere in the world. It was certainly the beginning of "the great voice" and the beginning of the changes that day brought about.

We immediately telephoned Dick O'Connor in San Francisco, and reported on the incredible news. We had to repeat our story several times, for, as he said, the story was far too fantastic to believe. He might have wondered about the sanity of one of us for he mentioned that the state insane asylum was in Napa, which it is. He insisted that we each tell him the story individually. When he was satisfied as to the correctness of our report, he said he would be in Napa in the morning and bring some of the stockholders with him.

The group arrived the following day and among them was Matt I. Sullivan, the famous San Francisco attorney. Matt Sullivan said: "Dick phoned, and tried to tell me what you had done, but I could get neither head nor tail out of what he was saying; so he sent Charles (O'Con-

nor's oldest son) over to my office to tell me in person. When he said you could hear your telephone a mile away, I thought the boy was off his base."

Matt Sullivan was certainly justified in thinking that anyone bringing such a tale was "off his base." It was peculiar that the possibility of inventing an apparatus which would amplify a person's voice many times had never been discussed by people in general up to this time. Most other developments and inventions have been anticipated, and in the press and in print have always been found many allusions as to what was about to come.

The benefit which immediately occurred to us for making a loudspeaker was a financial one and that was important for we were dangerously close to a complete shut-down of our whole venture. But after the first demonstration to our stockholders, who heard for themselves, we were assured that finances would no longer be a problem, and that was a great relief.

Pridham and I realized we could not forever continue to call our device a "dynamic loud-speaking telephone." The term was too long and did not give an accurate description of the apparatus. We battled with the problem for about a week. "Stentor" or a stentorian voice came first to our minds, but we dismissed it quickly. The name "Telemegaphone" was also discussed as the word means "a distant megaphone." This word had a lot of appeal, and it incidentally still has to me, as it is an accurate description of a loudspeaker, and it is in line with the words telephone, "distant sound" and telegraph, "distant writing." Somehow, tele, although meaning "at a distance," had come to be associated with electrical apparatus in the minds of the public. We dismissed "telemegaphone" for we were not interested in naming an instrument but were, rather, trying to find a name for a whole new art.

We called upon all our linguistic knowledge, and knowing that "megaphone" meant "a million sounds" in Greek, we turned to Latin which we both knew slightly. "Megaphone" is a fine name, but it denotes only a speaking trumpet, a mechanical voice amplifier. Ours, which was an electrical voice amplifier, and, as we thought, far greater, merited at least as good a name. One day the

word came to us. The word was "Magnavox" — Latin for "great voice."

All during the year 1915 we worked on improvements of our system. We redesigned the dynamic telephone and gave it a loudspeaker appearance. We also improved our microphones and began to use American-made microphone buttons. These buttons we mounted in a group of four on a single diaphragm, and the appearance of our new microphone resembled a present day hand microphone equipped with a mouthpiece. We called it a "four button transmitter." Our object was to make as powerful a microphone as possible for this was in the days before electrical vacuum tube amplifiers were known and the microphone was the one piece of apparatus which limited the amount of amplification.

We also made a fitting for our Edison cylinder phonograph whereby we could pick up the music from the record and load the sound directly into a microphone with a minimum loss. In this manner, we made a handy source of sound for our experiments. Whether this was the beginning of the modern phonograph "pick-up" or not, I do not know. Neither do I know whether we originated the term "pick-up" which later became a common word designating a phonograph arm equipped with a microphone which will "pick-up" whatever is on the record.

However, with this microphone attachment, we made a super phonograph which became the forerunner of all later electric phonographs and combination sets. In this connection, I might mention that Pridham and I, in 1916, filed a patent on an electric phonograph. In the patent we described and claimed an electric phonograph which consisted of a large cabinet inside of which was mounted a loudspeaker and which contained the necessary electrical apparatus; on the top of the cabinet was the turntable and the microphone pickup; a volume control was mounted on the outside of the cabinet in a convenient

place. The device functioned exactly like a modern electric phonograph, with the electric volume control permitting the instrument to be played either very loud or very soft, simply by turning a knob.

It is also noteworthy that the only reference that the patent office could find in the prior art was a patent on a small box inside of which an ordinary telephone receiver was mounted; the telephone receiver in the box gave off a whistling note which served as a warning in a small burglar alarm system. There were no other patents cited against us, either domestic or foreign. Our patent was granted in a very short time.

Using our powerful sound system, we often played music in the early evening for the entertainment of all the townspeople. Napa was a city of about five thousand people, and it covered an area of about one square mile. The nights in Napa Valley are frequently surprising quiet and conditions are very favorable for sending sound through the air over great distances. We would put the loudspeaker on the chimney and point it towards the town and our music could be heard plainly all over.

When these sound broadcasts started, they caused great surprise and wonder. There lived in the town a young girl, Mina Stockman, who was a very fine singer. She possessed an exceptionally deep and rich contralto voice. At important civic affairs she would be the featured singer, and everybody, including her own family, expected her to go far in her profession.

Her brother, Eddie, told me that one evening, as he was walking home from town, he suddenly heard a most extraordinary voice of a woman singing "Holy Night." He suspected it was some local woman singing in her home, but the voice was so perfect that he decided to investigate. As there were no radio broadcasts in existence, it could only be a singer in person, or possibly a phonograph record. So he walked around the neighbor-

hood, but as the voice did not seem to come from any definite direction, he was unable to locate the source.

The strength of this beautiful voice seemed to be constant, wherever he was. He could only think that it came from above, for, as he said, it was a heavenly voice.

He went home and told his sister, Mina, that she was no longer the best singer in town for he had just heard someone singing "Holy Night" who was better. They both wondered who it could be. The mystery was solved when they learned that we had played "Heilige Nacht" sung by Madame Schumann-Heinck, over our loud-speaker some three-quarters of a mile away.

It is a common human trait to be skeptical at first. It is also a human trait to turn from skepticism to over-enthusiasm, and to expect the impossible. The people in Napa were no different from other people as the following incident will illustrate.

We decided one evening, early in our experiments, to make a test, to see really how far we could hear the voice. East of Napa, and a couple of miles from the laboratory, is a hill called "Cup and Saucer" because of its shape. We arranged it so Pridham would do the talking and I would go up to the top of the hill to listen. We had agreed that, if I could hear him, I was to build a bonfire as a signal, for it was dark and much too far to shout back.

As I got to the top of the hill, I could hear Pridham, who was sitting inside the bungalow, talking away at a merry pace. As it is difficult to think of something intelligent to say for half an hour at a time, Pridham, on this particular occasion, gave an imitation of a wireless conversation such as he remembered it in our old radio days at Stockton and Sacramento.

His words were heard all over town when he said: "Hello, Sacramento, hello, Sacramento. Can you hear me? How is my voice coming in? Do you hear me clearly and

distinctly? Hello, Sacramento. If you can hear me, start your bonfire."

I started the fire promptly, for I had heard him distinctly. The whole procedure had been seen and heard by many people in Napa, and it took us weeks to convince them that we had not talked to Sacramento, sixty miles away.

Before the summer was over, our voice had been heard in Napa Junction, a distance of about seven miles.

1915 was also the year of the Panama Pacific World's Exposition in San Francisco. We decided against exhibiting our sound system at the fair for our patents were not yet in good shape, and we were fearful lest some large concerns should become interested and push us out of the picture. It was probably an ungrounded fear for we were left strictly alone for the next five years, in spite of all the publicity we subsequently received. It was not until 1920 that competition started.

We did, however, put on a couple of phonograph concerts from the "Tower of Jewels" where we had placed our loudspeakers half way to the top. We were seeking no publicity for these stunts and they went partly unnoticed. We were told, though, that the sailors on the old battleship *Oregon* which was anchored in the Golden Gate, off the Marina, danced to the music that mysteriously came from the tower.

