



## Sixty years of Wireless and Radio Reminiscences.

Horaden Pratt

Some of the very earliest wireless transmissions took place in San Francisco, California. During the summer of 1899, Mr. Marconi reported the regatta races off Queenstown and Cowes by wireless from a boat. These were witnessed by enthusiastic representatives of the New York Herald. Mr. Marconi was commissioned by this newspaper to come to New York and report the Columbia-Shamrock races in October.

The San Francisco Call, a morning newspaper, became interested and organized a team of electrical and telegraph men to conduct experiments, about July. They tried transmitting signals between the Call Building (later named the Claus Spreckels Building) at Third and Market Streets and Telegraph Hill, using a Tesla coil for a transmitter but electrical interference from the Third Street trolley cars was bad. They then tried on the ocean beach, transmitting to the Cliff House from eight miles south but again without success. Better luck was had over a four mile stretch on the beach, using a Rhumkorff four inch spark coil. It must be remembered that the only device for receiving in those days was the Branly coherer, an extremely unreliable and cantankerous arrangement that would respond to any electrical disturbance like trolley wire sparks and atmospheric discharges.

Learning that a new vessel built in Portland, Oregon and equipped with dynamo electric power had been recently stationed at the San Francisco Lightship some 10 miles out at sea, the Call secured permission to conduct tests from it to the Cliff House and an installation was made. The ship's mate made entries in the log telling about it and how, in August, some messages were transmitted because the tug Reliance came out from time to time and reported the words that had been received. These experimenters followed the quaint practice of taking down the aerial (the term antenna was not in use then) at five pm, before dinner and stowing it below for the night, probably because it might interfere with the ship's lights.

Mr. Marconi reported the big yacht races in October and, while in the United States incorporated the Marconi Company of America and arranged demonstrations for the Army and Navy but was unable to personally go through with these as he was suddenly recalled by the British Government to help prepare a number of wireless equipments to be sent to South Africa for the Boer War. The Marconi Company did not succeed in generating sales to our armed forces because it demanded a royalty in addition to high prices but the demonstrations did encourage interest in wireless telegraphy. The army conducted some experiments around New York and, in December, 1900, established stations connecting Fort Mason in San Francisco with Fort Alcatraz, after a storm broke the submarine cable connecting these places.

The United States Weather Bureau also became interested as a result of Marconi's visit. In September, 1902, it let a contract for a station on the Farallones to connect with Point Reyes. Vessels were told that the station had a range of only one mile and, to call the operator, should give five blasts on the whistle.

In February, 1905, the S. S. South Portland put into Drake's Bay to escape a 60 mile wind and picked up the new cable from the Farallones to Point Reyes after only 12 days of usefulness. The Captain ordered the cable cut to save the anchor.

Another result of Marconi's visit was an attempt to link the islands of Hawaii to each other. A Honolulu engineering firm, Catton, Neill and Company was contemplating laying cables between the islands but then heard of Marconi's visit and sent Frederick J. Cross to New York who contracted with Marconi for wireless sets for seven stations. The stations did not work well and the Marconi Company sent Arthur Gray to Honolulu in December 1900 with more apparatus. August 3, 1901 the Marconi Company sued for non-payment of money due under the contract. October 16, 1902 the wireless operators went on strike. One of them, W. R. Carroll became an operator at Avalon later.

Timothy Furlong, who in later years worked for me at the Mare Island Navy Yard, conducted some experiments in San Francisco in 1903 between Telegraph Hill and Bernal Heights, a distance of five miles, using two carbons and a needle for a detector. At that time Gray Brothers were using Telegraph Hill for a rock quarry and their blasting would shake the needle.

In The American de Forest Wireless Telegraph Company built a wireless station on the Palace Hotel in San Francisco. Furlong opened it in March, 1905. It had a two wire antenna strung from a pole on the Grand Hotel on the east side of New Montgomery Street to a pole on the hotel and then to the Masonic Temple on the north side of Market Street. The call letters were "PH", taken from the name of the hotel.

In 1905, the Pacific Wireless Telegraph Company established two kw stations connecting the Goldberg Bowen Building in Oakland with the Merchant's Exchange Building in San Francisco where the antenna was supported on a 100 foot tower on the roof. No signals got through, the messages being carried back and forth on the ferries by four messenger boys.

These properties were disabled by the 1906 San Francisco fire. After reincorporation as the Occidental and Oriental Wireless Telegraph Company, a station was built on school property on the northeast corner of Taylor and Vallejo Streets in San Francisco, call letters PH. Tim Furlong was the first operator and stood daily watches for over a year of idleness as there were no ships to work with. The station was taken over March 1, 1908 by the United Wireless Telegraph Company. They tried to interest the Standard Oil Company, but fearful that wireless might start a fire, permitted their Barge No. 3 to be equipped. J. O. Watkins relieved Furlong at the Russian Hill station while Furlong went on the barge which was towed to Seattle by the tug Atlas, leaving San Francisco March 19. This set worked so well that the Standard Oil Company had seven tankers equipped.

In 1905, the Pacific Wireless Telegraph Company erected a station on Mount Tamalpais with the intention of communicating to Honolulu. I believe that it did not transmit signals to any place except the Farallone Islands. Hjalmar Lundell, a master

mechanic for the company, worked on this installation. It had two wooden towers, guyed, 300 feet high. They withstood the San Francisco earthquake but fell during a wind storm in December, 1906. I could see the towers from the kitchen window and, noticing that they were gone, climbed up there with my father and was surprised to see that some guy anchor rods had been cut with a hacksaw.. Some time after 1930 when I was in New York, I received a letter from a lady in Oakland saying that she had some stock in the Pacific Wireless Telegraph Company and now that radio broadcasting had become so successful, it should be very valuable and where should she go to sell it?

Robert Marriott, one of the founders of the Institute of Radio Engineers in 1912, was an early pioneer. In 1904 he built a wireless system between San Pedro and Avalon, in Southern California for the Continental Wireless Telegraph and Telephone Company of Denver, one of the Gehring Companies originally created to exploit the patents of Dolbear. These stations operated a successful commercial business without interruption, until replaced by submarine cables, although equipments and ownership changed over the years, among the owners being the United States Navy during World War I and the Bell Telephone System when telephony was introduced in 1921. When I first worked on ships in 1910, this circuit was very busy, particularly during the summer time. Marriott's system was successful because he used a high pitched commutator interrupter and a microphonic type of detector which consisted of a blunt metal point touching a Prince Albert tobacco can that had been oxidized by burning. This ultra-sensitive device was mounted on a concrete pier erected on bedrock. It was necessary to shut down the engine generator when receiving. Marriott told the story that one of the first receptions was the report of a prize fight, which he posted on the hotel bulletin board. No one would believe it, even after the newspapers arrived on the boat, claiming that the news was flashed by lights or smuggled in on a boat at night. Finally, a sick woman received help from a doctor by wireless. But the system was not fully accepted until two men robbed the Avalon Hotel office early one morning and escaped on a boat. This had always worked but, on this occasion, the men were met by the police when they arrived at the dock in San Pedro.

Another very early wireless circuit was a Marconi spark coil system connecting Santa Rosalia and Guaymas, across the Gulf of Lower California. I would listen to this when going down the Mexican coast on an oil tanker. The coil vibrator was very slow and often a dot in the code would be only one spark. This made it hard to copy when the static was bad. Nevertheless this circuit operated successfully for many years.

The United States Navy established wireless stations at an early date, adopting the practice of locating them near light-houses so transmission would be mostly over water. This was very successful and by relay, they could get through from Mexico to Canada in the daytime. Lieutenant Commander George Cook Sweet and R. B. Stuart opened the Mare Island station March 30, 1904, call letters TG. Then came Yerba Buena Island May 5, 1904, call letters TI. Next was the Farallone Island station, put in by George Hanscom which opened December 9, 1904.

Its call letters were TH. Then came Point Arguello with a Hassic transmitter, February 6, 1906. Point Loma at San Diego opened May 12, 1906, call letters TH. Table Bluffs opened October 23, 1906 followed soon by Cape Blanco, North Head and Tatoosh Island off Cape Flattery. Then came the Alaska system, built by George Hanscom. Lieut. E. H. Dodd did much to develop this chain. Sitka was opened in 1907 and Cordova in 1908. While living at Sitka, Mrs. Hanscom collected artifacts some of which are now on exhibit at the old Fort Ross State Park, through the generosity of the late Mrs. C. C. Chapman.

It was in 1905 that I read in the newspaper that Major Squier of the Signal Corps (later the famous General Squier of wired-wireless fame) had conceived the idea of using trees for wireless aeriels, by driving a nail into the roots and another higher up, and connecting wires to them. He was going to try this out on the Fort Mason - Fort Alcatraz system. At that time the Signal Corps had a laboratory in the Phelan Building from which headquarters experiments were controlled. The original circuit between the forts was established under the direction of Captain Dyer, the actual work being done by Carl Kinsley, a civilian expert of the Signal Corps.

