GENIUS AT RIVERHEAD

A PROFILE OF HAROLD H. BEVERAGE

ALBERTA I. WALLEN

$15.95

Born on North Haven Island and prepared for college at North Haven High School, Harold H. Beverage was awarded the Bachelor of Science degree in Electrical Engineering in June 1915. He was destined to make significant impact with one of the greatest industries the world has even known — Radio Engineering.

He was associated from its inception with one of the world's most prestigious research and development laboratories; Radio Corporation of America, whose influence on radio frequency communication has affected societies over the entire earth in unprecedented ways. Harold Beverage achieved international recognition and due respect early in his enviable career for his brilliance, innovative engineering talents, and executive ability. Owing to his eminence in the wireless communication profession, he was recalled by his alma mater after only twenty-three years of pioneering accomplishment to receive on June 13, 1938, the honorary degree of Doctor of Engineering with all rights and privileges pertaining thereto.

On the occasion of his retirement from professional life at RCA in 1958 his friends and associates honored him by presenting the University of Maine Electrical Engineering Department with the Dr. Harold H. Beverage Award such that each year a student excelling in communications similarly might be honored in his name.

On November 18, 1959 he was initiated as an Eminent Engineer by the Maine Alpha-chapter into the national engineering honor society Tau Beta Pi.

He was called again to his alma mater on October 22, 1976 to receive the coveted Alumni Career Award for his distinguished devotion to the communication industry and his outstanding professional record. To mark this special occasion in fitting tribute, the RCA Corporation established an endowed scholarship at Maine named the RCA Harold H. Beverage Scholarship to remember in perpetuity this exemplary life.

Dr. Beverage is a man who shoulders a mantle of greatness with kindness, compassion and humility.

(Continued on back flap)

Among the community of important scientists and engineers who lived during the last century, he ranks as one of the pioneering greats; among Maine's prominent graduates, one of the greatest.

Dr. Waldo M. Libbey
Professor of Elecrical Engineering
University of Maine

Alberta Wallen, born in Connecticut, was graduated from Columbia University and received her MA in psychology and history from Trinity College in 1942. She devoted her professional life of over thirty years to teaching and administration. She then became involved in the restoration of a prerevolutionary house in Hebron, Connecticut which is now her home.

For sixty years Alberta Wallen has summered at North Haven, Maine. She speaks with a hint of nostalgia of her favorite island and it was there that the desire to research the life of Harold Beverage originated. After four years of collecting data and writing, *Genius at Riverhead* was completed, a story which otherwise might have been lost in the annals of history.

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1988

Photo Courtesy of Allan Beverage

The Radio Shack in the orchard on

North Haven Island, Maine.

1908

GENIUS AT RIVERHEAD

A PROFILE OF HAROLD H. BEVERAGE

BY

ALBERTA I. WALLEN

NORTH HAVEN HISTORICAL SOCIETY

NORTH HAVEN, MAINE

Cover: The classic Beverage two-wire wave antenna.

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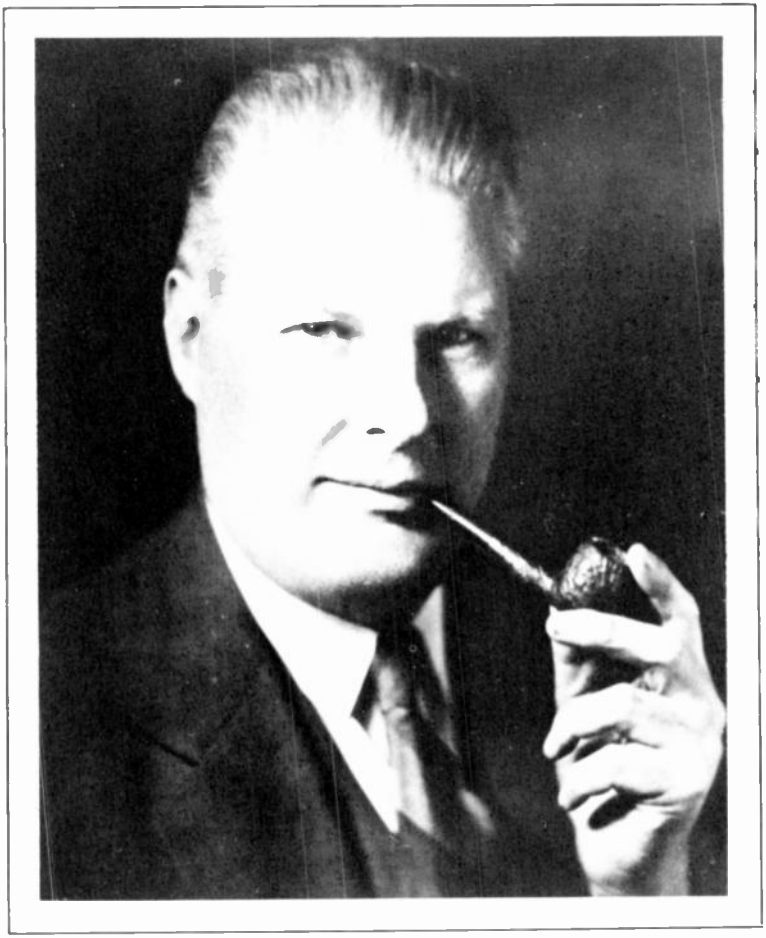

Harold H. Beverage

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Dedication
To Connie who first introduced me
to the unequaled beauty of North Haven

Preface

Within recent years, interest in tracing one's family "roots" has intensified. The North Haven Historical Society, organized in 1975, has taken the lead in researching, assembling and storing records of the town's history. These two facts have stimulated an increased awareness of North Haven's heritage.

The idea of conducting research of some of the island's men and women of the past was proposed to the Historical Society. The suggestion was received with interest. A list of those considered especially worthy of investigation was examined. Persons advanced as possible subjects for inquiry included, among others, the Reverend Benjamin Ames, Alexander Frye, Captain Ezekiel Alexander, Dora A. Ames, Harold H. Beverage, the Reverend John Alexander, Charles Brown, Dr. Lloyd Mills, Stanley F. Beverage, Leon C. Staples and Captain James A. Lewis. Initially, I hoped that this study might include as many as four noteworthy individuals. After consideration of the limitations presented, it seemed prudent to confine this research to only one person. Harold H. Beverage was selected.

It should be noted that I had a personal interest in the choice. During a visit to North Haven in 1927, I heard an interesting incident relating to one of the island's native sons. Leon C. Staples spoke with admiration for Harold Beverage, a young man who in the early 1920s had established the first radio station in South America. During the many intervening years, a desire had lingered with me to learn more about the exploits of that adventurer. It seemed the ideal time to pursue that interest.

It was readily recognized that information sixty-five years later would be limited since nearly all of his contemporaries who might have contributed pertinent information were no longer available. The happy disclosure that Harold Beverage was alive and well lent unexpected impetus to the endeavor. The wealth of firsthand information obtained over a four-year

period of correspondence with Dr. Beverage constitutes the major basis for this study. Fortunately, I was privileged to interview two remaining members of his family. Newspaper clippings, town records, letters and special documents all contribute to the preparation of the narrative. This document is presented with great esteem for an illustrious son of North Haven.

The facts in this study, as far as possible, have been documented. The impressions and assessments of the central figure are mine alone. An apology is offered for any inadvertent errors.

To the North Haven Historical Society, I owe a debt of gratitude for its sponsorship and continued support. My deep appreciation goes to Harold Beverage for the generous use of his time and energy, without which this study could not have been brought to fruition. I am especially indebted to Samuel Beverage for a critical examination of the manuscript and for copies of the Beverage family lineage. His loan of important photographs and his willingness to submit interesting anecdotes and folklore of the family's past was most helpful. I wish to thank Allan Beverage for sharing with me family pictures — many taken by his father, Stanley Beverage, and for his pertinent additions to the script. I acknowledge with much appreciation my good friend, Helen Popp, whose editing of the original copy was invaluable to me. My sincere thanks go to Nathalie P. Wright for her sustained interest in and unfaltering encouragement for this endeavor.