In spite of our isolation in Napa Valley, the news began to spread over the northern part of California about the big voice in Napa, and pressure was put on us to give a demonstration to the press in San Francisco.

The demonstration took place in the Golden Gate Park in San Francisco, on December 10, 1915. I will let the famous [Edgar] "Scoop" Gleason tell the story which he did so eloquently in the San Francisco *Bulletin* of December 11, 1915.

MAGNAVOX TESTED AT THE PARK

Wonderful Invention by Californians Solves Many Problems

The slender tone of a single violin plainly heard one mile away! Tetrassini's voice on a phonograph record resounding from end to end of the vast park stadium! The words of Attorney Thomas W. Hickey reading Lincoln's Gettysburg Address reverberating through the air like the roar of a giant! A piano solo resembling the chimes of Westminster Abbey played by the Colossus of Rhodes!

These things have been made facts by a new invention — the Magnavox. Just brought to perfection by two young California inventors, Peter L. Jensen and Edwin S. Pridham.

For some months Peter L. Jensen and Edwin S. Pridham have been entertaining the city of Napa nightly by putting a mere quiet little phonograph on a housetop and connecting it with the Magnavox. People a mile down the road ring up to tell them "That last Farrar record was fine. Now put on Caruso."

The Magnavox is electrical and it magnifies at least one thousand times. This is conservative. The invention was demonstrated yesterday at the park stadium before a group of representatives of the Bulletin and others. The inventors put on a band record and many hurried down from the top of Strawberry Hill thinking the Marine Band was rehearsing.

Little but big. The Magnavox weighs about 15 pounds and sounds like a million. Jensen is from Copenhagen, and his fellow inventor, Pridham, is a graduate of Stanford University in the electrical engineering department. In Denmark Jensen worked under Valdemar Poulsen, the Danish Wireless Telegraph wizard, and aided Poulsen in the perfection of his system. He came here to install the system of the Federal Wireless Company, which uses the Poulsen patents. Carl Albertus came with him and has helped in the construction of the invention. Jensen and Pridham have been working on the Magnavox for four years, and over the present machine, four months.

Penetrating but not loud: The machine is exactly what its name implies, the "Great Voice." It increases the carrying capacity of sound in the most marvelous manner, yet it does not increase the loudness of the sound so much as its carry-

ing capacity. The remarkable feature is that you can stand within ten feet of the horn directly in the current of sound without the effect being at all deafening. It merely sounds like a very intense, very busy telephone or phonograph, with a tone immensely musical and pure.

Then you start to walk away and the miracle occurs. The sound does not grow less. You go a block — two blocks — three blocks, and it is still the same. You are clear across the huge stadium and a cross wind is blowing, but the sound seems to shower down from the skies. You climb the fence and keep walking amid a rain of music, of words, inflections, intonations — all as clear as though the singer were at your elbow. You keep on traveling away from the sound and still it pursues you.

Voice Heard Four Miles: Four miles is the record distance to which the Magnavox has carried the human voice under ideal conditions. As the current may be increased indefinitely, this is not regarded as at all the limit of possibility.

"We developed it from the experiments on a telephone instrument and it was some time before we thought of attaching it to a phonograph and using it like a megaphone," said Jensen.

"A certain attorney in San Francisco, who talks much over long distance, has attached one of them to his office phone; he sits back in his chair and chats easily with Los Angeles and has cut down his telephone tolls by two-thirds. There is none of this business of 'Hello, are you there?' and 'What?'"

"A speaker addressing a huge crowd, say a national convention, could use the Magnavox and every one of his words would be audible to the entire crowd. He need not raise his voice over the conversation point. The master of a life-saving staff could direct a whole fleet of rescue boats from his station on shore. At sea a ship in a gale could be commanded from the bridge. One man could direct a crew of firemen or an army in battle. The commands would penetrate to the men's ears no matter what the counter noises might be.

"When you attach it to a phonograph one band record makes dance music for thousands. There is enough 'juice' in one light socket to run it. If I ran a big dance I would put

in a Magnavox, connect it to a phonograph and solve the orchestra problem.

"Or you could run your auto out into the country, couple the Magnavox to the electronic batteries of the automobile and furnish music for an entire village.

"One officer sitting in barracks could direct whole regiments out on the parade ground. Or a general ten miles away from his army could send words of encouragement to his trooper's ears. The Magnavox solves the problem of the synchronous moving picture and phonograph. It is the ideal means for making announcements at railroad stations, an athletic meet, or amid the traffic of a street crossing.

"President Wilson could sit at his telephone in the White House, and his voice would respond fully and clearly to the crowds at a thousand great political rallies everywhere in the country. One civic leader could address throngs in every ward and precinct the night before election and never raise his voice."

A Severe Test: At one of the tests before the Bulletin Staff the conditions were about as bad as they could be. It was drizzling at the stadium and a 20 mile wind was whipping across the field, and two football teams of high school boys were playing a game with shouts and yells. The Magnavox was at one end of the stadium and the listeners were at the other — at least a half a mile away. The listeners stood there in the rain and marveled as the delicate voice of Alma Gluck filled the air, and a dainty Hawaiian string quartet sounded like the harps of the cyclops. The football game was not even audible.

The patents of the Magnavox are owned by the Commercial Wireless and Development Company.

When I read the old article again after so many years, I could not help but smile at the daring predictions, which, according to "Scoop" Gleason, I made on that date. I have had the pleasure to live and see them all come true.

After giving the demonstration in Golden Gate Park, we made an arrangement with the *San Francisco Bulletin* to give our equipment a real tryout on Christmas Eve, two weeks later. The *Bulletin* had for some years been

sponsoring a big Christmas Eve celebration in San Francisco, and some world famous singer would always be invited to appear on these occasions as the stellar attraction and guest of honor. The celebration in former years had been held at the famous corner of Third, Kearney and Market Street, at Lotta's Fountain.

The distances here were so limited that the natural voices of speakers and singers could be heard easily, but the size of the audience had been increasing each year, and the *Bulletin* wanted to stage the celebration at the Civic Center. This center was a large open plaza in front of the new city hall. We agreed to furnish the instruments for reinforcing the voices of the speakers. This arrangement led to the episode described at the beginning of this book.

In the *San Francisco Bulletin* of December 25, 1915, is given full account of the celebration the previous night. Here are a few extracts:

THRONGS CROWD CIVIC CENTER

100,000 people cheer at Christmas celebration. The sound . . . and here is a truly wonderful fact. Every ear in that entire throng, including people hundreds of yards away, heard every syllable of the speeches and announcements with absolute distinctiveness. . . . How was it done? Simply the Magnavox — a most remarkable invention which last night had its first tryout in public.

The invention demonstrated its extreme usefulness beyond a shadow of doubt. For occasions such as this it showed itself to be so utterly essential that one wonders what the world has done without it before. . . . But here was the Mayor, talking into a mouthpiece, much like a desk phone, and over against a pillar was a mere wooden phonograph horn from whence the words were shot so violently that it seemed as though the horn would burst of the effort.

. . . The Magnavox . . . was attached to a familiar small victrola and played phonograph records that seemed uttered by a giant.

In the way Tetrizzini sang for us again as she did on Christmas Eve 1910. . . .

Jensen and Pridham operated their invention on the balcony last night. The horns were concealed behind an American flag and the sound seemed to issue from the granite side of the building.

The celebration was naturally a great event for Pridham and me. We became the talk of the town and we had a taste of how it felt to be famous, at least locally. It may be difficult for anyone living in a world today, where it is difficult at any time to get out of the range of some blaring loudspeaker, to understand the complete amazement of the people who heard a powerful loudspeaker for the first time. I, also, think that the statement, "One wonders how the world has done without it before," was one of the most significant statements made in the attendant publicity.