My father and mother, having both been telegraph operators that met each other on a private telegraph wire that ran around the city over roof tops in the 1880's, had taught me the American Morse code over a telegraph wire inter-connecting the floors of our home, so naturally I was interested in Major Squier's experiment and built a wireless receiving set. At that time telephone linemen were replacing galvanized wire on Franklin Street with copper and throwing the old wire into vacant lots, so I had plenty of that. I made a cage aerial using some old wagon wheels and suspended this from the gable of the house. As the coherer detector was going out of style in favor of microphonic devices, I used two pieces of arc light carboneach filed to a straight edge, with a sewing needle laid across the two edges. Plenty of carbons were available as they were replaced every day in the street arc lamps and the old ones thrown on the ground. I bought a "solid back" telephone receiver from the Manhattan Electric Supply Company for 64 cents. But I never heard a signal although we lived only four blocks from Fort Mason. As it turned out, Squier's idea never worked.

Then came the earthquake and fire and the wireless was forgotten until Theodore Roosevelt sent the Navy fleet around the world, in 1908. It was a school holiday and after seeing the imposing "Great White Fleet" come through the Golden Gate, it occurred to me that perhaps I could hear signals from these ships so I rushed to the basement, dusted the cobwebs from the 1905 apparatus, adjusted the needle and, sure enough, here were signals, loud and clear. They were mostly from the Flagship Connecticut and the U.S.S. Colorado. Messages were going back and forth with the Navy station at Yerba Buena Island, conveying invitations to and acceptances by officers for social engagements ashore. They used the Continental code which I did not know but having a copy of it taken from a library book, I was able to translate.

Lee de Forest had sold the Navy a number of wireless tele-

phone equipments, using small arc generators and some were installed on these ships at Norfolk by de Forest himself. Chief Electrician Keneratti used the set on his ship to send music to entertain his friends on the other ships, by putting the microphone in front of a phonograph. Occasionally, I could hear these but both transmission and reception were poor and erratic. Some of these sets were removed at San Francisco and when I worked at the Mare Island Navy Yard in 1915, I experimented with one that I found there. Arthur Rice, later to become the next "Radio Aide" after I received my appointment at the yard, was Chief Electrician on the Flagship Connecticut, but he was taken off the fleet at San Francisco.

It was not long before I had a complete wireless outfit with a mast 110 feet high, enabling me to talk to amateurs from Seattle to Los Angeles and with ships out as far as 1600 miles. Sometimes I would pick up the new station at Kahuku in the Hawaiian Islands built by Arthur Isbell in 1908, the Navy Station at Key West and ships of the United Fruit Company in the Gulf of Mexico. The American Morse code was used exclusively in those days by the Fruit Company and in the Puget Sound area.

Frank Rieber of Berkeley and others organized the Bay Counties Wireless Telegraph Association and I joined it. Many old timers belonged to it, Eddie Foy of Berkeley, Cyril Lotz of San Jose, Lewis Clement of Oakland, Drummond Browning of Hayward, Gilbert Cattell of San Francisco and Ellery Stone of Oakland just to name a few. It remained very active until the law of 1912 prevented amateurs from using wavelengths above 200 meters.

Two very active operators were on the air when I became active in 1908. One was Ralph Wiley, later San Francisco's Chief Electrician who devised the first street traffic signals and the other George Kellogg, who was in charge of the central fire alarm station in Jefferson Square. They conversed daily giving me a lot of code practice.

Early wireless amateurs had many interesting experiences. When I needed electric power, for which our house was not supplied, a friend, Secretary of the Pacific Gas and Electric Company, took me to see the proper official who told me I could not have power because they had so much trouble with wireless amateurs. He cited the case of my friend Bill Larzelere on Haight Street. In those days of combination gas and electric light fixtures an insulated joint was put in the gas pipe line supplying a house. This made the gas pipe system of the house into an excellent antenna. One day when Bill was transmitting, a spark jumped across the insulating joint in the house next door and an explosion blew out the front wall. It seems there had been a slow gas leak in the basement room, where the gas meter was. A few days later I got power installed by applying at the window where people came to get service.

One problem we had was blinking the lights of the neighbor's houses when transmitting. I cured it by using a series transformer that put just enough voltage on the line to compensate for the drop. Later the local power company foreman put me up a two kw private line transformer formerly used for an X-ray machine on Jackson Street, for a \$12.50 labor charge. All was

fine until it burned out one morning during my usual schedule at seven am. I could see little wisps of smoke coming out of it. Reporting a power failure, I went to school. Coming home that evening a new 10 kw transformer was on the pole and no questions had been asked. One morning my operations burned out fourteen light fixtures in an apartment house in the next block. The building superintendant caught me at it because he noticed sparking in the fuse box that coincided with the dots and dashes of my transmitter. I spent most of the day repairing the fixtures and just as I was leaving a man came along with a bag of tools and a coil of wire. He had been sent by the power company to make repairs. He seemed much relieved when I told him they had already been made.

On another occasion, one winter evening, a storm blew one of my antenna wires across a 13,500 volt power line on Chestnut Street, of the Great Western Power Company, burning through all six cables with accompanying lightning-like flashes. This loss of power shut down the Fillmore Street trolley line for awhile. I quickly cleared away my broken wire before the repair crews came. Again, no questions were asked.

In the winter of 1917 I decided to establish a receiving and control center in the office of the Pacific Coast Communication Superintendent of the Navy, on Goat Island with remote control of the transmitters at Mare Island. While making the installation, Commander Dodd, the P.C.C.S., wanted to know if I was using the antenna at my San Francisco home because if not, perhaps I could take it down and stop the flow of letters and telephone calls suggesting that this was a German spy station. I was not using it but my father liked to listen in. By taking the antenna down and putting one in the attic under the roof, everyone was made happy.

Another trouble we had was putting noise on telephone lines. An amateur named Sydney Fass on Green Street four blocks away, couldn't use his telephone when I was transmitting. Little sparks flashed across the carbons of the lightning arrester. I told him to take the carbon blocks out. An amateur on Steiner Street named Cummings created so much trouble the telephone company strung some closed wire loops on the poles around the block where he lived but this did not help. The carbons had to be removed from all the arresters in that locality. He was threatened with a lawsuit but, after he consulted a lawyer, this came to nothing.

I financed my operations by making and selling wireless equipment, mostly transformers. The highest price I collected for a two kw transformer was \$45. The lumber for my mast was donated by a friend in the Bellingham Bay Lumber Company. With some of my earnings, I wired the whole house and the family discontinued the use of kerosene (then called coal oil) lamps.

Ellery Stone was an active amateur in Oakland and developed a transmitter using an impulse type spark exciter. It was the only one that I knew of on the coast.

*in 1909*

It was during the Portola Festival week when San Francisco went wild, that on my way home early one morning, I stopped at

the Russian Hill station. Eddie Foy was on duty. The transformer was an old open core American de Forest Wireless Telegraph Company type in a mahogany case, located on the floor. The receiver used a carborundum crystal. The big spark gap was in a double, asbestos lined box. To see the spark, outer and inner doors had to be opened. We did this and could hear the echoes come crashing back from the down town buildings. Soon irate neighbors started shouting from windows so Foy closed up and we went home. Due to complaints the Board of Education refused to renew the lease and, under the direction of Arthur Isbell, the new company manager, the station was relocated on the mountain at Daly City and called the Hillcrest station. Meanwhile, a new station, call letters CH (for Chronicle) was established on top of the Chronicle Building and traffic was handled from there during the move. One of its night operators was A. Y. Tuel, a former railroad man, who started in wireless at the Astoria, Oregon station soon after it was built by Robert Marriott and it was at CH that I first met him. "Pop" Hyde was the operator at CH when I first visited it.

An early operator at PH on Russian Hill was L. M. Malarin. He swore so much that, on complaint of the Toyo Kishen Kaisha and the Commandant of the Mare Island Navy Yard, he was removed by Manager George Jessup and made Chief Operator in the downtown office.

In earlier years a small wireless station was put at Friday Harbor in Puget Sound. In July, 1908, the United Wireless Telegraph Company opened a larger station there. It was found that it worked very well, at night, with the United station at Monterey, California. Through messages went over this circuit daily until, by 1910, point to point operations were discontinued and wireless service confined to ship communications.. In those days United Wireless had stations at San Diego, Los Angeles, San Luis Obispo, Monterey, San Francisco, Ft. Bragg, Eureka, Portland, Seattle, Friday Harbor and ~~one-two~~ <sup>many</sup> other places. *Stearns*

Occasionally a foreign ship equipped with wireless came to San Francisco. This was always an occasion. All Japanese vessels bringing immigrants had wireless. At first, their operators had great trouble with the English language and the Continental code (the Japanese had their own code of over 50 characters). I remember that it often took a very long time to get a message received on a Japanese ship. It was the operator of the Tenyo Maru who asked Malarin for the rate to Omaha and then was unable to receive the answer. But <sup>when</sup> Malarin swore, sending it very slowly and triple, that the Japanese operator got it. I happened to be listening in at the time.