Alberta Wallen

Introduction

With more than fifty summers enjoyed on the beautiful island of North Haven, I have come to hold a special affection for its people. I have an abiding interest in their past and a firm faith in their future.

The islanders are hardworking, independent folk who for many generations wrested a living from the land and the sea. Within this modest lifestyle, one is apt to be unaware of the many sons and daughters who went from these shores to achieve unusual success in the outside world.

Brief references to several noteworthy persons of North Haven's past were made known to me over the years. Those incidents have remained vivid in my memory. After many visits in the home of Ed Mills, the fisherman, I was to learn only much later that it was his son, Dr. Lloyd Mills, who had established a reputation as a famous eye surgeon. The early geography book written by Alexander Frye had long been standing in my bookcase. A friend, upon noticing the volume, pointed out that the author had been a famous teacher as well as a native son of North Haven. Very recently, it was revealed to me that my long-time friends, Sarita Beverage and Samuel Beverage, were sister and cousin, respectively, of the celebrated radio pioneer, Harold Beverage.

It has been a unique opportunity for me to examine the documents assembled by the North Haven Historical Society. Finding sketchy references to men and women who had left their island homes and later had been recognized for some noteworthy achievement fired my imagination. To undertake a comprehensive accounting of these personages seemed a worthy endeavor. This document is the result of my research of the life of one individual of renown.

It is my hope that others may be challenged to carry on a study of North Haven persons of prominence. Especially, it is my desire that youth may find increased pride in their heritage and an awakened passion for further examination of their exciting past.

" . . . These people planted the seed which ripened into success for almost all who went out into the world seeking new services and new avenues for self-expression."

Leon C. Staples, *Our Island Town — North Haven*

1. Once Upon An Island

One may speculate on a small island's reaction when in 1940 a Maine coast newspaper carried the headline, "Maine Graduate Has Brilliant Career in Radio Engineering." On the island of North Haven there exists little evidence of the impact upon the community of the honor which had been proclaimed for a native son. Down at the boat landing one can surmise that the announcement drew from his peers varying degrees of enlightenment.

"By d---, I was in his class at school, he didn't seem that different from the rest of us."

"Don't you remember, some of us called him the whiz kid?"

"Where do you suppose he got that kind of brain?"

"Some guys fall into luck."

"By George, I always believed that Harold would go places in the world."

"I hear he's a millionaire."

Notwithstanding the reactions in the town of his birth, the illustrious career of Harold Beverage would bring him world acclaim.

Envisage a small outline of land twelve miles out in the Atlantic. North Haven, about the size of Manhattan Island,

is visible on a clear day from the mainland. There, heavy growth of spruce and fir reaching to the water's edge were familiar surroundings. There one could watch the harbor seals playing on rock outcroppings not too distant from the shore. There a boy grew up amidst peaceful splendor only infrequently touched by events in the outside world. This was the early homeland of the brilliant Maine graduate whom the newspaper extolled on that day in 1940.

1. Painting of the Fremont Beverage homestead at the Cubby Hole, North Haven, about 1917, artist unknown. Courtesy of Samuel Beverage

With a step back in time, the epic unfolds. The year is 1893, the date October 14th. The last fall harvest on the small island had been garnered for the long months ahead. Farm families had begun to "button up" against the inevitable blustering winds and frigid cold of a northern winter. Brown stubble covered the fields where earlier grain had displayed a verdant landscape. Sheep still frolicked on the rolling hillsides. The dainty blue harebells, so much a part of the

island landscape, slept until another spring. Everything seemed the same as so many Octobers past. But this October 14th was different and would be recorded as exceptionally noteworthy. Expectations were high in one little farmhouse where Fremont and Lottie Beverage tried patiently to await the birth of a third child. With pride in two lovely daughters, they agreed that a son would make the family complete. The excited announcement, "It's a boy," echoed through the household. Great elation attended the baby's arrival and the dream of anxious parents had been realized. A suitable name for the young child was considered with great care. The father wanted to give his son the most honored name he could think of -- the name of the great Republican President then in of-

2. *Harold Beverage (right), at an early age, with his sisters Alida (left) and Sarita.* Courtesy of Harold Beverage

fice. Benjamin Harrison was his choice. The mother, feeling that her boy would, in all likelihood, be nicknamed "Ben," resolved that a more appropriate name could be found. Finally, after lengthy deliberation, the new baby was called Harold Henry.[1]

North Haven island at the close of the nineteenth century was primarily a farming and fishing community with about 800 permanent residents. Growing up on a farm at this period with the absence of power machinery meant that the many necessary tasks were dependent upon hand labor. Each family member had special chores to complete each day. Even small boys were expected to do their share. It was said that young Harold could think of many excuses to escape work in the garden or hayfield. Rumor prevails that one of Harold's uncles was known to observe that his young nephew was never a farmer at heart. He revealed that when Harold's father sent his son out to work in the garden, he was likely to find him later under a tree reading a scientific magazine.[2]

Papa Fremont must have had more than one occasion to admonish his son. One can only guess at the number of times Harold heard his father say, "Son, vegetables need loving care; your reading can wait." Like many boys, Harold had difficulty grasping the importance of everyday necessities related to the running of a farm. He was obsessed with the revelations that his scientific magazines made so intriguing. Even baseball, the most popular game in town, held little interest for him.

Growing up in an active family often left little time for a boy to satisfy a consuming interest. By 1897 a younger brother, Stanley, had been born. Together with two older sisters, Alida and Sarita, it often became difficult for Harold to capture quiet moments. Reading the works of Marconi, listening to messages in Morse code, and indulging his inquisitive nature in wireless magazines were paramount to all other activities. A dream was beginning to take form.

3. Stanley Beverage, North Haven High School graduate, 1914. Stanley had a very successful career of 28 years with National Lead Company in St. Louis. (Many of the family photographs used in this book were taken by him.)
Courtesy of Allan Beverage

Impelled by the desire to expand his meager background, Harold, at age thirteen, made an unannounced trip to Massachusetts. For many years this adventure was shrouded in a mist of rumors but details of the true story eventually were revealed.

The excursion was precipitated by fascination with the mystery of ships far out at sea which could communicate with land. Young Beverage was motivated to see firsthand the mechanism that made possible this phenomenon. With $10 in his pocket, he slipped away from the island and once on the mainland, he boarded a train for Boston. While watching the motors which drove some woodworking machinery in the city, he was taken aside and interrogated by the manager of

the shop. The man, named Nixon, inquired for the location of the boy's home and further asked whether or not he knew anyone in Boston. Harold readily confided that his father's cousin, Orris Beverage, lived in town. As Nixon was acquainted with Orris, he called his friend who immediately came for the boy and took him home with him. Prior to his return to the island, Harold spent several days taking in the sights of the city including a visit aboard a docked freighter. There he met a wireless operator who demonstrated the equipment and encouraged him to consider a similar occupation. Harold thought a job like that would be the best of two worlds — a life at sea and a chance to indulge his hobby. The escapade abruptly ended when the prodigal son was returned safely to his home.

2. A Dream Ignited

Memory for Harold was vivid of the many times he had felt the excitement associated with listening to messages from faraway places. Some mysterious law of nature, he thought, must be at work. He dreamed of becoming a radio engineer who could extend the understanding of and possibly further the manipulation of that magical phenomenon. One great scientist fired the imagination of young Harold Beverage.

When Harold was only eight years old, Marconi, a nonconformist in the scientific world, was experimenting with electrical signals. A consideration of Marconi's unconventional ideas and a brief look at his experiments illuminate the revelations which incited Harold's curiosity.