Shortly after this event, which turned out so well, we were approached by a committee of citizens who wanted us to assist with our equipment in the dedication ceremonies of the new Civic Auditorium. The auditorium had been built by the Panama Pacific Exposition Company, and the ceremonies involved the presentation of the building as a gift to the city of San Francisco.

The main hall was one of the largest in the United States, with a seating capacity of 12,000 people. The problem of a speaker being heard in such a large hall was a serious one, and our job was to furnish the apparatus for reinforcing the voice of the speaker. This was the first time that it was contemplated using loudspeakers for large indoor structures; it was also the first time the attempt was made to transmit a speaker's voice over wires to a distant point and reproduce it there with greater volume than the original voice.

It was in the days before vacuum tube amplifiers were available; so our assignment was not an easy one, especially the problem of transmitting the governor's voice

over wires a couple of miles long. It was impossible to use the ordinary telephone connection between the two places for the purpose because the speech would be far too weak to be heard even though it was put through a very efficient loudspeaker. Our task was to transmit a powerful voice current in the governor's home and transmit it to the auditorium with as little loss as possible.

We wanted to string a couple of very heavy wires through the streets between the two places, but this proved impossible, not only because the time was too short for such an undertaking, but also the cost was prohibitive. However, we had by this time the support of the whole city administration, and the city engineers came to our rescue with the information that a very heavy single conductor ran the whole length of Van Ness Avenue. The conductor, however, ran up to the top of every lamp post along the avenue and down again. How much this increased the total length of the wire we had no time to figure out. As the governor's home and the auditorium were both quite close to Van Ness Avenue, we ran a special wire from the cable to the two respective places. This gave us a single heavy wire connection between the governor's home and the auditorium of a length of about two miles plus the innumerable ups and down on the lamp posts on the way. For the return wire, we used the ground by simply making our connections to the water pipes.

On our very first test, we discovered there was some hum on the line, but not enough to be distressing, and the speech came through with sufficient volume to fill every nook and corner of the immense hall. No one was more surprised than Pridham and I.

The ceremonies took place in the auditorium on December 30, 1915. We had given the orators instructions to hold the hand microphone a few inches away from the mouth, and with the mouthpiece at a slight angle to the

face. This position for the mike had proved most satisfactory, and all the orators on Christmas Eve had followed our instructions carefully. On this night to which I had looked forward so hopefully, instructions were not followed, and during the event, I went through emotions which varied from the height of enthusiasm to the depth of despair.

Pridham was at the governor's home, arranging for the sending of his speech over our special wire, and the show at the auditorium was wholly in my care.

The chairman, J. Emmett Hayden, opened the performance with a flowing speech, and he did a fine job, holding the microphone properly. His speech was heard by all and wildly applauded. He finished by introducing the architect of the building, John Galen Howard, the famous builder. I have no right to criticize him, but he caused me to suffer a thousand deaths during his apparently endless speech.

Mr. Howard thought, or so it appeared, that the microphone was given to him for the purpose of pointing with it toward the various features of the hall as he described them, one by one. When the microphone happened to pass across his mouth, much too close, an unintelligible roar came from the loudspeaker, and after it had passed by and was held in his outstretched hand in the general direction of some object, his voice sank to a ridiculous whisper. The performance was more comical than anything else, although to me it was stark tragedy, but, I must say the audience were good sports never once indicating disgust or ridicule.

Finally, the architect was through. During his speech, I had sneaked down among the audience to hide myself but now I had to go back on the stage in full view of everybody and get ready for the next event which was the Governor's speech. I dreaded to show myself for they all knew I was the culprit who was responsible for the

comedy just enacted. However, I quickly forgot my discomfiture for on the stage I ran into another serious predicament.

Here a large choir of about a hundred people had gathered, and the conductor had placed them, several deep, directly in front of the loudspeaker. The governor was scheduled to start any minute, and I tried vainly to disperse the choir so the horn would be in the clear to throw the voice toward the people in the audience and not simply up against a solid wall of human backs. I was unsuccessful in my efforts for no one could understand the significance of having the loudspeaker in the clear. In fact, no one knew what a loudspeaker was, and there was no time left for a lengthy technical explanation.

I had given the governor the O.K. to go ahead over the ordinary telephone, and he started his speech while I was still battling and trying to disperse this small army. I had to give up for the scuffle had almost developed into a free-for-all fight. The center of the horn was about level with the people's shoulders so I knew some of the sound would come out. My first impulse, of course, had been to raise the loudspeaker over their heads, but everything was nailed down and the wires were too short, and there was not enough time in the few remaining seconds to put it up higher.

I had my head close to the horn while Hiram Johnson was speaking, and he was such a remarkable speaker that every word came out clear and distinct. When he finished, the ovation from the hall was deafening. I was all smiles again, but when I got down on the floor, I learned that my fear about the choir blocking the sound was well founded.

The *San Francisco Bulletin* said next day in an article: "Governor Johnson, from his home two miles away, on Green Street, spoke to the crowd through the new Magnavox. Oddly enough, while his words were heard perfectly

in the distant galleries, on the main floor the results were less satisfactory, for the position of the chorus had been changed at the last minute and its members were massed directly in front of the horn. The governor congratulated the city and state on the achievement of the exposition and reiterated the promise of a still further civic and governmental advance."

We had almost bitten off more than we could chew with the last stunt. Yet, the results showed it was now practical to build a very large hall provided sound reinforcement apparatus were installed. Such enormous structures as the new Madison Square Gardens, the Chicago Stadium, Kansas City Auditorium, and others, would probably never have been built to such dimensions had it not been for the new art of sound amplification.

Pridham and I knew there was one piece of apparatus lacking in our sound system and that was an electrical amplifier. An electrical amplifier is a device which will take a weak electric current and amplify it into a much stronger one which retains the exact characteristic of the original weaker current. With such a device we would have received Governor Johnson's speech over the ordinary telephone, amplified the current at the point of reception, and led the output of the amplifier directly into our loudspeaker. We also knew that with such an apparatus we could amplify weak radio signals so they could be heard with loudspeaker volume at the receiving station, but we had not been able to secure suitable vacuum tubes.

When the American Telephone and Telegraph Company bought the patents on the De Forest three-electrode vacuum tube, they were mainly interested in improving their long distance telephone communications. It had been found impossible to talk over very long distances with the necessary degree of clarity heretofore because the current would gradually become more and more distorted as the distance increased, and finally die out.

The telephone people had partially solved the problem of distortion by "loading" their lines with Pupin coils some years previously, but to solve the question of preventing the current from becoming weaker and weaker towards the end of the line they needed a "booster" or an amplifier which did not introduce distortion. The three-electrode tube became the nucleus in such a device.

By 1915, successful electrical amplifiers had been built and installed at certain intervals along the transcontinental telephone lines connecting New York with San Francisco, and demonstrations were given daily at the San Francisco Fair of good telephone communications between the two cities. It was a remarkable achievement for its time.

The American Telephone and Telegraph Company also pulled off a stunt which sounded the death knell of all previous radio systems. By October 21, 1915, the engineers of the telephone company had erected three radio stations, one in Paris, one at Arlington, near Washington, D.C., and one in Honolulu. For the generation of radio waves, they used vacuum tubes; in fact, they used a very great number of small tubes in order to get the necessary power. Larger tubes had not yet been perfected. For reception they used vacuum tubes also, and they used tube amplifiers to boost the strength of the incoming signals. It was an all-vacuum tube transmission and reception system, which is in universal use today.

According to the publicized reports, Mr. Shreve was in Paris, Mr. [John B.] Webb at Arlington, and Mr. [Lloyd] Espenshied was at Honolulu, and Espenshied reported that during a test of radio telephone transmission, he heard Webb at Arlington say: "Goodbye, Shreve."