Starting in 1905 with McCarty in Oakland, primitive wireless telephone rigs using small arc generators, became a fad around San Francisco as stock selling enterprises. I never paid much attention to them because their signals interfered with telegraph operations. One of these had a transmitter in an old warehouse on the northeast corner of Fillmore and North Point Streets where, at that time there was a dock in the bay for boats. The station was conspicuous, having a mast on the roof supporting an antenna. I could hear their signals very well at my home about eight blocks away. In early 1909 I wanted to

erect a mast and needed blocks and tackle. Thinking that these people might have some I went down there and talked to Mr. H. D. Dwyer. They had what I wanted but was told that I could not borrow it as a drop of acid on the rope might weaken it and cause an accident. But when I told him how well his signals came in he became excited and said I could have the tackle if he could bring prospects to listen to his transmissions. This went on until my mother refused to have any more strangers in the house but by that time my mast was up and I did not need any more help. Their transmitter was always covered with a black cloth so I never got to see it. Later, Dwyer and his associates had a station on the Fairmount Hotel and another in Fruitvale. In 1912 these men were to make a radio telephone transmission to an airplane at the Oakland meet but I have not been able to learn whether they accomplished this..

A former telegraph operator, Arthur Isbell, was working for the Massie Company at Point Judith, Rhode Island. In 1907 he equipped the new S. S. President with Massie equipment and, in 1907, accompanied her as wireless operator around Cape Horn and up the west coast as far as Nome, Alaska. While at Seattle, he had lunch with Bob Harriott. Isbell became Pacific Coast manager for the Massie Company, established a station near the beach on Sutro Heights in San Francisco and equipped several ships, mostly of the Pacific Coast Steamship Company. Massie had trouble paying his bills and Isbell left his employ in December, 1907.

C. J. Hutchins had obtained control of the old Wireless Telegraph Company, Ltd., in the Hawaiian Islands. He came to San Francisco and induced Isbell to build a powerful station at Kahuku, Oahu. Hutchins had brought an old family friend, Jack Balch, to Honolulu. Balch was a sick ex-mining engineer. Balch had nothing to do with Isbell's project except to purchase supplies while Isbell lived with the Japanese on a sugar plantation at Kahuku. In 1913 the station was moved to another location to make room for the 300 kw station Marconi built at Kahuku. Isbell later had a falling out with Balch and left the island incognito. He made some trips across the Pacific and sold some equipments in New Zealand. Later he became Pacific Coast manager for the United Wireless Telegraph Company.

It is interesting to note that, in 1907, Isbell was sued by the United Company for criminal libel because he had issued a signed statement that United officials were liars, cut-throats and thieves. It happened a few years later that some of these officials received penitentiary sentences.

The Massie San Francisco station had two masts 190 feet tall, 185 feet apart with a five wire antenna. Operator W. S. Smith, sent from Point Judith, worked at the San Francisco station from February, 1908. While working the S. S. Lurline during a lightning storm, rare in San Francisco, he suffered severe burns on his right arm. I remember reading about this in the newspaper. Massie sold out to the Marconi Company in 1912, receiving \$5000 for the Pacific Coast properties that included 13 ships. Massie, contrary to most wireless promoters, did not believe in selling stock to keep his company financed.

Mr. A. H. Ginman became the Pacific Coast manager of the Marconi Company of America after its acquisition of the United and Massie assets, taking office in February, 1912. Isbell became the manager of the Marine department.

It was in August, 1910 when I had the third trick at the Hillcrest station, that Isbell would come to the downtown office late at night and listen on the telephone line to see if his operators were doing their work. I could hear the clicks on the line. One night he did this and I said "Good morning, Mr. Isbell." He clicked off immediately and never did it again. Later, he asked me to teach him some principles of electrical engineering and took several lessons at \$1.50 each but soon gave that up. Chief Operator Malarin could sometimes get officious. Once I left a crystal detector on the table and the day operator, George Baxter, reported it. Malarin threatened to fire me stating my action could bring on a patent suit. The only result was that, thereafter, I kept my crystals in my pocket. The company was a bit nervous because its predecessor, the American de Forest Wireless Telegraph Company, had lost the famous patent suit on the electrolytic detector in 1906 which had been in the courts for three years which decision resulted in the firing of de Forest and later President Abe White. This opened the way for Christopher Columbus Wilson to become President of the United Company who died in the Atlanta penitentiary after conviction of fraudulent use of the mails. United Wireless only had rights to the carborundum detector, invented by its Vice President, General Dunwoody. This detector was inferior to others,

Captain Matson had a standing order that any message from any of his ships received at night was to be telephoned to his home. It was his daughter Lurline that had to answer the telephone. Many a time her sleepy voice would come on the wire in the small hours of the morning but we always got a laugh out of it.

In those days the Navy had the first half hour and we had the last half hour. This was a good arrangement because I could use the Navy time to put messages on the Western Union wire, do necessary telephoning and read stories. In 1912 I had the second trick at Hillcrest. While reading an exciting story of a south sea pirate attack, the wireless shack shook accompanied by a loud noise. There had been an operator's strike and we had a revolver that George Baxter borrowed from the National Guard armory. Grabbing this I rushed outside but saw nothing that could have caused this. Just as I got back into the story it happened again. Realizing that someone was hiding in the privy I announced that whoever might be in there had better come out as I was going to put a bullet through it and fired a shot into the air for emphasis. Out came my amateur friend Bill Larzelere who had dropped large rocks on the roof from the hill above, looking a bit pale.

The most interesting part of the PH job was receiving messages from immigrants on Japanese vessels, which they would start to transmit as far as 1500 miles west of Hawaii. One evening at five the lumber schooner Fort Bragg sent me a message reporting leaving port but stopped in the middle of it. The next morning I found the operator in the downtown office. Crossing

the bar a big sea washed away <sup>the</sup> the radio cabin and, after floundering around in the water found a stanchion and pulled himself up. Malarin got him another ship.

Due to the 1906 fire, I graduated from high school in December 1909 and since it was not expedient to enter college then, asked Malarin for a job. He put me on the S. S. Riverside going to Puget Sound, Captain Dalquist. The upper berth in my room was used by the company for transferring men and on this trip it was the accountant that checked expense statements. Needless to say, he was unpopular and, not being a good sailor, had to rush on deck at the first meal because his water glass had been filled with sea water. I spent a lot of time evenings relaying messages to CH which generated a lot of ozone and this poor fellow would lean over the edge of the bunk and, with tears in his eyes, ask when I would finish. The climax came when the officers told him the roughest part of the trip would be the passage from Seattle to Tacoma and I can still see him on the bridge peering through binoculars looking for the rough water. The ship then went to Olympia and discharged many tons of black powder. When I saw men crunching around in this stuff on the decks and dock, due to breakage of some of the canisters, I took a long walk for the day until they were through unloading. Then I was told of a terrible explosion there when the overhead tramway had an accident while carrying dynamite.

The next boat was the sister ship, S. S. Falcon, again Captain Dalquist who had been transferred. He was an expert seaman but so nervous he would stay awake nights for fear his mates might wreck the vessel on the coast. This actually happened. While the exhausted Captain slept in a wicker chair in his room off the bridge, the mate ran aground on Blunt's Reef very early one clear morning with the Blunt's Reef Lightship in full operation. The ship was a total loss.

Malarin then put me on the Union Oil Tanker S. S. Washtenaw which I boarded at Oleun, Captain Graham who was a friend of a company official. Graham drank and was impossible. After pumping cargo ashore at Portland we were ready to sail at midnight but no captain aboard. The first mate with several men, as usual, found him in one of his favorite dens and five sailors carried him up the gangway and deposited him in his bunk. He came to life the next afternoon while crossing the Columbia River bar. The North Head navy station asked us to help a disabled sailing schooner being blown toward the beach but Graham would not take the time and incur extra expense. He sent for me one morning about six o'clock. I donned a bathrobe and was told never to appear without being dressed. The next time he sent for me I took time for dressing and was told that, when called, to come immediately. He met his Waterloo when he knocked down half of Schmidt's pier in Seattle.