Born in Bologna, Italy and educated at the university in that city, Guglielmo Marconi became an engineer. Although theoretical treatises had been published earlier, Marconi was credited with the first wireless signaling device. Unlike his predecessors who were reconciled to work with theories, he was representative of the experimental school. This method involved the process of "try it out and if it works in a useful manner, develop the mathematical formula afterwards."

In 1890 Marconi became interested in wireless telegraphy. By 1895, his apparatus was capable of sending signals for more

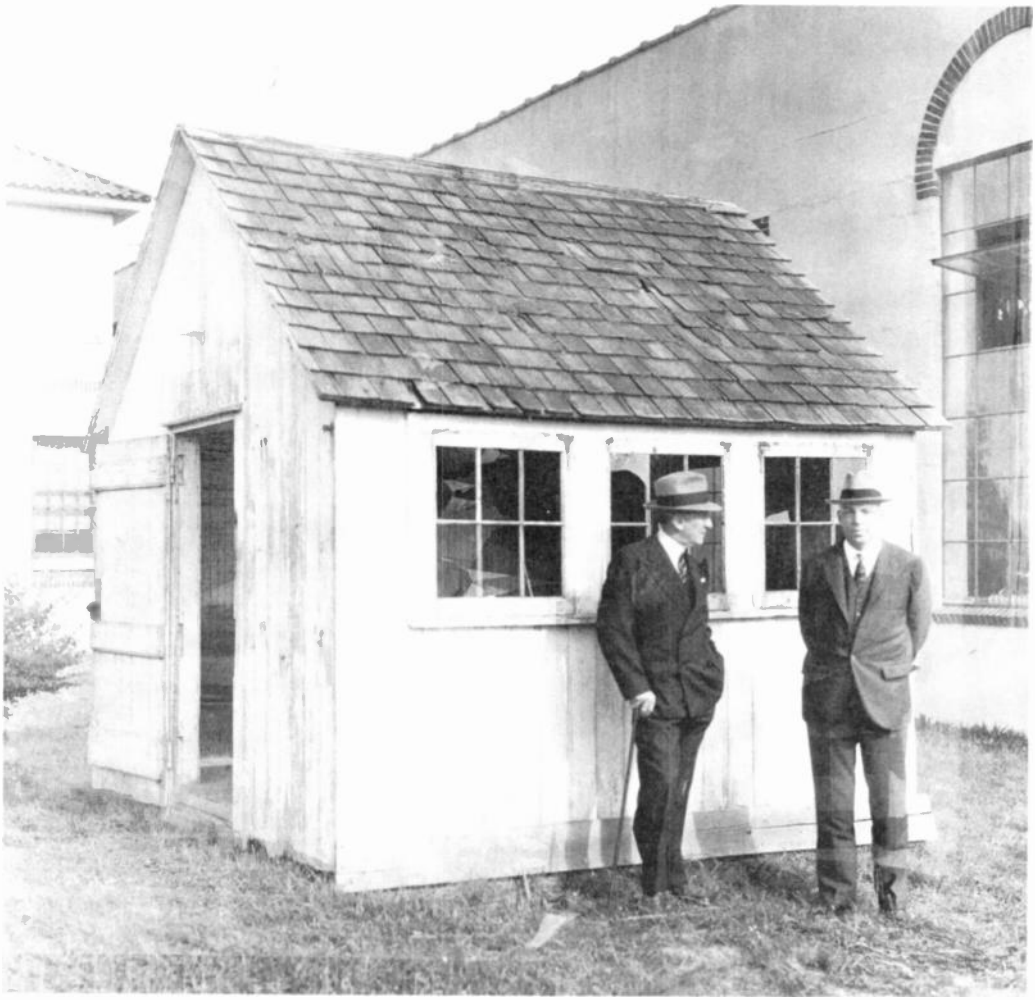
than a mile distant. He formed the Marconi Telegraph Co. Ltd. in London, England in 1897. Marconi's experiments between 1895 and 1900 were over a "line of sight" distance. The theory then prevalent promoted the idea that wireless signals traveled like light, limited to the range of optical distance — hence, the horizon. Marconi postulated that this reasoning was not necessarily true. He erected a transmitting center at Poldhu, Cornwall, England. He then traveled to St. Johns, Newfoundland, to test his belief. He used a kite to support his antenna while waiting for a signal from Poldhu. In December 1901, he heard over his improvised receiving set the three dots . . . of the code letter "S." His experiment had refuted the "line of sight" theory and had proven his calculation to be correct.

Later, the "line of sight" theory was challenged by others. Oliver Heaviside in England and Professor Arthur S. Kennelly in the United States, independently of each other, suggested that an ionized layer above the earth's surface reflected the signals of radio waves around the curvature of the earth. It was named the Kennelly-Heaviside layer.

By 1902 Marconi had established a wireless station at South Wellfleet, Massachusetts. This was one of the stations from which Harold copied signals on the island. Messages from that station were exchanged in January 1903 between Theodore Roosevelt, then United States President, and the King of England.

In the late winter of 1902, Captain H. J. Round of the Marconi Company constructed one of the first commercial wireless stations in America at Babylon on Long Island, New York.

Less than a decade later, Harold Beverage, excited by these phenomena, was avidly reading and experimenting on his own. Marconi had been the spark that ignited a dream.



4. "Babylon Shack" after it had been moved to RCA site at Rocky Point, New York, 1933. Guglielmo Marconi (left) and Major Edwin Howard Armstrong. This wireless shack was constructed in 1902 for Marconi Co. and was later bought by Armstrong. It was presented to David Sarnoff when he was president of RCA. Marshall Etter, the last engineer in charge of RCA Rocky Point Station, has researched the history of the Babylon wireless shack.

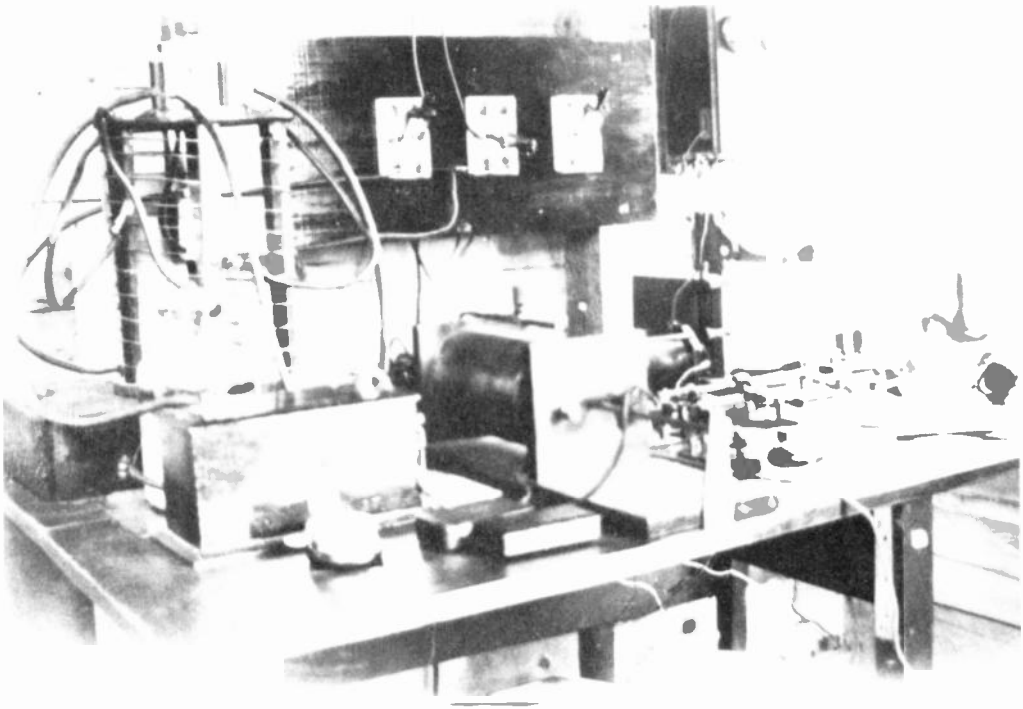
Courtesy of Harold Beverage

3. *The Dream Unfolds*

Young Beverage built his first full-scale wireless in 1908. The receiver was a homemade affair with a "cat whisker" galena detector. Harold was delighted to receive signals at night up to 2500 miles away. The transmitter was described as an Electro Importing Company one-inch spark coil using cast-off batteries from Ozzie Brown, the local boatshop owner. Dry cells from the telephone company were also a welcome addition to his project. He erected two masts 60 feet high to anchor a two-wire antenna 100 feet long. A wire led from the center of the antenna to a small building housing his wireless equipment.