The widely publicized news that a radio telephone conversation had taken place between two places so widely separated as Arlington and Honolulu put an immediate damper upon the wildcat stockselling com-

panies or small radio telephone concerns, and they faded out. The larger commercial radio companies, however, continued for some years longer to use their own respective systems, but by the early twenties, they had nearly all changed over to complete vacuum tube equipment.

The transition period, when the older systems of Marconi and Poulsen began to be superseded by the modern system based upon De Forest's three-electrode tube, began during the First World War. The older systems were yet dominating the field until after the war's end for all long distance communications.

The largest United States radio stations, such as the Panama Canal, the Arlington, and the Lafayette station in Bordeaux, France, were Poulsen Arc stations. The Lafayette and the Arlington stations acted as the main communication link between the American Expeditionary Force in France and Washington. Some improved spark stations were still used both on ships and on land, but the Poulsen system had been in the ascendancy for several years past. With the war came the demand for small, compact radio transmitters of which radio for aircraft was one of the most pressing necessities, and intensive development work was begun on tube transmitters and receivers.

World radio progress can best be illustrated in the broadcast outline by considering the various stages through which it went. There was first the preliminary stage with Clerk Maxwell, the Scotsman, formulating the theory of electro-magnetic waves which are used for radio transmission, and the work of the German, Heinrich Hertz, who demonstrated in practice the validity of Maxwell's theories. Then came the first commercial stage with the advent of Marconi and his spark system. The dominance of Marconi's system and his damped waves lasted roughly from 1896 to 1910. By 1910, the Poulsen Arc system, which produced a train of undamped waves,

began to assume world importance, and during the decade 1910 to 1920, continuous wave transmission became almost universal. I shall, therefore, call this period the second commercial stage. The third commercial stage began about 1920, with the introduction of vacuum tube equipped transmitting and receiving sets in which the principle of using sharply tuned undamped waves was retained. We are still living in the third stage.

Although many brilliant minds have contributed greatly to the remarkably high status of radio today, to Dr. Lee De Forest must go the credit for being responsible for bringing about the third, or present, stage of radio. I shall call it De Forest's stage, and it is truly universal.

My own debt to De Forest is great, for without his contribution, the sound industry with which I was later so closely associated could never have been developed to the degree of importance it holds today.

In 1917, the Commercial Wireless and Development Company ceased to exist. We needed more capital than we had available for going into the actual manufacture of sound systems. There was actually only a small demand for announcing systems, and the use of loudspeakers by public speakers was looked upon askant, even by the speakers, themselves, who had been schooled in the old art of oratory. The suggestion of employing artificial sound reinforcing means meant to many of them that a certain degree of aspersion was cast upon their natural ability. But the idea of manufacturing an amplified type of phonograph had much appeal. The uses of such an instrument were manifold and it was a free and open field.

We, therefore, consolidated our concern with the Sonora Phonograph Company of the Pacific Coast. The Sonora Company had a sizeable annual income from its going business, and we became no longer dependent upon old or new stockholders to furnish capital for our work. Frank M. Steers, who was the president of Sonora, became the first president of the new company which we named the Magnavox Company. Dick O'Connor retained his high influence and stayed our best friend until his death in 1924. Pridham and I received and held jointly the title of "Chief Engineer."

When the United States entered the war in 1917 against the Central Powers, the Magnavox Company switched to war work, and our regular work on sound was practically suspended for the duration. Late in the year 1916, we had sold our property in Napa, and moved the laboratory

to San Francisco, but while still in Napa, we had made the acquaintance of Lieutenant Commander Sweet, whom all old radio men remember well. Lt. Commander Sweet was attached to Mare Island Navy Yard, which is located only fifteen miles from Napa, and he had taken a great interest in our work.

Shortly after the war broke out, he came to see us in San Francisco and told us that he had recommended the use of our loudspeakers to the Navy Department in Washington, as a possible means of permitting the crew in an airplane to speak to one another. He presented the idea that perhaps the voice from a loudspeaker could be heard over and above the terrific din of the noisy motors. He also suggested the use of a powerful loudspeaker to talk from an airplane to troops which might be isolated on the ground below.

Acting on Mr. Sweet's suggestion, we secured the use of an airplane in order to test the possibility of speaking from a plane in flight to people on the ground. The experiment was carried out along the shores of the Golden Gate, and we succeeded in hearing and understanding messages which were flashed to us while the plane was flying by. However, an excessive amount of noise from the motor was mingled in with the speech, because the microphone picked up all noises around it, including that of the motor, and the speed of the plane was so great that within a fraction of a minute it was out of earshot. Peculiarly, the voice was clearest as the plane was going away.

The Navy Department was informed of our results, but to my knowledge, our armed forces did not use this type of communication between planes and the ground below, using radio instead whenever it was possible.

We were more successful with the other problem which Lt. Commander Sweet presented to us, namely, the problem of establishing perfect communication between the individual members of a crew in the same airplane, with-

out the crew having to leave their seats. This problem had been difficult to solve, but Lt. Commander Sweet thought that if each member could talk through a common loudspeaker, the loudspeaker might reproduce his voice so loud that all could hear it above the noise of the plane.

Across the bay from San Francisco, in Oakland, was located the Hall Scott Motor Company where aeroplane engines were being built and where engines were continuously being tested on blocks outside the factory. These engines on test made an infernal racket and the amount of noise approximated that found on board a plane in flight.

Pridham and I carried our equipment over to Hall Scott and we tried to talk to each other over a loudspeaker standing alongside one of these roaring motors. The result was entirely unsatisfactory, for the noise of the motor found its way into the microphone with a far greater power than our speech, and the result was, if anything, only more noise. The speech was unintelligible.

We both realized we had to keep the motor noise out of the microphone and still keep it sensitive to our own voice. We tried in various ways to pad the microphone and to make special mouthpieces which would fit over our faces, but which would exclude all extraneous noises. With these devices, designed to shut out all unwanted impulses, we had only limited success. The reproduced voice always sounded muffled and was, in our opinion, unsatisfactory.

One day coming back on the ferry boat from Oakland to San Francisco after one of these tests, Pridham said: "If we can't shut out all the noise, why not let all the noise in?"

"And neutralize it," I said.

"Exactly," said Pridham.

We had worked so closely together for such a long time that we understood each other perfectly without waiting

for a lot of words to be exchanged. The solution was clear to each of us.

As soon as we came back to the shop, we stripped our microphone of its casing and mouthpiece and made it look as much like a skeleton as possible. The diaphragm was exposed directly to the air on both sides and only a narrow rim held it in place. When we held this new microphone in a noisy place, where the source of the noise was more than a couple of feet away, the microphone was completely noiseless or insensitive. The reason was that the violent sound waves would hit both sides of the diaphragm practically at the same time, and with the same force. Therefore, the diaphragm would not vibrate, and no disturbances were heard in the telephone or loudspeaker. However, when a person placed his lips close to one side of the diaphragm, the force of his speech would be greater on that side and practically absent on the other. Hence, the diaphragm would vibrate freely in accordance with the spoken words. We filed a patent on our new anti-noise microphone which was placed in the secret files during the war, but which was later granted to us.

Using our anti-noise transmitter as the nucleus, we made up a complete airplane intercommunicating system, but using earphones encased in rubber which were inside the aviator's helmet, instead of loudspeakers.

I was delegated to go to Washington and show our device to the military authorities. The Navy Department immediately adopted it as standard, and during the war we equipped every navy plane, and thousands of army planes, with our system. In addition, thousands were shipped to the Canadian and French governments.

These activities kept us busy until the war's end. It was a great satisfaction to have arrived at the point where we had our own factory and where our company was self-supporting. During the years of our experimental

work, our income had been rather meager, and it was a most welcome feeling to know that we could loosen our belt a little.