Next came the biggest tanker in the world, the former Dutch Shell Oil Company's S. S. Pectan. She flew the British flag though owned by the Union Oil Company of California. As usual, a sample of the seashell the ship was named after, rested in a small glass case in the main cabin. We carried oil to Chile. Jim Watkins partially installed the wireless set at the Union Iron Works at San Francisco and I finished the job at sea. She

had a very cheap compressor for refrigeration which kept breaking down. Due to a strike at the shipyard we had collected a "beachcomber" crew of derelicts and the Chief Engineer and I were the only ones capable of using tools. We kept repairing this compressor until, off the Galapagos Islands it broke down for the last time, the ice box got warm and we threw all the perishable food overboard except some meat we put in brine in casks on the boat deck. I was thin as a rail when we got home. In addition, the main engine broke down in Chile. Repairs were made in Taltal but more breakdowns occurred along the California coast and we entered the Golden Gate doing about three knots and had to wait for an incoming tide in order to make it through. The Pectan was finally wrecked on San Miguel Island off the Santa Barbara Channel. Her Captain was the most nervous of any of them.

On the southbound voyage, just after crossing the equator, I picked up 500 cycle signals from a Telefunken equipped ship speaking German. I called him but he did not answer. Later I heard him ask who UW (my call letters) was. I called again and he answered. It seems he answered my first call on the 600 meter calling wave whereas I had been tuned to his working wave. He was following the rules of the 1906 Radio Convention which the United States did not ratify until 1912, so I did not know about calling and working wavelengths. It was the ship Holger of the German Cosmos Line, just out of the Strait of Magellan, having coaled at Coronel. Later we were together in the port of Taltal. The operator was a Telefunken engineer sent to demonstrate a new model of wireless equipment to South American governments. They were taking off old equipments on their ships which were being rebuilt at the factory and sold, some of them to the United States Navy. I received an education in modern apparatus and methods. The installation had a remotely located and controlled motor-generator, power factor correction, quenched spark gaps, corona shields on the antenna wire, a sharply tuned receiver wound with litzendraht and an electrolytic detector. He then took me to the cabin where beer, pretzels, coffee and cake were served. Every evening he would handle messages with a station across the Andes at Bahia in the Argentine where there was a cable connection with Hamburg. I could never hear the Bahia signals even with my best crystal but on his set the signals were very clear. I had a United Wireless type "D" tuner which we got to call the detuner.

75- While in Taltal I visited the largest sailing ship at that time, the barkentine Preussen, all steel with steel masts and yards and wire rope running rigging. She was hauling nitrates to Germany. They would not let me walk on the freshly hollystoned poop deck. If the captain made the voyage to Hamburg in 90 days (steamers made it in 64) he received a substantial cash bonus and a chance to try it again. But if he failed he was transferred to a smaller vessel. Picking up a French language newspaper that fell on a Sacramento Street cable car I learned that this beautiful ship had been wrecked in a fog in the English Channel by collision with a steamer. In 1956 I found her ship's bell in the New York Yacht Club's quarters at the marine museum at Mystic, Connecticut. At Taltal, I saw her towed to sea and depart with all sails set.

While on this South American trip, the new PH at Daly City was put into operation. The hours were 8 pm to 8 am. A. Y. Tuel was the operator and I picked up the signals off the coast of Lower California. By the time I got home he had resigned and joined the new Federal Telegraph Company. Just previous<sup>to that</sup> the late J. O. Watkins had also left to go to the new company. The Captain wanted to be towed into San Diego but the company sent orders by wireless to continue to San Francisco. The wireless was unpopular, the captain no longer being a dictator at sea. However, I helped reinstate some interest in the wireless when I reported the Jeffries-Johnson fight at Reno, blow-by-blow, sent to us by the station at San Luis Obispo. The station I heard the farthest south was that of the Navy, TH, on the Farallone Islands. Two years before, this station was able to connect with the round-the-world fleet when it was in Magdalena Bay for target practice.

Among other ships was the passenger vessel Santa Rosa in 1911. She sailed every Thursday in the morning at eleven for San Diego, returning the following Monday. The ship was due to pass Points Arguello and Conception about three thirty Friday morning. Captain Alexander always told the mate on the midnight watch to call him at three and besides, he set an alarm clock in his cabin. He did not trust his mates but set the new course himself because if it was done too soon the ship would run into the land and if done too late, pile up on San Miguel Island. In July the Captain took his annual vacation at which time I left the ship to attend surveying school. The mate from another ship was given the command but at midnight Thursday he just told the mate on watch to change the course when abeam of Point Arguello light and turned in for the night. The mate did this but used the headlight of a railroad locomotive coming up the coast. The ship ran aground on a sandbar and when the tide went out broke in half. Two sailors were drowned rigging a breeches buoy. Operator Kessler at PH handled most of the emergency traffic that day. For years I could see this ship's boilers in the beach sand when going by on the trains.

While on the Santa Rosa, I heard that de Forest had a station on the Phelan Building in San Francisco and another on the Security and Savings Bank Building in Los Angeles. The next time ashore I found the Phelan Building station door locked with a sheriff's attachment notice on it. Later I found the same situation in Los Angeles. de Forest had put in quenched spark 500 cycle transmitters working in the 2000 meter band but, while signals were good, he had no pick-up and delivery facilities and consequently operated at a loss. The Federal Telegraph Company bought his equipment at the sheriff's sale and in 1912 I bought some of it from Federal's Chief Engineer, Cyril Elwell, for the laboratory at the university.

Arriving ashore one Monday in June, 1911, Malarin told me I had to have a Federal Government license. The Ship Act of 1911 had come into force. I could take an examination at Mare Island or at the office of the new Department of Commerce Radio Inspector R. Y. Cadmus. I chose to see Cadmus. Knowing that I could telegraph he said he would ask me one technical question. If, during a sea emergency, all my Leyden jars became broken, how would I transmit a wireless message. I answered: "Put some

bottles in a tub, put sea water in the tub and in the bottles, put wires or chains down the bottle necks and connect them all together." Right answer, he said, and gave me my Certificate of Skill. We became friends. When the new law of 1912 came into effect, Bill Larzelere and I wanted the first two licenses. Cadmus gave us examination questions and told us to write our answers at home as he had to go to Los Angeles. We gave him the papers on his return. Some days after he told us that he had not been able to look at them but gave them to his wife to examine and that she had given us both 100%. We got the licenses. Soon he was transferred to Baltimore and Robert Woolverton became Inspector after the vacancy had been filled for a very short time by Thompson.

One day Mr. Cadmus showed me a new wavemeter with a leather carrying case, recently sent to him from Washington. It had been made by the Wireless Specialty Apparatus Company and cost \$650. Borrowing it, made a copy of it at home winding the coil on a piece of fibre tubing and making a variable condenser with copper discs taken from discarded electric house meters. These two wavemeters were the only ones I knew of around San Francisco except one owned by the Federal Telegraph Company and theirs was for long waves. The Federal Company made beautiful variable condensers having dies with which to stamp out the plates. Once, I called on Mr. Elwell and tried to buy some of these plates but he would not accomodate me.

The summer of 1913 I ran on the lumber boat George W. Fenwick, Captain Ludlow. In his younger days he was a quartermaster on the old Pacific Mail steamer China. On one trip she encountered a typhoon near Guam. The wind was so strong the pressure on the control wire kept blowing the whistle and the frightened passengers huddled in the lounge thought the ship was calling for help. Ludlow's job that night was to go aft and read the log. This, he explained, took about two hours as he had to crawl carefully and cling to something all the time, being washed by the tremendous seas. A freighter that was near then never was heard from. Finally a big sea washed the after deck house away with several persons in it. I remember reading in the morning paper many years before, how the China arrived in San Francisco partly wrecked.

Ludlow also was a mate on the Pacific Mail ship Korea, its best vessel. In port all the mates had to work cargo hatches. So those mates who had watches when sailing, were already worn out from long hours of working. So it was one night when the Korea put to sea from Yokohama and Ludlow was on the first watch. After dropping the pilot, Ludlow suddenly awoke finding himself draped over the bridge railing having been sound asleep. Rushing to the opposite side of the bridge he found the other mate sound asleep. The quartermaster at the helm in the wheel house couldnot see anything except the binnacle in front of him so here a large passenger ship was hurtling full speed through one of the world's busiest waterways on a dark night without any lookout, a result of penurious management policies.

During my last years at Berkeley several of my class, for a thesis, built a radio laboratory in the engineering building. The new 300 foot tall Campanile tower was under construction and

I wanted to string a wire from its top to the Mechanics Building chimney for an antenna. The University authorities refused permission. But I put it up anyway, by making friends with the watchman and doing it under the cover of a rainy Saturday when no construction work was in progress. This was because my electrical engineering professor, H. F. Fischer goaded me by charging that I did not have any resourcefulness. The wire was so high up that nobody noticed it. With this antenna we could pick up the large 500 cycle Telefunken stations on the German islands of Yap and Nauru, 6100 and 5100 miles away respectively. A German company was mining phosphates on Nauru and kept in touch with Hamburg by radio to Yap and then by cable. These communications were destroyed by the Japanese at the outbreak of war in 1914.