Harold's father felt from the beginning that all of this activity by his son was a waste of time. Finally, seeing Harold's determination in building and assembling all of the necessary equipment for his innovative endeavor, Fremont not only relented in his attitude, but also exhibited a father's pride. He constructed a building which housed his son's wireless station. In the bicentennial publication, *The North Island — A Story Of North Haven,* a picture of the Beverage homestead taken about 1912 appears in which that antenna is clearly visible.

Since Harold had no means of measuring the antenna current, the transmitter was tuned by guess. He was able to work



5. *Interior of Harold's wireless shack on Beverage farm, 1908, North Haven, Maine.*
The transmitter (left) consists of a "one inch" spark coil shown at the left. Next to it is the spark gap and transmitter tuning helix. The range was about 50 miles.
The two-slide receiver tuning coil is shown in the center. The sliding plate capacitor is at the right side of the receiver coil. The "cat whisker" galena detector is shown at the right front. All of the equipment was "homemade" with the exception of the spark coil, variable capacitor and 'phones which were purchased from Hugo Gernsback's Electro Importing Co.
Courtesy of Harold Beverage

6. Harold Beverage erecting mast for his antenna on the pig sty building, Beverage farm, North Haven, Maine.
Courtesy of Allan Beverage

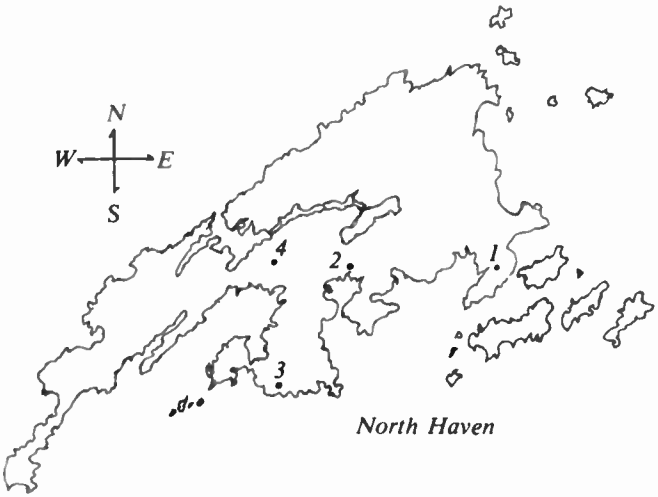
7. Harold attaching guy wire from the mast, Beverage farm, North Haven, Maine.
Courtesy of Harold Beverage, photo given to him by Allan Beverage

8. Wireless shack on Beverage farm, 1908, North Haven, Maine, with the operator in the doorway. Courtesy of Harold Beverage

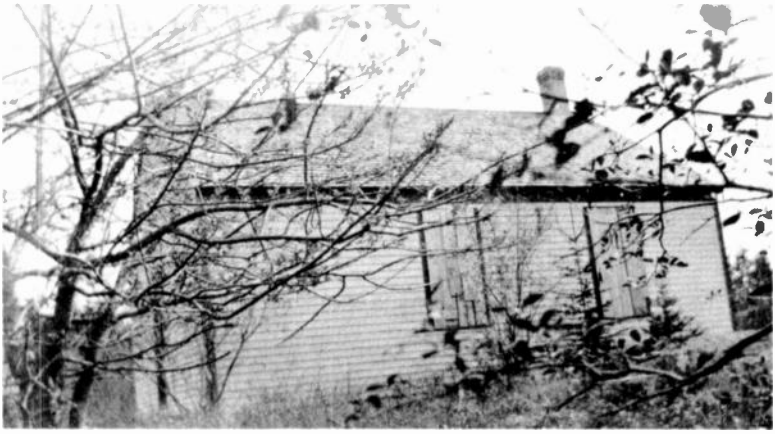
two-way with a private yacht and also with an operator on the mainland in Castine. He used his initials "HB" as his call sign. Weather and news were copied from various stations including "CC" at South Wellfleet on Cape Cod. That station had been constructed by the American Marconi Company under the direction of C. H. Taylor. Years later, Harold was to find himself under the supervision of Taylor.

The whole electronics field was still in infancy and books on the subject were limited. Harold's dream of becoming a radio engineer was not to be suppressed. Harold began his formal education in a little yellow one room schoolhouse at the southeastern end of the island known as Little Thorofare. He spent one year there with his father as teacher. At a later

date, he was asked to evaluate his father's performance. True to North Haven's reserve, he could not be excessive in his appraisal when he replied, "He was a good teacher, I guess."[3] With the closing of the Little Thorofare school, Harold was



9. Map of North Haven showing locations of (1) Little Thorofare School, (2) Beverage homestead, (3) Village School and (4) High School.

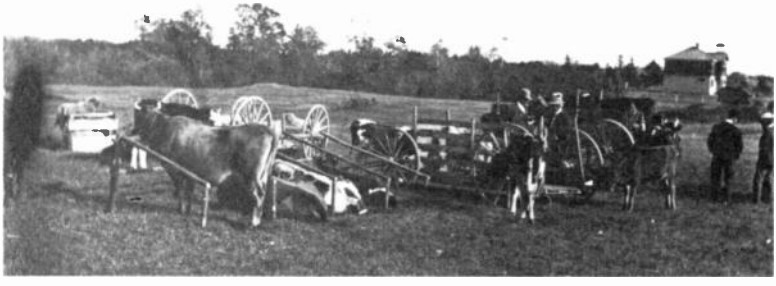


10. Little Thorofare School, about 1923, no longer standing.
Courtesy of North Haven Historical Society, photo given by Clara Thornton

transferred to a two-room school in the village. That school has since been closed and the building now houses the Town Office and the Historical Society Center.

Since transporting children to school was not considered necessary, students often walked several miles over dirt roads to attend class. In the spring, mud could be ankle deep — in winter, the roads were frequently ice covered and students slogged through snow and skidded over them. Aside from walking, the only means of transportation was by horses or ox-drawn wagons and carts. The "jigger," a vehicle perhaps indigenous to North Haven, proved to be especially useful. With a low slung frame and large wheels, it was an ingenious wagon for hauling bulky loads. It maintained a relatively long functional life.

Even though the automobile had been in use in many places for a decade, it had not been accepted on North Haven. In the warrant for Town Meeting in 1906, one item read, "To see what action the town will take to defer the use of automobiles on the island." This was the conservative attitude which prevailed when Harold was a lad of thirteen. Change on the island was viewed with a dubious eye — often resisted and at best came slowly.