When the war was over, we kept our factory busy with the manufacture of telephones for ships. We had designed a watertight telephone which had been adopted for use on United States Shipping Boards vessels and which was also bought by the United States Navy for installation on 250 destroyers. The outstanding features of this telephone were that it employed a dynamic receiver and an anti-noise transmitter or microphone. The dynamic receiver improved the quality of the speech, and the anti-noise features of the microphone made it particularly suitable for use in storms or in noisy engine rooms. I think it was the outstanding telephone of its day.

We were beginning to think that, after all, our future was to be linked up with the manufacture of telephones for there were as yet no signs visible that the loudspeaker industry was shortly to become an important industry. However, we had kept abreast of the art of our first love, and we had developed a good electrical amplifier which made our sound system far more versatile than before. With this new addition we could take any current, practically, no matter how faint, and amplify it to loudspeaker volume.

We lent our equipment out to be used for various local affairs so we had gained considerable experience since 1915. But the actual income from this source was virtually nil, and our exploits were hardly known beyond the borders of California.

Then President [Woodrow] Wilson made his famous trip across the United States, making his last and most sincere appeal to the people to support his League of Nations. His health was beginning to fail and his doctors forbade him to speak out of doors.

The President was scheduled to speak in the city of San

Diego, and the citizens of that illustrious town would not be denied such a golden chance to advertise its famous climate. So a group of them approached the Magnavox Company with the proposition that we install a loudspeaker system in their municipal stadium which has a seating capacity of about 50,000 people. The plan involved the building of a glass enclosure at one end of the stadium from within which the President was to deliver his speech. In this manner, the President would be sheltered from the weather; everyone could see him, through the glass, and everyone could hear him speak, through the Magnavox equipment.

Pridham and I discussed the happenings at this event many times after it was over. This was to be an occasion where the President of the United States, himself, was to use a sound amplifying system for the first time. The whole nation was following the trip with the deepest interest. Scores of correspondents, representing the press associations and most of the country's newspapers, were traveling with him, and every happening and every utterance made by him were immediately dispatched to the four corners of the land. A slip-up in any of the arrangements would have been most humiliating to all concerned.

I was away on a business trip East; so Pridham went to San Diego alone to supervise the job.

We both shivered many times when we thought back on this occasion when he went on that all-important mission with only a single set of apparatus. A break any place in the sound system would have been fatal, for, since the President was completely enclosed, not a soul could have heard a word of what he said. Had he spoken from an open platform at least those nearby could hear, and a failure would not have been so disastrous.

I shall repeat the story of this affair as Pridham told it to me afterwards:

"We put the apparatus up and arranged them as neatly

as possible. Everything was in shipshape condition, and working well. The whole stadium was filled to the last seat at least an hour before the President was scheduled to arrive.

"I played some appropriate phonograph music through the system while we were waiting, and we made announcements at regular intervals, informing the people of the progress of the parade, which was escorting the President through the town towards the stadium. Everything was in good working order, and the people applauded loudly every announcement we made.

"I knew the President was near the stadium and I was watching the entrance. As the President's car came into view, there was a deafening ovation, and in that same second the system went dead!

"I frantically snapped the power switch on and off, but no clicks came from the horns. Each individual hair on my head stood on end for I had not the slightest idea where to begin to look for the trouble. I knew it would be as impossible to find as a needle in a haystack.

"Thoughts of burned-out transformers impossible to replace flashed through my head; short-circuited or broken connections, impossible to locate; and the President's car was approaching nearer every second.

"A fine thread of smoke started to come out from the top of the amplifier. In utter desperation, and just for the sake of doing something, I automatically reached out and pulled the nearest tube out of its socket. A click, like a shot from a gun, came from the horns.

"I waited and the smoke became fainter. I waited a few seconds more, and the President's car stopped in front of the glass house.

"As the President walked up the steps to the enclosure, I put in a new tube, and thanks to the everlasting glory of God, the system was alive again!

"I discovered later that the elements inside the tube had

short-circuited; in a few more seconds the amplifier would have burned up. It so happened that the first tube I pulled out was the one causing the trouble. Never again do I want to go through such dreadful seconds!"

The affair took place on September 19, 1919, and the press correspondents sent out over the country long accounts describing what many of them called a historic event.

The following account was written by Philip Kinsley and appeared in the *Chicago Tribune* on September 20, 1919:

There in the afternoon sunlight they looked upon their President as he stood on a big glassed-in platform. They listened to his League of Nations argument, delivered in an ordinary speaking voice and carried to them over wires and through an instrument known as the Magnavox, which magnified his voice until it reached the farthest tiers of seats, probably a quarter of a mile away from the platform. . . . There were 50,000 people ranged in concrete seats and packed in the center when the President entered the gates. . . . As the President stood on the platform . . . over his head hung two black funnel-shaped horns. As he talked into these to the thousands or more in front of the platform his voice sounded somewhat hollow and strong. But the horns picked it up and tossed it out over the sea of faces and they smiled or grew thoughtful following every turn of his argument with as much ease as if he were talking in a small banquet room.

The affair in San Diego marked a turning point in the art and manner of public speaking. Here, for the first time in public, was used a remote microphone, giving a speaker the full freedom of his hands. The only obligation put on the orator was that he deliver his address reasonably close to the microphone. On that day, we also used a speech amplifier and dynamic speakers, identical with all public address systems today. The individual instruments used have been improved since then, but the system remains the same.

It was always one of my deepest regrets I was not present at the President's speech, but in April 1920, I was sent to San Diego to put up the same sort of amplifying system for the reception for the Prince of Wales, now the Duke of Windsor. The Prince of Wales made only one stop in the United States while on a cruise around the world on board the battle cruiser *Renown*. San Diego was the city selected for his visit.

The citizens remembered the success of the President's visit, and similar arrangements were made for the ceremonies for the future King of England.

The huge stadium was again filled, and the Prince had his first introduction to a public address system. When I requested him to stand on a small rug while speaking, he consented good naturedly, and when he saw the horns he smiled, and turning to me said with his typical English accent: "Are they going to blow at me?"

Everything went off smoothly and without any incident.

Afterwards, I was invited to visit on board the *Renown*. On behalf of the Magnavox Company, I presented a small sound amplifying system to the cruiser as a gift. I had the pleasure of spending several hours alone with the Prince and Lord Louis Mountbatten in their cabin, where we had tea.

Lord Louis Mountbatten was especially interested in all the technical details of the apparatus. In spite of his age (he was only twenty at the time), he possessed a surprising amount of knowledge of a highly technical nature, and his knowledge was by no means superficial. He struck me as being about the smartest young fellow I had ever met. He saw immediately the great possibilities of using loudspeakers on board warships and I was busy most of the afternoon answering questions, not only on sound but also on radio which happened to be his chief hobby at the time. When I afterwards described him to my friends, I used to say that, in my opinion, he would some

day become a great man in England for he struck me as being the perfect type of a future "empire builder." In the parlance of American slang, I maintained, "he has the goods."

I shall dwell upon only one more specific performance in this country. It took place in Washington, D.C., as part of the ceremonies attending the opening of the Liberty Loan Drive. The ceremonies were held on the steps of the Treasury Building, and the open space in front was filled with spectators. The crowd was so large it extended beyond General Sherman's statue.

Our equipment was used by Admiral Simms, Billy Burke, the actress, and others, including high government officials, to amplify their voices. But the *piece de resistance* was the stunt we pulled off when we sent an airplane up from Anacosta airfield equipped with a radio telephone transmitter and piloted by Lt. [Herbert] Metcalf.

While flying high above the heads of the spectators, Lt. Metcalf read the President's Liberty Loan Proclamation. His voice was radioed to the ground where we amplified it so everyone in the audience could hear it.