Taking courses in astronomy on the side, I was asked by the astronomy department if signals from the Navy station at Arlington, Virginia could be received. At that time a project was under way to exchange radio signals between Washington and Paris, to obtain a more accurate figure for the difference in longitude. We did this, piping the signals to the astronomy department building where connections were made to a chronograph and the local sidereal clock. After months of observations a substantial correction in longitude difference was secured between Washington and Berkeley.

We received bad interference with the signals from the distant German stations every time the Federal Telegraph Station at South San Francisco started up although the latter was on 7500 meters wavelength whereas the German stations were on 2500 meters. I suspected that the Federal station was radiating a strong third harmonic. One Saturday, Ellery Stone and I took a wavemeter to the Federal Company's beach station and concealing ourselves behind a guy anchorage, found that plenty of harmonics were being radiated. This was an important lesson to me. Later I was told by Eugene Sibley who built the radio system across the United States to service the Post Office air mail route, that he used to listen to these German stations when he was a Navy operator on the collier Jupiter and that the big Federal station always interfered.

The patents for the Poulsen arc system were licensed to a California Corporation which was organized by a Stanford University graduate named Cyril Elwell in September 1909, named the Poulsen Wireless Telephone and Telegraph Company. It was reorganized in 1910 as the Poulsen Wireless Corporation and, after demonstration stations had been built at Sacramento, Stockton and San Francisco, an operating subsidiary was established named the Federal Telegraph Company. A public telegraph service by radio telegraph was established from Portland to San Diego and stations put in Phoenix, El Paso, Kansas City and Chicago for a system never put into operation because of technical difficulties. In 1912 a successful service was inaugurated between San Francisco and Honolulu.

One of the pioneers on the Pacific Coast was Sydney Maddams. He learned telegraphy at the Government Telegraph School in London and, in 1901, became a telegraphist in the Central Telegraph office where there were 3000 men operators manning the

provincial circuits and 2000 women operating the Metropolitan London circuits. At that time Mr. Marconi was conducting experiments with his wireless telegraphy but as he did not even know the telegraph code, he was loaned operators by the government. In this way Maddams was sent to Poldhu where he would send the letter "S" for fifteen minutes and then listen for fifteen minutes. These tests proved to be a success and Marconi, aged about 31 then, gave vent to his Italian temperament by jumping up and down and slapping the operators on the back. Maddams went to Canada in 1905 and late in 1907 helped build a wireless station at Pachena Point on Vancouver Island which was equipped with Shoemaker apparatus. He relates that the U.S. Navy station had trouble communicating between Tatoosh Island and the Bremerton Navy Yard, whereas Maddams was unable to communicate with the Canadian station at Victoria. So Maddams received help from Tatoosh Island who relayed for him to Victoria and Maddams relayed from Tatoosh to Bremerton. Pachena Point had call letters KPD. Maddams then joined the United Wireless Company and, on May 16, 1908 operated at PH at which time he worked the ships Hilonian, Enterprise, Alameda, some American Hawaiian Steamship Company vessels, some China Mail and Japanese Marus. While at PH he heard music, "The Merry Widow Waltz". Then a voice asked if anyone heard it. Replying by telegraph he said: 'Yes I heard it very loud and clear. What is it? Please come back by voice.' The voice came right back. It was the little wireless telephone on the battleship Connecticut, of the Great White Fleet. Maddams telephoned the Examiner to send up a reporter to listen to these signals. The story was printed in the paper and Maddams received \$10 for it.

George Jessup sent Maddams on the S. S. Hilonian which was having equipment trouble which he corrected, making fourteen round trips. On the last one to Honolulu he met Jack Balch who offered him a job. He was put in charge of the new station at Kahuku, built by Isbell, and gave it the call letters HU. He said that Balch had ambitions to establish a commercial circuit with the Federal Company at San Francisco and opened negotiations. Maddams made tests and was able to receive excellent signals, night after night, from the Federal Stations at San Francisco, Phoenix and El Paso. The Federal Company sent their President Beach Thompson and A. Y. Tuel to Honolulu and finally established their own station at Heeia Point and opened service in 1912, employing Maddams as their manager. Having lost out on this, Balch went to New York and tried to interest the American Marconi Company in a circuit but they had plans of their own and threatened Balch with suit for infringing some of their patents on his inter-island system. Finally they agreed not to sue if Balch would get them the required franchises in Hawaii. Their service, with 300 kw spark stations, opened in September 1914. Maddams retired from the company (then Mackay Radio and Telegraph Company) in 1945.

Graduating from college in May 1914, I became assistant engineer at the 300 kw trans-Pacific Marconi spark station at Bolinas with its receiving station at Marshall on Tomales Bay. My classmate, Lewis Clement, got the same job at Honolulu. We were indebted to Mr. Ginman for these positions. No radio equipment had yet been installed. This work started when the general contractor, J. G. White Engineering Corporation, finished leaving a crew of about 150 men. My boss, Adolph Rau went off to marry the telephone

girl in the San Francisco office and then took a three week honeymoon. When he returned we were testing with Honolulu. It was not an easy job. Blueprints were missing, some were wrong, some equipment did not arrive and my only technical assistant electrocuted himself. About 2000 amperes flowed in the local oscillatory circuit through twentyfour inch wide busbars. When we first turned this power on the building filled with smoke from burning paint on the beautiful steel and iron busbar supports which got very hot. New parts of bronze had to be made in San Francisco which took time. At the inauguration of service, Mr. Ginman brought a busload of prominent San Francisco men including Mayor James Rolph, to Bolinas. While they were looking at the oil filled entrance insulator for the antenna feeder, it exploded but fortunately the oil missed hitting anyone. It took quite a while for a crew to chop a hole in the concrete wall for the feeder so that the exchange of congratulatory messages could continue.

As the Marconi Company had no patent rights to good crystal detectors, they provided the old magnetic detectors but these were very insensitive and we were expected to use carborundum detectors, rights to which were acquired through the absorption of the United Wireless Company in 1912. We did our best work with other crystals. In 1915 when a circuit was opened with the Japanese, de Forest audions were used clandestinely.

While playing tennis with George Baxter before lunch one Saturday in November 1914, a steamboat whistle sounded close by. There was a fog over the ocean. We climbed down the bluff to the beach and could dimly see the vessel. She had run up onto the reefs that fringe this coast, while en route between Point Reyes and Point Bonita, an area known to early mariners as "The Potato Patch." Soon the fog lifted some. A self-righting self-bailing boat with three men came from the Point Lobos Life Saving Station, the ship having sent an SOS call by radio. The men in the boat could not get near the ship, the rough water overturning it. We saw only two of the men climb back onto it. The ship tried to launch a boat but it was dashed to pieces. A second boat did not survive, the two sailors in it being drowned. They tried firing a mortar shot ashore but it fell short so the mate put in two charges of powder for the next shot and the gun was torn from its lashings and struck the mate in the chest. Our chief rigger, George Hanson, established anchorages on the cliff and made up a breeches buoy rig in case a line could be put from the ship. About sundown a young man named Schwerin volunteered to swim ashore with a line but it became untied and when he reached the beach it was gone. At dusk some of our men found a corpse in the surf and brought the blue body to one of the fires we had burning along the beach. Soon the corpse moved its eyes and we revived the man in the hotel kitchen. It was Captain Clark, the third man that did not get back in the surf boat. He had gotten caught in a rip tide and swam all afternoon before touching the beach at which moment he became unconscious.

Meanwhile some reporters from the San Francisco Examiner appeared on the scene and when they found nothing was being done they telephoned the Steamship Company but it was closed so they

then called the newspaper. Telephoning the Golden Gate Life Saving Station, the Examiner found these people had no funds for travel expenses. Indeed, their horses for pulling surf boats on the beach could not be replaced until they died. The Examiner hired a truck and the crew arrived at the accident scene about one in the morning. The life saving crew worked with precision and put at least two lines aboard as we discovered the next morning but they fell fore and aft where they could not be reached. The wooden ship had been breaking up all afternoon and evening. The cargo of railroad ties with doors, inside furnishings and all sorts of wreckage came ashore. By one am all 83 persons aboard were huddled on the bridge and pilot house. We maintained communication with the wireless operator using flashlights. About two o'clock the ship broke up. We could hear the wails of the people wafting over the water. Somehow the operator's flashlight started up again from a piece of wreckage and he told us the water was covered with fuel oil and that this was suffocating some persons. When all was over the next morning 23 out of 83 were gone and the S. S. Hanalei was no more. Among the dead was the wireless operator. Among the living was Captain Carey and the mate with the broken ribs. After the investigation the captain's license was suspended for a year. Later he was captain of a Dollar Line ship which stood by at the S. S. Vestris disaster off the New Jersey coast. A life saving station was established at Bolinas but it has long since been discontinued. I wrote the following verses about this incident.