11. Animals and wagons or "jiggers," quite possibly at the Grange Fair, North Haven, sometime between 1907 and 1918.
Courtesy of Allan Beverage

The high school on North Haven since its origin had offered only a two-year course. Only shortly before Harold enrolled, had it become a four-year school. The choice of subjects was limited. A teacher was expected to present several fields of learning often as diverse as Latin and physics. It was said that on occasion, Harold would amaze his fellow students with his knowledge of physics. Even as a freshman, he was known to be called upon for the explanation of some phenomenon which the teacher apparently did not understand. True to his abiding interest, Harold's oration upon graduation from high school was "Electricity."*

12. North Haven High School built in 1907.
Courtesy of the North Haven Historical Society

**Program is found in Appendix 1*

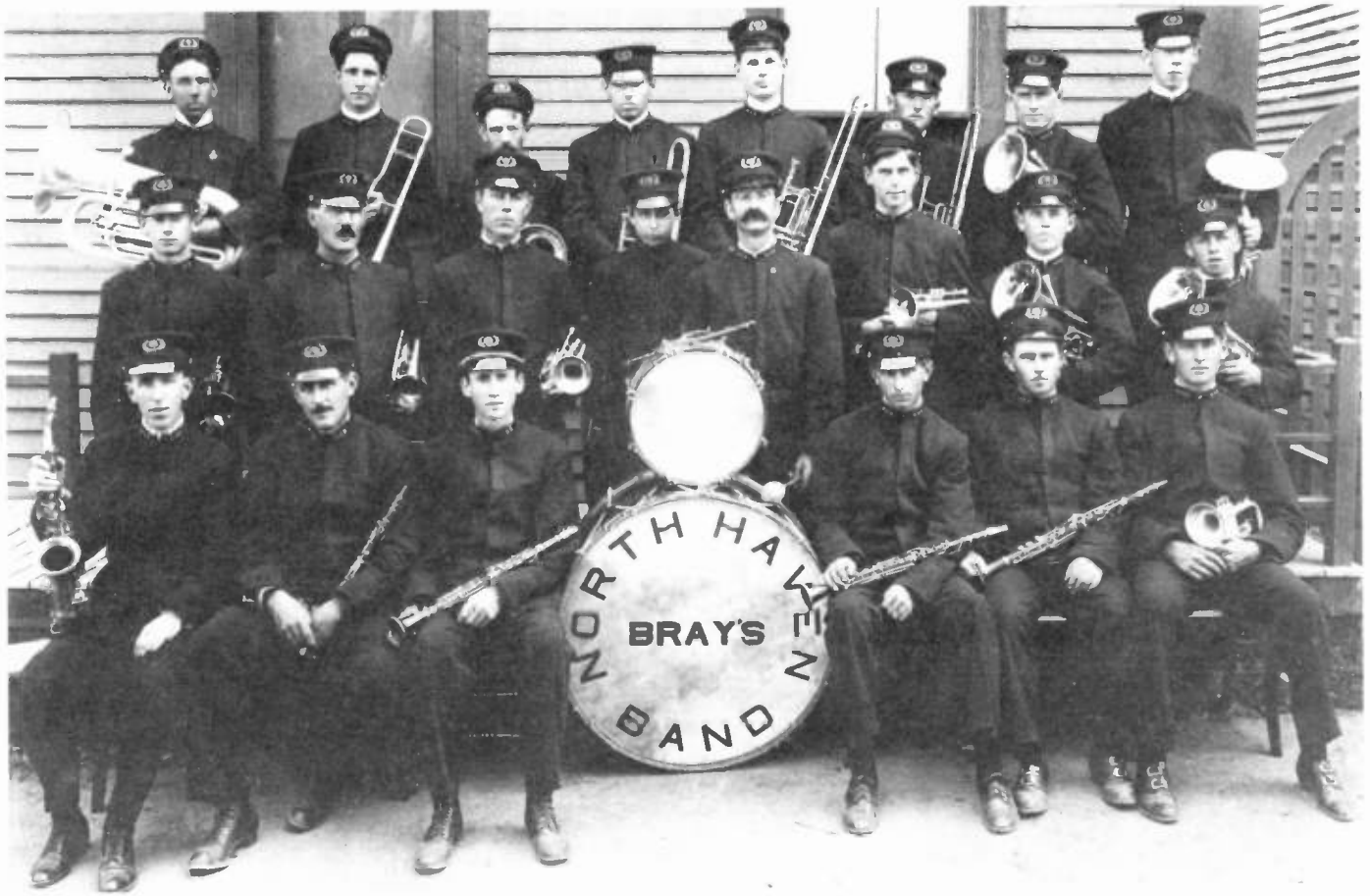
13. Harold H. Beverage, high school graduate, 1910.
Courtesy of Harold Beverage

While Harold was still in high school, he applied to the Knox Telephone Company for a part-time job. He was hired. The assignment entailed maintenance of the telephones on North Haven. There were about sixty subscribers at the time including two party lines with eighteen members each. Those early phones hung in a box arrangement on the wall. When one wished to place a call, the user turned a crank on the generator. This alerted "central" (usually a local lady) at the central office in town who in turn at a switchboard plugged in the appropriate connection. The telephone box was set up with the generator on top and the battery fixed at the bottom. The line came in on two binding posts at the top of the generator box. Consequently, a dead line required considerable search before the defect could be identified. Harold discovered that too often some old lady had placed her metal framed glasses on top of the generator which in turn had short-circuited

the line. With eighteen phones on the same line, it might require a visit to several homes before the guilty party could be located. Apparently Harold was a very satisfactory employee in a situation not customarily open to young boys. It was said that he welcomed the chance to stop hoeing weeds to go out looking for trouble on the lines.

Harold spent many happy hours at the pumping station talking with his good friend, Parker Stone. Parker was station attendant and also the town plumber. The pumping station was a relatively simple device for propelling water from Fresh Pond through pipes to a large cistern or standpipe on an elevation in town. This in turn furnished the water supply to homes without individual wells. On one occasion at the pumping station located on the Beverage farm, Harold surprised a group of adults with his knowledge of electricity. One day in preparation for laying a water pipe, men were blasting a short distance from his home. The blasting machine generator failed and the men in charge began a search over town looking for a guy named Beverage to fix it. Little did they realize that the Beverage they were looking for was a young boy standing not more than 500 feet away from the site of operation. Beverage admitted that he had never seen a blasting machine before, but he was able to locate and repair an open circuit on the commutator. The special talent of this boy most likely bewildered his elders while Beverage considered the episode amusing.

Harold's friend, Parker, in addition to possessing mechanical skills, was known for his fine tenor voice. He was also a member of the town band. This talent must have struck a responsive chord in Harold's budding interest in music. With the purchase of an alto horn in 1907, he joined the band. Although the group would be considered small, it was fortunate in having Mr. Farnum from Rockland as its leader. He came every Monday evening for rehearsals. At his suggestion of the need for another trombone, Harold later bought a Besson



14. Bray's North Haven Band, 1908. (Left to right, back row) Harold Crockett, H. Alton Lewis, Ariel Calderwood, Parker Stone, HAROLD H. BEVERAGE, Almon Cooper, Harry Dyer, Lamar Lewis(Middle row) Ralph Gillis, Sam Nutt, Elijah York, Arthur Eaton, Edgar Hopkins, Francis Mills, Ivan Ames, Earl Marden (Front row) Arthur Bray, Owen Lermond, James Lewis, Murray Stone, Floyd Duncan, Foy Brown

Photo taken by Frank Winslow, Oct. 1908. Courtesy of North Haven Historical Society

trombone. His grandmother, proud of her grandson's continued interest in music, bought him a slide trombone which he later played in the Rockland High School Band. It is not clear whether Harold received lessons or rather was self taught. The love of music for Harold never diminished as later years proved.