Our business was located in Oakland, California, where we had built a small but very attractive factory. Neither Pridham nor I had ever published anything over our own names, nor had we ever read any papers before scientific societies in order to gain recognition. We felt our financial success lay in keeping the nature of our apparatus a secret as long as possible, or, at least, until our patent situation had become secure.

We had been doing our early work in far away California, and most of the United States was unaware of our existence for a long time. We had experienced no competition up to 1920, and no one else in the world had been engaged in the same kind of work as we. It was only when we invaded the East, and with a blast of fanfare

which the "great voice" so significantly amplified, that others sat up and took notice. Luckily for us, the publicity which we had received was by that time so widespread that in the minds of the common people all loudspeakers, and all electrical sound reinforcing systems were thought of as "Magnavox" — "The great voice" — and it was so commonly called.

But the slumbering giant finally woke up. We had jokingly applied the name "the slumbering giant" to the American Telephone and Telegraph Company the day they turned down our patent in New York, and the term stuck with us. We knew, of course, that they had been doing beautiful work in advancing the art of telephony, both by wire and radio, and we feared their competition. We knew that if they applied their infinitely greater resources, their mass intelligence, their splendidly-equipped laboratories, and their prestige, we would have a well-nigh hopeless battle on our hands.

In 1920, the American Telephone and Telegraph Company entered our field and they supplied loud speaking equipment for use at both the Democratic and Republican conventions held in that year. Our equipment was used extensively by the presidential nominees, [James M.] Cox and [Warren] Harding, during their campaigns. This means of reinforcing speech had by now become a matter of course.

When it came to selecting a public address system for the inauguration ceremonies of Harding on March 4, 1921, our system was recommended, and I understand that David Lawrence was one of our most active supporters, although none of us knew him personally. We declined the honor, however, for we had not the personnel available for such a large undertaking so far away from home. The "slumbering giant" was left to do the job, which they did in their usual perfect style.

We no longer had any fear of competition for our

position was solid from a commercial as well as a financial standpoint. Had the American Telephone and Telegraph Company put on a show in some large Eastern city shortly afterwards which was similar in scope to our San Francisco Christmas Eve celebration in 1915, we would have been forgotten, but they left us alone for nearly five years. Our rapid growth during 1920 to 1921, however, did not come from a greatly increased production and sale of public address apparatus; it came rather from a different direction, from the field of radio.

There had always been, ever since the inception of radio, a great number of radio amateurs in the United States. These amateurs had kept pace with developments, and at times were even a little ahead of the commercial companies. When the soldiers came home from World War I, many of them had received radio training while in the services; so the ranks of amateurs were greatly swelled during 1919 to 1920. In 1920, a few experimental broadcasting stations were operating in different spots of the country, and the amateurs concentrated their energies on the building of vacuum tube receivers and amplifiers. As there was practically no other loudspeaker available but the Magnavox, we found a large market for the sale of this item alone, and our speaker became the standard equipment in every up-to-date amateur radio set.

It was the beginning of the third stage of radio and the numbers of amateurs, who now began to include people from every walk of life, increased with leaps and bounds. In the basements of hundreds of thousands of American homes, the father and the sons of the household would be busy every night putting together some sort of a radio set. The mother of the house would complain about the maze of wires which began to clutter up her living room, but all was forgotten and forgiven if the menfolks succeeded in hearing Station XYZ, five hundred miles away.

This phase of American life lasted for a couple of years, until commercial radio sets became available. By 1922, the trend had become a tidal wave, and we were taxed to a point far beyond our capacity in order to produce enough loudspeakers to fill a universal demand. The dynamic speaker became the first, and it is today, the "great voice" of radio.

I had long wanted to make a trip to Denmark where my mother was still living, and now growing old. So, when prosperity burst upon us, I began to make preparations for a trip to Europe. I felt very grateful to my associates for their understanding, and it was arranged that I was to go in the interests of the company, with all expenses paid. My trip was for the purpose of studying the latest in loudspeakers in Europe, and also to see if we could expand our market in England into which country we had already shipped some amplifiers and speakers.

With a couple of trunks filled with apparatus of various kinds, I arrived in London about the first of May, 1922. I registered at the Hotel Cecil on the Strand, where I had stayed in 1910, and I had barely gotten to my room when I was informed that a gentleman downstairs wanted to see me.

I went down, and the gentleman introduced himself as Mr. Guy Burney. When I asked him how he knew I was in London, he replied that he knew when I left New York, and that he was waiting for me. He informed me he was the managing director of the Sterling Telephone Company, and that he was very desirous of obtaining the exclusive right for the distribution of Magnavox products in all of Great Britain.

This proposal came as a surprise for I did not know that the story of our exploits had traveled so far. However, the Prince of Wales episode in San Diego had been widely publicized in England at the time, and had aroused great interest in technical circles. Besides, radio broad-

casting was beginning in England, and I knew the prestige of the Marconi Company demanded that when that company placed a receiving set on the market, that set had to be equipped with the latest and best loudspeaker. Mr. Burney and I made an agreement whereby the Sterling Telephone Company became the agents for Magnavox products in Great Britain. This tie-up kept me in England for more than four months. The time was well spent, however, for I learned to like and admire the English people, and the financial returns resulting from the arrangement proved very satisfactory. The expenses of my trip were paid back to my company twentyfold.

Mr. Burney was the chairman of the British Broadcasting Company in 1922. The B.B.C. had recently been organized by a group of tradespeople for the purpose of providing radio programs for the listening public.

The radio broadcast idea was just beginning to sweep over England, and, of course, if better programs could be provided, more radio sets could be sold. It was in the sale of sets that Mr. Burney and the other promoters of the original B.B.C. were primarily interested.

Mr. Burney was perturbed because radio was considered a plebeian innovation by most of the wealthy class in England who were, of course, potentially buyers. Talking machines have always been deemed the poor man's substitute for music, and a stigma due to snobbery was attached to the idea of listening to phonograph recordings. Radio broadcasting had inherited this prejudice, because it sounded like a phonograph. Burney felt it would be difficult to overcome this prejudice in old and conservative England.

While discussing this problem with Burney, it occurred to me that Lord Louis Mountbatten would be just the man to cut through conventions and become the champion of the new art. Lord Louis Mountbatten is a direct descendant of Queen Victoria, and a cousin of the King

of England. He had impressed me as being a courageous young man, and I knew radio to be one of his hobbies.

I told Mr. Burney of my meetings with him and the Prince of Wales in San Diego and that I had been invited to visit them in London. Although I had no thought of ever accepting their invitation, I now suggested that I go to Lord Louis and talk the matter over with him.

We discussed the kind of message I was to give him. I was to tell him about the latest strides radio broadcasting had made in the United States, and that England was certain to catch up shortly if only a person of high rank would endorse it. I was to ask him if he would be the champion of radio in England for the sake of science and progress. I was also to point out the great cultural advancement which might come with radio, and that broadcasting might well cause a greater unification of the British Empire. My definite mission was to obtain Lord Louis' consent to "go on the air" and, in whatever words he chose, endorse the new art.

It may seem peculiar that I, an American, should undertake this mission rather than Mr. Burney, himself, as the president of the B.B.C. There existed a great gulf between ordinary tradespeople and royalty, a gulf which the people themselves were reluctant to bridge.

In 1922, Lord Louis was the idol of England. He was about to be married to the beautiful Lady Ashley, and everyone was discussing the royal romance. It was to Lady Ashley's home I went for my appointment. Lord Louis received me most graciously, and, although he must have been very busy, for he was to be married the following day, he gave me about an hour of his time.

He said he remembered me very well, and that he was pleased about my calling on him for he said he wanted to tell me about the fun they had had with the loudspeaker equipment on board the *Renown*. He told me they turned it over to the British Admiralty upon their return to London.