#### A TALE

It is a tale by all asserted,  
Near Bolinas by the sea,  
Upon the rocks that shoreward skirted  
Was piled the steamship Hanalei.

At noontide on a day of mist,  
From her course far led astray,  
She quietly settled with a heavy list,  
Unsheltered either from sea or spray.

Now all that remains of the little ship  
Are some sticks and timbers on the sands,  
Tossed hither and thither by the grip  
Of the swells beneath where Marconi stands.

Relations with Adolph Rau deteriorated and he took to communicating with me by mail. I reciprocated but in February, 1915 I resigned against Mr. Ginman's advice. He said the company had a great future. Later that year he resigned also saying he did so for the same reasons that I had left. He went to London, obtained sales rights for China from the Marconi Company, sold the Chinese a lot of apparatus and collected a handsome profit. In 1921 we found some of this equipment in the railroad yards at Harbin still uncrated. In 1934 Adolph Rau came to my office in New York seeking employment, the depression having been unkind to him. I admired his courage to do this and sent him to Washington to represent the company on two projects under construction in that locality until they were completed.

In February, 1915 I went to see George Hanscom at the Mare Island Navy Yard. He put me on as a machinist at \$4.32 a day and later secured an appointment for me as "Expert Radio Aide".

I also took the examination in San Francisco for Engineer-at-Large which took three full days, passing as number 9 out of 39. The Reclamation Service offered me a position at Denver at \$100 per month which I refused, earning more than that at the yard. This examination qualified me to take the examination for 2nd Lieutenant in the Army Engineer Corps. It was said they made this examination so tough nobody could pass it leaving the Corps free to pick persons acceptable to them. After the war started the Corps offered me inducements ending with an appointment as Lieut. Colonel without examination provided I could pass the doctor. But I decided against a military career.

My duties at Mare Island were running the laboratory, designing apparatus and fitting out shore stations. Later, I put special equipment on ships including direction finders on the 4-stack cruisers. One early job was participating in the 30 day acceptance tests of the new 100 kw arc station at Darien in the canal zone. I also was inspector on the purchase of Federal Company arc equipment, investigated inventions and worked on parts of the 200 kw arc station being constructed at San Diego. The technical aspects of the privately owned radio stations that the Navy took over as we entered the war, came under me. In this way, the Bolinas 300 kw rock crusher came under my control again. Arthur Isbell, after returning from Alaska, was the resident representative for the Marconi Company. We soon shut the station down because of the terrific interference it produced.

At Mare Island my interesting experiences were numerous. I will relate a few of them. After the war started Arthur Rice who had charge of ship installations, often had an emergency job to do over a week-end. Usually I found on Monday mornings, that he had taken equipments out of the laboratory for a rush job. I did not mind this if he only would replace them but he never did that. When I complained he only gave me a patronizing smile. I told Commander George Cook Sweet who was on special duty from Washington about this and he took me to his class mate, Captain Yarnell (later an Admiral) who was Captain of the Yard. Yarnell ordered up a Marine guard for the building at night and on week-ends and only Sweet, Commander Coman (the Radio Officer) and I had keys with the right to enter. Rice was completely frustrated and of course the whole yard was wondering what sort of mysterious things were going on in that building. This continued until I was transferred to Washington in July, 1918.

One day the Commandant told me to see the head of Naval Intelligence in San Francisco, Commander Van Antwerp. The Commander told me he had been asked to verify that a large radio station sending in the German language, was located in Mexico and could I help? Assigning a couple of his officers to me I constructed four direction finding receiving sets in the shop and installed them, one at Point Loma near San Diego where Ellery Stone was in charge, one on a bean farm where the Los Angeles airport now is, one at Phoenix and one at El Paso, the last two at the former wireless stations of the Federal Telegraph Company. With these we triangulated and found the station to be near Mexico City. One of my assistants, Ensign Robert Morton who was in the Naval Reserve knew an astronomer at the Mt. Wilson labora-

tory who had a Western Electric Company amplifier in the Pasadena laboratory. He borrowed it and we set it up in a barn on the bean farm. As usual the amplifier squealed loudly when you did not want it to and on the second night about four in the morning we were ordered out with our hands up at the point of a gun by a squad of Army Intelligence men. It seems the farmer became suspicious hearing these strange noises and turned us in. The incident ended by all of us, except the farmer, having breakfast at the hotel in Inglewood. Soon after returning to Mare Island we received a letter via the State Department from the Ambassador in Mexico telling how he watched this station being erected in Chapultepec Park while on his morning horseback rides. We later found that C. Reuthe, the German manager of the Sayville station on Long Island who fled the United States with his Polish engineer the day before the declaration of war in April, 1917, built this Mexico City plant with a 100 kw spark set formerly used at Nauhen, Germany which had been smuggled through the British blockade on a Swedish ship.

Needing a vacuum pump at Mare Island early in 1915, I went to see a glassblower in Oakland named Hyde whose specialty was making mercury rectifier tubes for charging batteries. He showed me some small radio tubes he was pumping out. They were in an oven that was very hot. He said that some days before two men named Moorehead and Meyers came to him with a de Forest audion bulb asking if he could make some like it. Telling them to come back in a week he decided to use a more simple construction by sealing the ends of a simple glass tube and stretching the filament through its center. Asking him why he was pumping them out in an oven he explained that he learned to do this when he was manager of the General Electric Lamp Works in Emeryville because this enabled all of the gas to be evacuated.

Dr. de Forest had a booth at the Panama Pacific Exposition at San Francisco which he left in charge of Meyers. Moorehead was a wireless operator who had been employed by Isbell on the Marconi station construction projects at Juneau and Astoria. On returning to San Francisco he visited the Exposition and noticed Meyers was selling audion bulbs at five dollars each. Moorehead's fertile mind conceived the idea of making such tubes and selling them over de Forest's counter and pocketing the proceeds. Talking Meyers into this led them to visit Hyde. Going back a week later to get the vacuum pump, Hyde told me the two men returned with a radio receiver and his samples worked so well that they locked arms and danced around his place, giving him an order to manufacture fifty tubes. Not long after Bill Larzelere brought one of them to my house to try, having bought it at the Fair for five dollars. It worked well and I still have it.

When the fifty tubes had been sold, Moorehead and Meyers went to a glassblower in Berkeley named Fosdick, who did work for the University Physics laboratories, and ordered fifty tubes, leaving a sample. Fosdick knew nothing about pumping them hot so they lost their vacuum when lighted up, but they sold at the Fair on the reputation of the first fifty. The Fosdick tubes could be identified as he used colored rubber tubing over the wires whereas Hyde used colored braided sleeving. Meyers came to the Navy Yard with a handful of tubes but I told him Washing-

ton did all the purchasing but if he would leave some samples I would try them on the Alaska Supply ship Saturn and if they were good I would send a favorable recommendation to Washington. The samples soon became worthless. Soon Meyers fled to Canada to escape creditors and wife trouble. Eventually, he worked for de Forest again in New Jersey. Neither Hyde or Fosdick were ever paid.

Moorehead established a laboratory on Mission Street in San Francisco which I visited from time to time. He worked long and hard to develop a good tube and eventually succeeded but how he financed this effort was a mystery until it was learned that he had a silent partner named Cunningham, who had been operating a radio store called Haller and Cunningham. In due course these men, and Hyde who had been doing a brisk export business with his tube, were sued by the Marconi Company for infringement of the Fleming patent. The Marconi lawyers had a hard time. Usually, after the long trip to San Francisco, the judge would adjourn the case on petition of the lawyers for the defense. Finally, Cunningham negotiated a license agreement which provided that, if he should ever give up making tubes, he had the right to hand pick tubes from Marconi's production and have his name put on them. RCA inherited this contract and, as everyone knows, the Cunningham tubes usually were superior to those bearing the Marconi label.<sup>CH</sup> Later, Cunningham became President of the RCA manufacturing company at Camden, N.J. The Moorehead tubes were sold in large quantities during the war, 50,000 to Great Britain and 100,000 to the U.S. Signal Corps. Moorehead used his profits to fall into very fast living and died soon after the war was over. It was his tubes, purchased on the war surplus market, with which I equipped the Federal Company new coastwise radio telegraph system during 1920 - 1922.