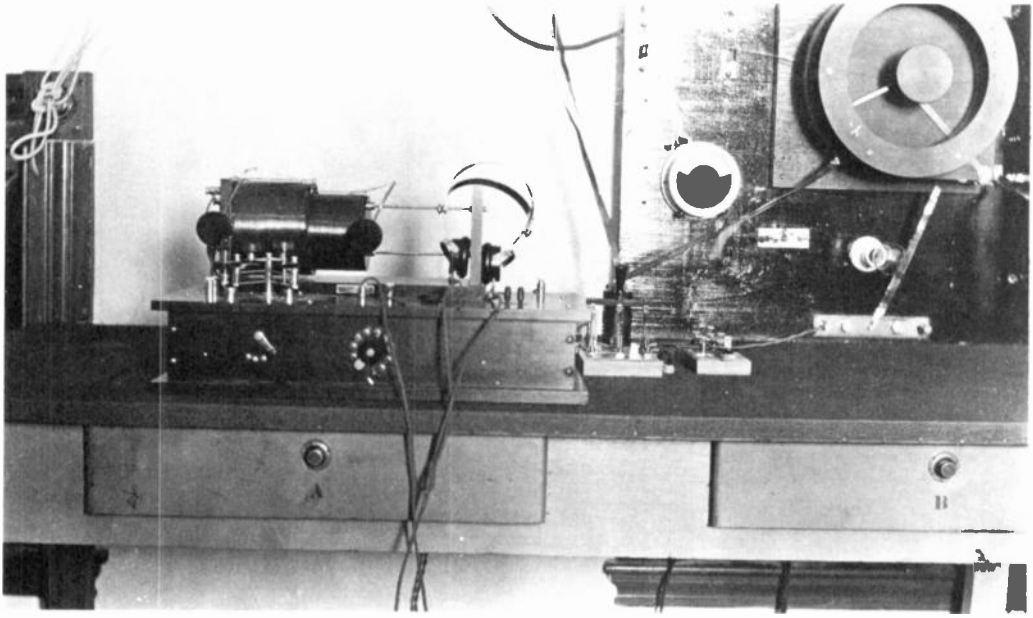
At age sixteen Harold was spending all of his spare time with his homemade radio. On one occasion Harold surprised one who had been unimpressed by his radio enthusiasm. Over his homemade receiver he had picked up the news of the death of President Wilson's first wife. Harold knew that his grandmother, one of the few Democrats in the area, had a special interest in everything related to the President. Harold was eager to convey the news but found his grandmother's skepticism more than a little disconcerting. Since there had been no voice recording, she was convinced that noises from the wireless meant nothing. When a Boston newspaper reached the island confirming her grandson's report, she was so impressed by his achievement that she gave him a $5 gold piece.[4] This was the first of many awards that he would receive.

Harold had made a major resolve. He understood that were he to pursue his dream of becoming a radio engineer, he must attend college. A shattering disappointment loomed ahead. On his entrance examinations for the University of Maine, he failed both Latin and English. With a determination to attain his goal, he enrolled for one year at a high school on the mainland (Rockland, Maine) in preparation for repeating the exams the following year. At a young age, to leave familiar surroundings and the security of one's family to do this required a firmness of purpose. The following year with mandates in all subjects satisfied, he was enrolled at the University of Maine.

A second roadblock was encountered. North Haven High School had not offered French and German, both of which

were university requirements. Along with the basic freshman course, French was added. In his sophomore year the same schedule in German was imposed. He took these added responsibilities in stride and also found time for a number of personal interests.

In the early 1900s it was difficult for parents to put aside adequate funds for their children's higher education. Harold's parents with four offspring to educate had saved sixteen hundred dollars for that purpose.[5] Harold's ingenuity found a way to contribute to his educational expenses. Participation in Bray's North Haven Band and the high school band gave him the incentive to put his musical talent to good use while at college. He played in the university band and also organized another group of musicians. This proved a way to supplement the limited funds which his parents could provide. For Saturday night performances, he realized a fee of five dollars.[6] In addition to this activity, Harold became a member of Sigma Alpha Epsilon fraternity. He also set up a ham radio station. For four years he maintained a wireless station on campus using the call sign "UM." He described the antenna as a single wire about thirty feet long. "A far cry from my antenna at North Haven," he said. However, limitations did not prevent experimentation at Lord Hall. Professor William H. Barrows certainly had cause to remember when Harold's spark transmitter was "on the air." On those occasions the professor became frustrated by the electrical interference which rendered his telephone inoperative.[7] The "Beverage coils" which were developed in this early experimentation may be viewed today at the University of Maine museum. Of the hours Harold spent at his wireless center, perhaps one of the most memorable ones occurred on the evening of April 14, 1912. He recalled, "I copied signals from the steamship Titanic," he related, "which at the time was sailing at a high speed on her maiden voyage. She was hopeful of setting a new record for transatlantic crossing. On the next day I copied signals from the S.S. *Carpathia,*



15. Beverage coils which are part of the receiving section of the wireless station used in the attic of Lord Hall, University of Maine, by Beverage in 1915. Currently displayed in Barrows Hall Museum, University of Maine.
Courtesy of Samuel Beverage, photo given to him by Allan Beverage

the first ship to reach the ill-fated Titanic after she had collided with an iceberg and sunk. I was shocked to learn of the disaster in which many hundreds of lives were lost." At a later date, Harold discovered that a young wireless operator on that same occasion made a name for himself by copying messages for seventy-two hours straight at the time of the disaster. That young operator was David Sarnoff who eventually became president of the great Radio Corporation of America and also Harold's future employer.

In 1915 Harold Beverage was graduated from the University of Maine with a Bachelor of Science degree in electrical engineering. With this event, the dream that had germinated earlier and the high resolve to prepare for becoming an engineer had been achieved. The opportunity to utilize his training in radio research lay ahead.

4. A Radio Pioneer

At the age of twenty-one, Harold Beverage, whose pathway had not always been easy but whose resolve was steadfast, embarked upon a career that would have a significant impact upon a fledgling industry. He would travel to many corners of the earth and associate with great men of his time. He would become a leader in a field of scientific research. He would achieve world recognition.

Upon leaving the University, young Beverage was eager to enter the work community. His intense interest in radio had been established. Furthermore, his participation in musical groups had gained attention. Two diverse offers of employment were before him. An invitation from Lowes Theater to play trombone seemed inviting. He was offered the attractive sum of $22 a week for evening performances. At the same time, scouts from the General Electric Company had discovered the promising engineering student and were interested in hiring him as a test man. They were prepared to pay him $11.20 a week.[8] As always, life presents choices and the decision that Beverage was to make would determine his destiny. While analyzing the two alternatives, Beverage considered taking the theater job which would involve only his evenings. He felt that would allow him time to take classes at the University dur-

ing the day. He decided, however, against going with the theater as he said that he feared he might fall asleep at work and also possibly in class at the University.[9] Also, the opportunity to enter the radio field was too inviting an incentive to turn aside. With the decision to join General Electric began a career of great promise.

At the General Electric Company in Schenectady, Beverage spent a year testing motors, transformers and generators. At that time Dr. Alexanderson of the same company was developing a new alternator to produce continuous waves of immense power. Beverage was impressed by the engineer's ability and looked upon his laboratory as an ideal place to work. Dr. E. F. W. Alexanderson was recognized as one of the most prominent men in communications. He had come from Sweden in 1901 and had become a major figure at General Electric.[10]

In 1916 Beverage presented himself to Dr. Alexanderson and suggested that he needed someone on his staff versed in radio propagation and receiving system development. At the first opening, Beverage was taken into the laboratory where he found his superior an inspiring scientist, bubbling with ideas. Alexanderson would often present six or more problems to his research staff and then return two hours later to see what number had been solved.

In 1918, while France and her allies were still at war with Germany, it had become increasingly evident that control of communications would be a major factor in determining the course of the conflict. As a result, Beverage was given his first major assignment. He was to assist in the development of the Alexanderson barrage receiver system.[11] It was intended that the proposed arrangement would provide a radio barrage or defense against the German reception of American signals. It would seek to foul the arrival of Allied signals entering the enemy's territory.