I stated my mission, and he was very sympathetic towards the idea, and promised to comply with our request at a later date. However, his plans were for leaving England the day following his wedding. He and his bride were going to France and from there directly to the United States. Americans will remember how popular this young couple became during their visit to Hollywood in 1922.

Mr. Burney was disappointed when I told him our plan had to be deferred, and he took a gloomy look at the future. As I left London before Lord Louis returned, I do not know when he first spoke over the English radio. I am sure he has spoken over the B.B.C. system many times since. However, the popularity of radio grew by itself so rapidly in all countries that endorsements by individuals became less and less important. When I now hear a broadcast from London, either by Churchill or the King, himself, I cannot help but think of Burney's pessimism twenty years ago.

Shortly after I arrived in London, the whole city became very excited over a prizefight which was to take place between George Carpenter and Ted (Kid) Lewis. The newspaper, *The Daily Mail*, had made a request to the Johnson Talking Machine Company for the loan of a Magnavox outfit with which to announce the fight, blow for blow, to the crowd in the street. This was to be the first demonstration of loudspeaking equipment in England, and I was naturally pressed into service.

It was arranged that our equipment be used in a *Daily Mail* office in the square "Elephant and Castle" in South London. We put up a couple of speaker horns, pointing out the windows and covering the square, and a private telephone line was established between our office and the ringside.

We could, of course, have connected the amplifier directly to the telephone line and amplified the reports

as they came straight from the ringside observer, but the officials would not listen to such a procedure. The idea of an observer, sitting at the ringside, and relaying his observations directly to a crowd gathered on a distant square was too new an experiment to be undertaken. Consequently, we merely received the report from the man at the bout over the telephone. At our end, another reporter was to receive it and he, in turn, would tell our local announcer, who was my friend, Morby Smith, of the Johnson Talking Machine Company. (The art of direct reporting was yet to be developed.)

Across from us, on the same square, were located the offices of the *Evening Standard*, another London newspaper. The *Evening Standard* had erected a huge illuminated sign upon which the progress of the fight would be written in letters of light. There was great rivalry between the two newspapers, and, apparently, it was of extreme importance to which offices the crowd would turn for their information.

When we opened up with some preliminary announcements, through the loudspeakers, the crowd immediately sensed that they stood in the presence of something new and startling. I could hear the echo from our voice ring across the plaza and down through the streets. The entire crowd turned around as one, and their eyes were never taken away from our windows for the rest of the evening.

A London crowd is far more responsive than an American audience, and all kinds of remarks were hurled at us from down below. Shouts followed every one of our announcements.

"Elephant and Castle" is a workingman's quarter, and I was told *The Daily Mail* was not too popular with the people living there. I was advised to keep away from the windows as a brick might come crashing through any minute. Morby Smith was doing all the announcing and every time he ended up by saying, "*Daily Mail*," he turned to me and whispered, "Duck!"

The scene at the ringside had been described to us by the reporter and relayed, through the speaker system, to the people below. The ceremonies attending the arrival of the Duke of Connaught had been described in great detail, all interesting information which the *Evening Standard* across the street naturally could not give with its slow lettering system. No one paid any attention to their sign.

Finally, the fight started, and we roared out a blow by blow description to the immense delight of the people who now stood like packed sardines in the street. Our stentorian voice had attracted everyone in the neighborhood. Towards the end of the first round, our reporter who was listening on the phone became very excited.

The telephone had been cut off and he was not sure whether the last words he had heard were "Lewis knocked out," or "End of round one." He wrung his hands, for he knew that if he released the first report, and it was not so, he would lose his job, and perhaps the mob would break every window in our building. We looked anxiously toward the *Evening Standard* sign, but there was no flash.

Precious seconds passed, and the young reporter could stand it no longer, so he gave the order to announce, "George Carpenter knocks out Ted (Kid) Lewis in the first round." Then he sat down and buried his head in his hands.

We paid little attention to the deafening roar which greeted the announcement; we were all staring at the *Evening Standard* sign. Forty-five seconds elapsed, and the long-expected flash appeared on the screen across from us.

To our great relief it verified the correctness of our announcement. *The Daily Mail* had scored a smashing scoop and there was a lot of handshaking and general hilarity. The young English reporter staggered across the room to his coat. From an inside pocket he pulled

out a bottle from which he took a long drink before he passed it around. His job was saved.

Half an hour after the fight was over, the telephone connection was restored to the ringside. We were told that chaos had reigned in the hall following the knockout. A surge of people had swept across the poor reporters and their instruments, in an effort to get into the ring. Telephones were swept on the floor and connections broken; it was only after the hall had been cleared that the damage could be repaired.

During this summer in London, I had the pleasure of meeting Marconi himself. Mr. Burney invited Marconi, his general manager, Mr. Gotfrey Isaacs, and me to a lunch at the Savoy Hotel, and Burney had advised me to be ready to spend the whole of the afternoon with them.

When I was first introduced to Marconi, I was struck by his apparent youthfulness. He was a well-built, handsome man; although his one protruding eye, which I believe was blind, detracted somewhat from his classical features. His speech was entirely free from any trace of an Italian accent, and he spoke and acted as if he were a typical English business man of great culture.

Marconi especially wanted to know all about Poulsen's early work in Denmark, and he chuckled when I told him how the Poulsen Arc time and time again had outperformed his spark system. As he laughed at my remark, he turned to Isaacs and winked his one good eye.

Isaacs said, "Why was Poulsen always such a difficult man to do business with. He ought to have known that together we could have controlled the world!"

Mr. Isaacs knew as well as the rest of us that that was not the real reason for their failure to get together. The reason was that in the early days of radio there was such an intense personal rivalry among the top pioneers that it was impossible for them to get together.

As we shook hands in parting, Marconi said in his

lyrical manner of speech, "You have seen the glories of the past, but you are a young man, and it will be nothing compared with what you will see during the rest of your lifetime."

And he was right.

It was late in May when I made the first of my three short trips during that summer to Denmark which I had not seen since 1910. My exploits in America, and more recent ones in London, had been publicized in the Danish press; so when I arrived in Copenhagen, I felt in a small way like Charlie Chaplin must have felt when he first returned to London, for quite a delegation was at the station to meet me.

It was good to see the old familiar places after an absence of twelve years. The First World War had come and gone, but the country had recovered, and it struck me as being extraordinarily clean and orderly. It looked more prosperous than when I left, and the standard of living seemed to be much higher among the common people. The squalor of the English cities has a depressing effect upon a visitor, and the Danish towns, by contrast, were bright and cheerful. Technological advances were unquestionably responsible for part of the progress, but I could not help thinking that the democratic processes which had been flourishing in Denmark were responsible for most of the advances. Denmark had not had a reactionary government since 1901, and the cooperative spirit and the more equitable distribution of wealth, which had come about due to social legislation, were in the main responsible for the rapid progress. England could learn a lot in that respect from her smaller neighbors, it seemed to me at the time.

In Copenhagen, a group of influential men approached me with the idea that a large public demonstration be given of the Magnavox loudspeaker system and that King

Christian of Denmark be asked to attend, and to speak through the device. It was suggested that we use the large square, called Groenttorvet, which is used in the morning for the vegetable and flower market. In the evening this square is very quiet, it is centrally located, and would have been ideal for the purpose.

The proposition naturally appealed to me, for who does not, as a returned son, long for some honor and glory from his fatherland? Yet, I chose to decline, because I had only one set of apparatus with me in Denmark. I remembered Pridham's experience with President Wilson, and the breaking down of the equipment at a critical moment, and I promised myself never to be a party to exposing prominent people to embarrassment simply because I had something to gain.

As I look back upon this matter now, I still do not regret my decision. The chances that the affair would have been a success were practically assured, yet when I stood face to face with a situation I had dreamed of and hoped for in my youth I shrank from it.