It was in 1915 that the transcontinental telephone line was inaugurated, made possible by de Forest's amplifier, rights to which were acquired by the American Telephone and Telegraph Company in 1912 who perfected the device. At the invitation of telephone engineers I was in Native Son's Hall the evening before public service was inaugurated and from a telephone on the main floor, talked with a man in the basement over some seven thousand miles of circuit, via New York City. The A. T. & T. Company had an exhibit in the same building where de Forest had his booth at the Fair, where they told about the new trans-continental service and passed out brochures which mentioned inventor Pupin but not de Forest. It was called 'The Story of a Great Achievement.' This infuriated de Forest who had some brochures printed with the same cover, put his picture in place of Bell's and had then passed out to persons leaving the Bell exhibit. Across the back of his own booth he stretched a twelve foot banner proclaiming: "The de Forest audion amplifier, leased to the A.T. & T. Company as a telephone relay, made the Transcontinental line possible."

In Washington, I had charge of the construction and maintenance of all high power radio stations. Besides those already completed at San Diego, Pearl Harbor, Darien and Cavite, new installations were going in at Guam, Sayville, Tuckerton, Annapolis, Puerto Rico, the new 1000 kw station near Bordeaux, France and the Alexanderson alternators at New Brunswick. I spent considerable

time with Alexanderson and Harold Beverage on this interesting project.

General Pershing at the head of our forces in France, became much worried about the Germans cutting submarine telegraph cables, having demonstrated their capabilities by cutting two off Fire Island, New York, in July 1918. At his instigation it was decided to build another large station of 1000 kw size, in the United Statesland to avoid possible winter sleet storms that wrought havoc with antennas during the winter of 1917-1918, North Carolina was chosen, particularly since this was the home state of Josephus Daniels, Secretary of the Navy, who had to provide the funds by asking President Wilson for an allotment from the special appropriations Congress gave him for war uses. Daniels was very reluctant to do this. George Clark and I spent two weeks that July touring North Carolina in a Model T Ford automobile and picked a site near Monroe. Getting no action from Daniels, I went to Monroe and prevailed on Mayor Sykes and Chamber of Commerce President Henderson to wait on Daniels with a political delegation including a Senator and two members of the House. On the third day Daniels wrote the letter and the allotment was made.

Bernard Baruch's office refused to let us have steel for towers and I took recourse to a number of 600 foot brick chimneys for antenna supports. The Alphonse Custodis Chimney Company of Brooklyn signed up the output of several brick yards in the south for the tremendous quantities of brick needed. Contracts for the chimneys amounting to about \$3,250,000 were on my desk on Armistice Day for the signature of Franklin D. Roosevelt, Assistant Secretary of the Navy, and fiscal officer. Eventually the lands were returned to their owners and damage claims paid off. Alexanderson helped me design the antenna and made a drawing of one at lunch on the table cloth in the old Shoreham Hotel, then at H and 15th Street, N.W., Washington using a thick, soft lead pencil he always carried. In a modified form, this design was used at the RCA Rocky Point station in 1920.

During 1917 and early 1918 a wealthy radio amateur named Fabbri, found that he could receive good signals on his Bar Harbor, Maine estate from the European stations when they were poor or unusable at the receiving centers further south. He offered the use of his estate and was commissioned as a Lieutenant in the Navy. Finally, all receiving was concentrated there, two teleprinter circuits leased from the telephone company connecting with Washington by wire. Anticipating the possible duration of the war into 1919 and wondering if radio reception still further north might be better, I sent a man to St. John's, Newfoundland late that summer to make observations. This place was chosen as the cable companies had wire connections with the United States over which messages could be relayed. When this man unpacked the receiver sent from the Washington Navy Yard he found it was for shorter wavelengths than those used by the European stations, the important ones being Carnarvon, Wales; Stavanger, Norway; Lyons, France and Rome, Italy. Nevertheless he was able to send us better copy taken on harmonics radiated from these stations than we obtained at Bar Harbor during times when transmission conditions were below normal.

It was in May, 1918 that the scandalous deal was made whereby the Navy purchased the radio station properties and patent rights of the Federal Telegraph Company to prevent them from being acquired by the English Marconi Company, for the price of \$1,650,000. When brought to light, Washington Dodge, President of the Company, respected former Tax Collector of San Francisco and Bank Director, shot himself in the elevator of the Exposition Building in San Francisco. The company underwent complete reorganization. A Congressional Committee looked into bribery charges but none were verified. In 1919, legislation was introduced in Congress at the instigation of the Navy Department, to give the government a monopoly of external radio communications but it failed of passage. In 1919, the Radio Corporation of America was organized at the request of the Navy Department in order to prevent rights to the Alexanderson alternator being sold to the English Marconi Company. The decision was made to discontinue placing spark transmitters on United States government ships and 300 small arc type transmitters were ordered from the Federal Telegraph Company for vessels of the U.S. Shipping Board. I resigned at the end of 1919 and became an assistant engineer for the Federal Telegraph Company at Palo Alto in January, 1920.

When the Navy took over the radio telegraph stations of the Federal Company in 1917, the Company continued its telegraph business over leased lines obtained from the Pacific Telephone and Telegraph Company. When Mr. Beal, Chief Engineer, was sent to France in February to conduct the acceptance tests of the large station near Bordeaux, I was placed in charge. One Saturday morning Mr. R. P. Schwerin, the President, came to the Palo Alto factory and told me that the company was going out of the telegraph business because <sup>of</sup> notice that the line leases would not be renewed and that the employees were to be given termination notices. The telephone company said the lines were needed for the growing telephone business. I protested and said the company should revert to radio and ask for injunctions to hold the leases while a system was being constructed. Schwerin asked me to tell this to the Board of Directors on Monday which I did. The late Hiram Johnson, Jr., the company's attorney felt that as we were in interstate business and had built up a valuable public service (we charged the same minimum for 15 words as the wire companies charged for 10), the Federal Courts would protect us. The Company was successful in obtaining injunctions in California and Oregon good for one year between Portland and San Francisco and longer between San Francisco and Los Angeles.. Afterward, the telephone company offered leases as they were installing a carrier system along the coast giving them additional facilities but it was then too late. The company floated a \$500,000 bond issue and I built the system which was completed in 1922 including a service with ships. Telephone officials finally told us that the Western Union Telegraph Company, annoyed at the biting competition, asked them to discontinue the leased lines. An ironic twist came while we were constructing the plants. The telephone engineers said that one of the wavelengths we intended to use was right on top of one of their new carrier frequencies and the interference to them would be bad. These were the days before cables were used and the long lines were open wire and could pick up radiations from extraneous sources.

As all of their equipment had already been made, would we change to another wavelength? Since we had found out the truth about the lease cancellations and had no reason to annoy the telephone people and because it was easy for us to make the change, I accomodated them. This paid off, the telephone engineers thereafter being friendly and very helpful.

Western Union gave us other annoyances. One morning they posted a copy of a telegram handled by us, in the window of their office on Spring Street in Los Angeles. It was labeled: "For secrecy send your telegrams by Western Union". At that time there was no Federal law regulating secrecy of communications. Within hours we uncovered their clandestine receiving station and faced with this, they stopped the practice. By 1926 the Federal Company was handling over half of all the telegraph business between the Pacific Coast Cities.

In 1921, Mr. Schwerin sent a Mr. Morse to open negotiations with the Chinese government for a comprehensive radio system including a trans-Pacific connection. A contract was executed but the day before the San Francisco bond houses were to underwrite the bond China issued to pay for the projects, China defaulted on an interest payment on a loan carried by some Chicago banks and the deal came to a standstill. To finance this, Schwerin finally went in with the RCA on a joint enterprise called the Federal Telegraph of Delaware and Ralph Beal became its Chief Engineer. Due to other ensuing complications the project never materialized.

Leaving the Federal Company in 1922, I went to Mexico and negotiated several contracts on my own for communication systems but these were cancelled when the de la Huerta revolution started in early 1923. I settled in Los Angeles, Married Florence Bacon and acquired an orange by-products company, employing George Baxter as manager. One day I met Robert Morton on the street who told me he was Secretary of a new company organized to bid for the first air-mail route in the West which was to run between Salt Lake City and Los Angeles. The Post Office Department which was operating the transcontinental air mail service between New York and San Francisco, had decided future operations were to be done by contractors. Morton said if they got the award would I build them a radio communication system? They got the award and I built the system in 1925 and 1926. The line was called Western Air Express (now Western Air Lines). The stations were at Los Angeles, Las Vegas, Milford, Utah and Salt Lake City. Subsequent improvements made the Milford station unnecessary and it was dismantled in 1926.

Short wave radio was then in its infancy and little was known about their behavior. With a base station in Los Angeles transmitting signals on schedules, my wife and I spent about two months in the southwestern deserts in our car with a receiver studying radio wave propagation, resulting in the selection of 20 and 50 meter wavelengths for the system. We asked RCA for equipment quotations but they wrote that they had nothing suitable. We had to avoid infringing their patents, particularly vacuum tubes on the sale of which they had a monopoly. We organized a company in Nevada called Airways Radio Service, Inc., and after much searching, I got 250 watt tubes made by an X-ray

manufacturer in Hamburg, Germany. We bought enough of them to last for several years.