The first barrage receiver was erected by Beverage and his associate about four miles north of NFF, the powerful

transmitting station at New Brunswick, New Jersey. A 200-kilowatt Alexanderson alternator was employed. A ground antenna was extended two miles northeast and two miles southwest from the receiver which had been installed in an old farmhouse. The extremely strong signals from New Brunswick were readily "balanced out" — eliminated. At the same time, it was possible to receive signals, though weak, from MUU in England.

The United States Navy became interested in the newly developed system and in the same year asked to have one installed at Otter Cliffs, their receiving station near Bar Harbor, Maine.[12] Subsequently, Beverage was sent to Otter Cliffs. When the task was completed, the Navy found the newly installed barrage receiver performed as planned. Not only did the Navy find the new equipment useful to the war effort but an unexpected development ensued from the Beverage assignment. If the following account of the engineer's activities seems elementary, one needs to remember that the experimentation on behalf of the Navy was a forerunner of an impressive breakthrough in radio development.

For several days Beverage draped wire over the countryside near Bar Harbor. In setting up the station, he arranged to have a northeast wire extended two miles from Otter Cliffs to Bubble Mountain. The southwest wire extended two miles to Hunters' Beach, crossing Otter Creek on a bridge. It was found that the signals from Europe were excellent on the northeast wire but only static was received on the southwest wire. Beverage thought that possibly the reception on the southwest wire was poor because of the "dogleg" which he had arranged to cross the bridge. To overcome this faulty system, he extended the southwest wire from a tower to a high tree on the opposite side of the creek. This was no improvement. Finally, as Beverage explained, he "horsed" a receiver and storage battery down the cliff at Hunters' Beach to the southwest end of the southwest wire. Quite to his astonish-

ment and delight with this setup, the signals from Europe on the southwest wire were excellent. The ground wires he decided were uni-directional; that is, they received signals from the direction in which they were pointed. It suggested to him the idea of an aperiodic uni-directional antenna — aperiodic because many signals had come through at one time. Thus, at an outpost in Maine, the principle of the Beverage wave antenna was born. At a later date, Beverage would verify his theory and receive his first patent for the important advancement of wireless communication.

In 1919 the General Electric Company installed a radiophone on the *U.S.S. George Washington.* This was to enable President Woodrow Wilson, on his way home from Paris, to talk while the ship was at sea with Navy Secretary Daniels. Beverage, who had installed the receiver and some of the audio equipment, made two cross-ocean trips to Brest Harbor, France. Since President Wilson was not ready to return on the first trip, a second trip was necessary. In preparation for the calls the President would make, Beverage made many test calls from sea to the Navy Department in Washington. Having been impressed on several occasions by the excellent speaking voice on the other end of the call, he inquired for the name of the speaker. The forthcoming reply was unmistakably precise, "This is the Assistant Secretary of the Navy, Franklin Delano Roosevelt."[13]

Even though Beverage had major responsibility for arranging President Wilson's address system, he found him to be aloof. Even when meeting him face to face on deck there was never a nod of recognition. The President's distant demeanor backfired in his July 4th speech to the crew. Because he was reluctant to communicate with anyone on board, he failed to appear on the assigned deck where equipment for amplification was assembled. The speech never reached the intended audience. Beverage commented, "This fiasco might be considered the voice that failed."

Following World War I, Beverage had a major turning point in his career. One day, quite to his dismay, he received a "pink slip" of dismissal from General Electric. The United States Navy had been urging important corporations to make provision for keeping valuable patents of the radio industry in the hands of American companies. As a result, General Electric joined together with Westinghouse to form the Radio Corporation of America. Dr. Alexanderson was named chief engineer in the newly formed enterprise. Beverage recalled upon receiving the "pink slip" from GE, that he went to Dr. Alexanderson and asked him why he had been fired. Dr. Alexanderson absent-mindedly replied, "You fired? Oh, I forgot to tell you, I had you transferred to RCA."[14] For the next two years, Beverage was in charge of radio reception systems, including receivers, antennas and radio propagation studies of high frequencies. At the early RCA rather primitive research center at Riverhead, Long Island, the first full-scale Beverage antenna was erected. Beverage and Philip Carter laid out a wire six miles long beside an old sand road extending southwest from Riverhead. By cutting the wire at intervals and inserting a receiver, they saw how the European signals increased while at the same time static from the southwest decreased. They found, also, that the losses in the wire as it lay on the ground were high. The obvious answer, they decided, was to erect the antenna on poles to increase the velocity and decrease the attenuation. An antenna on poles was constructed. For the first time it was possible to receive a wide band of frequencies without adjustments to balance out the static and interference from stations south of Riverhead. For many years, long wave signals from Europe were received on this antenna. These same antennas were soon erected all over the world. Paul Godley, who had used the wave antenna at his station in Scotland, reported great success in picking up amateur stations (ham operators). He had heard Beverage's station 2BML at Riverhead and attached the Beverage name

to the new invention. From that time on, the proven wave antenna was referred to as the Beverage antenna.[15]

The first written account of the Beverage wave antenna was published in 1922 in *QST*, a publication for radio amateurs. The term, uni-directional traveling wave aperiodic antenna, Beverage admitted, was quite a mouthful. He introduced the article by saying that the paper would be confined to very elementary theory. A portion of the first paragraph reads, "If a wire is suspended in space, it has a certain capacity and inductance per unit length which bear a definite relation to each other. This relation may be expressed as

$$1/\sqrt{LC} = V \text{ where V is a constant.}$$

This constant is the velocity of light."*

The use of the wave antenna complemented the Alexanderson transmitting system. This combination made it possible for RCA to establish the first successful commercial international communication service with Europe, Hawaii and Japan using long wavelengths. Beverage had made one of his first major contributions to the growth of RCA. For the wave antenna and other outstanding developments during this period, the Institute of Radio Engineers in 1923 awarded Beverage the coveted Morris Liebmann Memorial Prize.[16] He subsequently served as director of the Institute's board for several years and was elected president in 1937.

Research facilities for the Radio Corporation of America began on a modest scale. Beverage had the unique opportunity to select the site for the laboratory. The section of Long Island, New York, chosen seemed to be ideal country which RCA needed for its operation. Wide open spaces, cheap land near the coast and a respectable distance from any city offered a desirable location. The unusually sandy soil beneath the pines was also an asset. This condition, Beverage believed, would increase the radio signal impulse and thereby improve recep-

**The complete text of the article is found in Appendix II*

16. The first Radio Corporation of America Laboratory, winter 1919-1920, at Wildwood Lake, Long Island, New York. Courtesy of Harold Beverage

17. The RCA laboratory, spring 1920, at Riverhead, Long Island, New York — Harold Beverage inside tent. Courtesy of Harold Beverage

tion. Not far from Wildwood Lake, soon to be known as Riverhead and Rocky Point, three research engineers, Harold Beverage, Chester Rice and Edward Kellog, in 1919, set up a tent.[17] In this improvised laboratory they conducted research that initiated a change in the entire communication system.

The work of a scientist is not without many humorous episodes. While Beverage and some fellow workers were laying ground wires one afternoon, they were accosted by a suspicious farmer who asked, "What be you doin'?" With the explanation that they were from the radio station, the farmer was outwardly unconvinced. He left promptly to round up a posse of friends and neighbors. It was later reported that they soon returned with pitchforks and whatever other makeshift weapons that lay close at hand. Their intent was to turn in the intruders as spies, but by this time the radio men had left. The only person the posse found was an old tramp holed up in the abandoned farmhouse which held the engineers' receiving equipment.