Instead of going through with the official arrangement, I chose to make an arrangement with the large newspaper *Politikken* to stage a demonstration in the City Hall Square, which the newspaper offices faced. I placed my apparatus in the second floor offices, and a couple of speakers adequately covered the square.

The affair attracted a tremendous crowd. I could not now estimate the number of people present, but in some old copy of *Politikken* all the details can be found. Suffice it to say, the square was completely filled by an enthusiastic mass of humanity. All traffic was stopped for the event. Giant voices were completely unknown on the European continent and everyone in the city seemed to be eager to hear for himself.

We provided a varied entertainment of speeches, music, and singing, but the sensation of the demonstration was

the amplification of a two-way telephone conversation between our offices in Copenhagen and the *Politikken* correspondent in Stockholm, Sweden, some five hundred miles away. This telephone conversation was amplified so it could be heard plainly by the whole audience. The greatest sensation was caused when we asked the man in Stockholm to hold his pocket watch up to his microphone. The tick of the little watch in Stockholm sounded throughout the square in Copenhagen like a hammer striking an anvil. The people who heard it insisted that he used an alarm clock, but I can verify that the sound reproduced and amplified was his watch.

At the first opportunity, I left for Falster to see my mother. She was living alone in a little house which was built after my father's death in Moseby. The house was in the village where I had gone to school as a child.*

My mother had aged greatly during my absence. Many years of hard toil had bent her body and gnarled her hands. She was now in her sixties, and she had refused to take life easy. From her pension and her savings she had lived comfortably on a standard of her own choosing. Money which I had sent her she had carefully deposited in the neighborhood savings bank in my name, and never touched it. Yet, in spite of her small income she had been able to extend a little help to many who came to her with their troubles, and to the children in the village, she had become a kindly godmother. My mother had never been demonstrative with her affections; I do not remember that she ever kissed me as a child, yet I knew she loved us children with a passionate mother's love, and no sacrifice was too great for her to make for our sake.

When I first met her, I gave her a resounding kiss, for I had learned to show my affections in America. This

*Of the four Jensen children who immigrated to the United States, only Peter returned to Denmark during the lifetimes of the mother, brother and sister who remained in Europe. Karl Sandvig Jensen, Hans' son, wrote, "Grandmother lost four children and four children lost their home."

might have startled her, but she said only in her simple and practical way: "I hear you are famous; now I only hope it will last!"

My arrival at Copenhagen had caused more of a stir than my coming to Moseby. To the people of the village I was still the pilot's son who had gone to America and who now had come for a visit. The fact that a reporter from one of the island's largest newspapers came to see me on the first morning also failed to impress them. It was only after I had sent my first cablegram to San Francisco through the village telephone exchange and paid the equivalent of seventy-five dollars for it that everybody sat up and took notice.

I shall never forget my first visit to the home of my childhood, which I was anxious to see after my long absence. It was June fifth, Constitution Day in Denmark, and a flag was flying high above every house in Denmark. The Danish flag is red with a white cross, the old Crusader's emblem, and the Danes think their flag the most beautiful of all. It has flown proudly over them for nearly a thousand years.

I walked down to the little fishing village of Hesnaes, the village where the old sawmill is located. I went down to the wharf, and as I looked back, there were all the flags, outstretched by a gentle breeze, and outlined in the sunlight against the green background of the forest. A lump came in my throat, for there was the old flag, waving above the happy hamlet, and symbolizing the peace and tranquility which reigned within the homes.

I wanted to be alone; I wanted to enjoy to the fullest these first impressions of the old familiar places. I walked north on a path which runs in the forest along the shore close to the city. I knew nearly all the trees; they had grown taller in the twelve years, since I last was there, and some of the old ones had been cut down.

The path led me past two houses in the woods, about

a mile from Hesnaes. As I approached, I could hear music coming from the nearest one. It was one of Sousa's marches being played on a phonograph. The lump came up in my throat again for there was typical American music coming from a friendly house which was so typically Danish. The old red and white flag waved above it, and the garden was full of flowers. The house was old, but a picture of beauty, and there was that music floating out through the forest.

The path led me past the open window; and inside I could see people having their afternoon coffee. I used to know the family which once lived there, but these were new people; so I went by. The wife came to the window and looked at me after I had passed; she probably wondered who the stranger could be.

The path led me into the woods again and past the lighthouse on Hestehoved, the easternmost point of Falster. I did not stop for new people had come to this place also.

The Strait of Groensund begins here and I walked on a short distance. I was getting nearer to my old home and the Island of Moen was beginning to loom up across from me. I went over to the cliff and sat down. I sat there and gazed upon the old familiar Baltic, the sound and the islands in the distance. A sailing ship was just passing by and far out to sea. I could make out the faint smoke of a steamer.

A thousand memories passed through my mind, recollections from my childhood became clear and vivid. I had changed, but the scene of my first happy days had not. The birds in the forest were singing behind me, and a distant cuckoo and the cooing of wild pigeons added to the enchantment. It was seven o'clock in the evening and the sun was still high. It did not seem to be sinking, but only to move slowly towards the north. Streamers of light were yet coming through the foliage, but an al-

most imperceptible darkness was beginning to set in under the trees.

I had long since started to think in English, and Sir Walter Scott's old familiar poem ran through my head, again and again:

*Breathes there a man with soul so dead,
Who never to himself has said,
This is my own, my native land?
Whose heart hath ne'er within him burn'd,
As home his footsteps he hath turn'd,
From wandering on a foreign strand?**

The poem was written for me and for this moment, I reflected, and I knew I would forever be rooted in the soil upon which I sat.

I had become an American in speech, in manners, and in my philosophy. I had striven to throw off every vestige of a Dane in my effort to become a better citizen of my adopted country. Now I knew I had been wrong. In that hour of meditation, I believe I became a better American and a better Dane than I had been before. I reasoned that one could not be faithful to any ideal, or any country, if he were false to himself. I would be false if I said I no longer had any feelings towards my native country, for I did. I also loved the United States, and it became clear to me I would always feel that way.

In the United States was my home. For that country I would fight. For Denmark, I would weep. And now, twenty years later, I did both.

I began to understand what my citizenship in the United States meant. It obligated me to give more to the country of my adoption than I received. As a contribution I should bring with me the best in Danish culture, in substance but not always in form. I should carry on and practice the simple virtues which were taught me in Den-

*"The Lay of the Last Minstrel."

mark, and I should always, by my behavior in my new country, reflect glory upon my old.

The sun had moved further to the north and was now getting low. The darkness under the trees was deepening. The schooner was letting go her anchor chain. The wind had completely died down and the sea was like a mirror. All nature was in its early summer glory, and it was a scene of indescribable peace.

It was late in September, 1922, when I returned home to California. The seed of the "great voice" had been planted across the Atlantic, and it grew in all the countries of Europe as it had grown in the United States.

My fondest hope had been realized. The great voice had become the voice of radio. Not until 1927 did the silent film get a voice and it was the great voice. After 1930, the great voice became the universal voice of the phonograph.

Here, in this country, I found upon my return, a feverish activity in all matters pertaining to radio. New broadcasting stations were springing up almost daily, and it had become a desire of nearly every citizen to have in his home a radio receiving set with a loudspeaker.

Long before, the great voice had become the voice of public speakers, the voice of kings, presidents, dictators, statesmen, educators, entertainers. The voice of evil men, but more often the voice of good men.

In the present world conflict, the dynamic loudspeaker to which we gave the name "the great voice" is being used to call men to their battle stations on ships; it is being used by commanders to give orders to distant troops, and it is being used to hurl propaganda across the devastated no man's land to affect the morale of the opposing enemy forces. Truly, one wonders: "How did the world ever get along without it before?"

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