Our chief pilot was C. C. Moseley. He laid out the route using a de Havilland biplane. Coming into Las Vegas for fuel on one of his trips, he found quite a crowd of people at the field which had been made by scraping the rocks off the desert floor. They had followed the gasoline truck to the field. When he took off the plane was very wing heavy. Imagine his surprise when a man climbed up over the lower wing, a hobo that rode the brake rods into Las Vegas and followed the crowd to the field. He watched his opportunity and grabbed the lower wing skid when Moseley took off. He rode the plane into Los Angeles. Moseley said he came to the office the next day and begged for a lunch!

Finally opening day came and air mail service was inaugurated. Maury Graham started from Los Angeles and refueled at Las Vegas. Clouds were lying on the mountains to the northeast so Graham followed the Union Pacific Railroad through a canyon, keeping the rails in view by looking over his shoulder. Suddenly he saw an airplane pass below going in the opposite direction. Jimmy James carrying the westbound mail from Salt Lake City was doing the same thing. James lived to become President of the line. Graham, after racking up trophies for flying the most miles without an accident, ran out of fuel in a snowstorm near Zion National Park. Weeks later the plane was found undamaged with mail sacks aboard and, some miles away Graham's body. He had cooked a can of beans and went to sleep in the snow, forever.

Riding around with these pioneers was exciting. For fun we often chased bands of wild horses in the Utah wastes.

Early in 1927 Western Air's President, Harris Hanshue a former automobile racer, told me at lunch in Salt Lake City of the Air Commerce Act establishing aviation departments in the government and suggested that I should apply for the job of running the radio aid development program which was to come under the Bureau of Standards. Knowing Dr. J. H. Dellinger from World War I days, I wrote him and was promptly hired and put in charge of this work. It was here that I met the later famous Lloyd Berkner who became a life-long friend. He was to go with Admiral Byrd's first expedition to the Antarctic as communication expert and was assigned to my group for awhile to learn what we were doing. Needing more help, I found an electrical engineering professor at Lehigh University named Harry Diamond on the lists of the Civil Service Commission. I took him on and he became invaluable. Later he developed the radio sonde for upper atmosphere weather reporting and became famous for his contributions to the proximity fuze that was so successful in the late war. An award of the Institute of Electrical and Electronics Engineers is named in his honor.

Here we brought forth the first successful radio range after finding how to correct for the uncontrollable "night effect" error. A start was made on an instrument landing system. While this work was all absorbing I was anxious to get back into communications.

In July 1928 I received three offers. One was to build a trans-Pacific system for Stanley Dollar, one to head a department

of aviation in the Bell Telephone Laboratories and one to join the new International Telephone and Telegraph Corporation. I chose the latter, thus closing the aviation chapter in my career.

I. T. & T. Corporation had just purchased the All America Cables and the Mackay Companies which owned the Commercial Cable Company, The Postal telegraph Company, an interest in the Commercial Pacific Cable Company and the Federal Telegraph system that I had built. Its objective was world-wide expansion and the sky was the limit. They appointed me Vice President and Chief Engineer of the radio subsidiary companies and over a twenty year period we spread a system of radio communication all over the world. From 1927 to 1951 I was a delegate to most international communication Conferences and had very close relations with several government departments. When war threatened I was given an appointment to the National Defense Research Committee and later became Chief of one of its Divisions. In 1946 I was invited to the Atom Bomb trials at Bikini Island and in 1947 became a Panel Chairman of the Research and Development Board of the Department of Defense.

Highlights of my earlier activities in the I.T.&T. Corp., *capable* involved intensive development work to produce devices of being immune to patent infringement and some of the equipments and gadgets we evolved were unique. Then we won an important patent suit but it took seven years and the Supreme Court to do it. Our success was largely due to shop rights the Federal Company had to some of de Forest's inventions made while he was in the company employ in 1912. Ellery Stone was responsible for getting these rights preserved, legally.

When the second World War broke many of our people entered the military services. We were asked to provide a communication team to accompany the army for the North African invasion as the military did not want to be burdened with handling dispatches for the Press and soldier's messages. We put up a station in Algiers with a crew headed by Leroy Spangenberg. Later we supplied a team accompanying General Patton across France and into Germany and another team that entered Berlin the day after its capitulation. When the French government asked us to leave Algiers we established a large relay station in the international zone of Tangier which was very active for many years.

*an early*  
As a publicity measure we undertook to provide communication service for ~~Admiral Byrd's first~~ Antarctic Expedition. After the passage of the Communication Act of 1934 which forbade public service companies giving any free service, the Navy provided these for later expeditions. At a meeting with the Admiral in New York he mentioned that he was taking some anthracite coal with him as a precaution. Asked why, he explained that explorer Scott, who reached the South Pole only days after Amundsen had put his flag there, January 18, 1912, had taken kerosene in five gallon tins. Upon returning to his bases he found the kerosene gone. The Antarctic cold had crystallized the soldered joints of the cans so that they fell apart. Having no fuel to melt snow, for heat and cooking, his party perished. This was an example of Byrd's careful planning.

While in Spain in 1951, I was asked if I would accept an appointment as Telecommunications Advisor to the President. Such a <sup>ed</sup> post had been recommended by a special Commission appoint by President Truman to study telecommunications administration within the government. I flew to Washington to see the President. He urged me to take the position saying the various departments had objections to other nominees. Retiring from the I. T. and T. companies, I started this activity in October, 1951. In June, 1953 President Eisenhower abolished it as a special committee he had set up said too many persons were reporting to the President directly and, in a measure, they were right.

President Truman was a very personable and earthy man and entirely loyal to his helpers, too much so as he would back a man even if he knew he was wrong. I had to be careful not to ask him for help because if I did he would pick up the telephone and stir up all officialdom. When I went to see him he often would tell of his troubles. One day he handed me a small book whose pages had statements written by President Grover Cleveland and his Cabinet Officers. He said a small boy had found it in a trash can and sent it to him. I asked what he was going to do with it and the reply was he intended to give it to some boy that might visit the White House who he thought would treasure it. Truman was a hard worker. One Monday morning a huge pile of papers was on his desk. Asking what that was he called it his week-end homework saying he never had time to read in the office with all the callers, etc. But it was his ability, he said, to dismiss the cares of the day when retiring and enjoy a good sleep. Yet he was up before six for his early morning walk.

President Eisenhower, on the other hand, worked through a staff and innumerable people were not running in and out of his office. This habit no doubt was due to a military life devoid of political overtones. I got the impression that he did not care much for the job and was irked at the loss of personal freedom. Soon after he took office I happened to look out of the window to see a traffic jam on the street. Soon camera men were erecting tripods on top of cars. Eisenhower was practicing a little golf putting on the lawn. This invasion of privacy annoyed him immensely.

For five years I worked with a group developing and licensing inventions under the name of the Dualux Corporation, finally retiring from business in 1958.

I had become a member of both the Institute of Radio Engineers and the American Institute of Electrical Engineers in 1914. Elected a Director of the Institute of Radio Engineers in 1935 I became President in 1938 and continued as an Officer and Director until 1965 when I was named Director Emeritus. I served on the Committee that negotiated and administered the merger of these societies into the Institute of Electrical and Electronics Engineers which came into being in 1963 with a world-wide membership of some 150,000 engineers. In 1938 the Institution of Radio Engineers of Australia made me an honorary member at Sydney during their World Radio Convention. I was also a Charter Member of the Institute of the Aeronautical Sciences,

now the American Institute of Aeronautics and Astronautics.

There is not much left of the wireless and radio communications of the kind that developed during the major part of my career. Long distance communications, first by what we called long waves (now called very low frequencies) and later by what we first called short waves ( now called medium high frequencies), have largely been replaced by other methods, except for special purposes. These two methods which filled a world-wide void in communications and provided inexpensive communications to sparsely settled countries were subject to the vagaries of nature caused by interferences from lightning discharges and disturbances in the ionosphere caused by solar events and the eleven year solar cycle. As the demands for greater reliability, accuracy and need for larger volumes of traffic arose, newer methods were gradually developed. Now, only the ship-shore services continue very much the same as they have in the past. Individual message service by telegraph which, a few years ago, constituted practically all telegraph traffic, now takes second place to leased circuits and automatic printer connections established by dialing as is done with telephones. Data processing and the connecting up of computers on networks such as are used by the airline reservation services are demanding more and more communication facilities of high quality. Astonishing performances have been attained in outer space communications for the control of vehicles and the transmission back from them of information such as pictures, over many millions of miles. Most of these present-day accomplishments were not even dreams not so long ago.