Scientists seem always ready to experiment. Beverage had one experience of acting as a "rigger." Some loops in a wire needed to be made at the top of a pole. With a rope and pulley and the aid of an old Ford car as leverage, Beverage was to lift his assistant in a bosun's chair to the top of the pole. The device was raised faster than was expected. Had the bosun's chair not been hurriedly evacuated, the poleman might easily have flown off the top. The return procedure was equally hazardous. Beverage was controlling the cable on the descent. Because the combined weight of the chair and cable was heavier than Beverage, he started up in the air. A rugged linesman appeared on the scene at the crucial moment of the wildly out of control situation and saved Beverage from a dangerous ride into space.

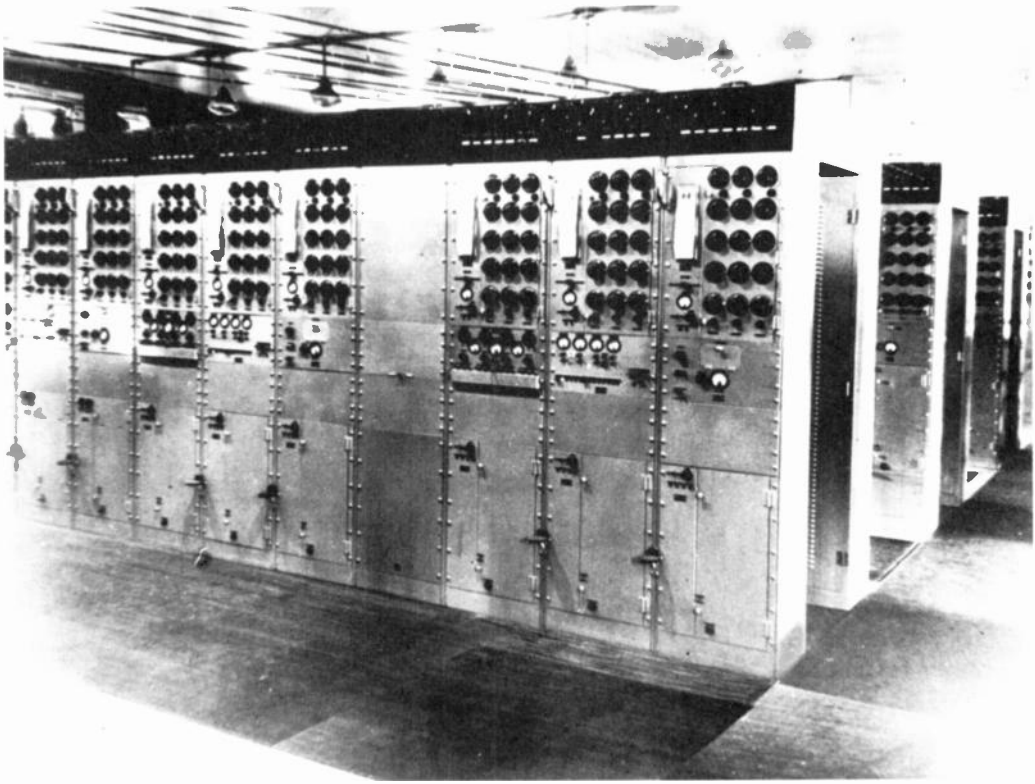
During the period of the 1920s when Marconi was continuing his experimentation, the shortwaves below 200 meters

were considered useless. The signals could be received over long distances only at night, a condition which was generally accepted as an absolute. Marconi refused to submit to this assumption. Beverage, for many years, had looked upon Senatore Marconi with high regard. He admired his determination to pursue his beliefs which were often contrary to the science community. Marconi continued to work at his shortwave transmitting station in Poldhu, Cornwall, England. The strength of the signals sent from there as measured at the station in Riverhead was sent to Marconi. Poldhu started transmitting on 90 meters and later at 60 meters. As expected by Beverage, these signals were heard at night but never during the daylight hours. By 1924, the Poldhu transmitter had been adjusted to transmit at 32 meters. Those signals were heard not only at night but also during the day. The experiment was contrary to all theory. Everyone was astonished by the result, including Marconi himself. This started the shortwave revolution which opened up a wide band of frequencies. For the first time an inexpensive system for long distance traffic was established. Brite and Tuve in America and Appleton in England had been studying the makeup of magnetic layers. They had discovered that not one but several ionized layers high above the earth existed. Shortwave signals were known to pass through the Kennelly-Heaviside layer and were reflected back to earth by higher layers which were called F layers.

Beverage early recognized that nature does not reveal her secrets easily. The atmospheric static which bothered long waves had practically disappeared on the shortwaves. However the shortwaves were interrupted by rapid fading. Upon study of this new problem, Beverage and his associate, Dr. H. O. Peterson, found that shortwave fading was random. With this in mind, they combined signals from three aperiodic antennas spaced about 1000 feet apart in a manner independent of phase. This resulted in a steady signal at a fraction of the cost of other systems, notably the Marconi beam developed in

England. Since this development solved the rapid fading problem, it was called the space diversity reception system. Beverage as a co-inventor had made another major advancement in radio. This system to eliminate fading is still used in a modified form for reception from satellites.

"Few people realize today that Riverhead is famous in the annals of radio history in America. It was in Riverhead in 1919, when the history of radio itself was still young, that the newly formed Radio Corporation of America established its powerful Atlantic Seaboard International Receiving Station, known as the 'Ears of the East.' "[18] It was in this remote



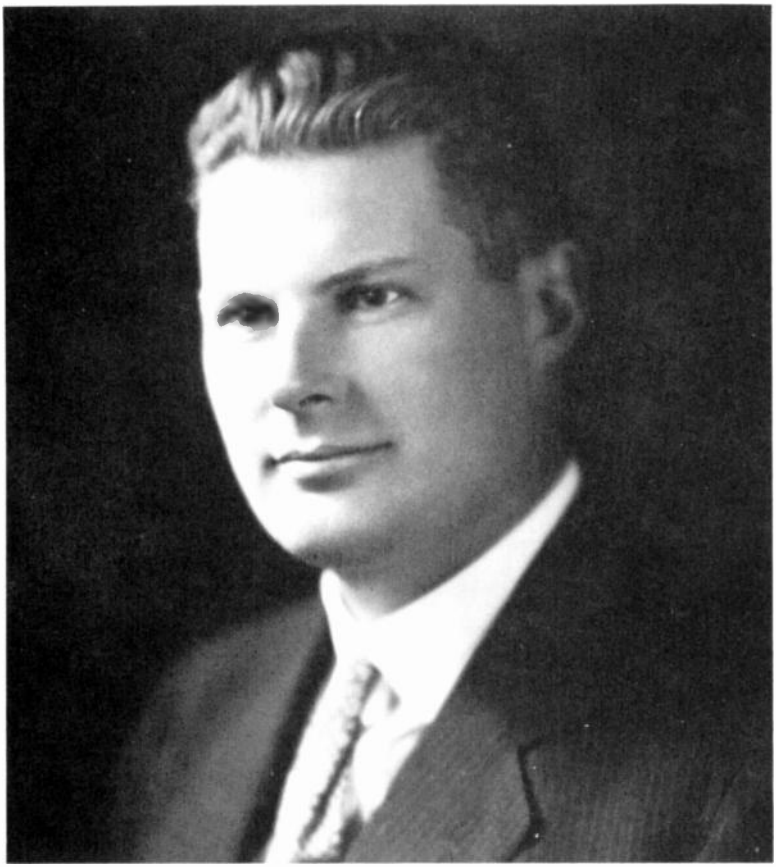
18. Final model of diversity receiver at Riverhead Station. Courtesy of Harold Beverage

19. Marconi visits David Sarnoff, President of RCA at Rocky Point, New York, 1933.
(Left to right) C.W. Hansell, J.R. Rostron, C.H. Taylor, C.W. Latimer, GUGLIELMO MARCONI, DAVID SARNOFF, W.A. Winterbottom, Gaston Mathieu, Lloyd Briggs (Left to right, back row) B.S.Y. Cliften, David Rau, Harold H. Beverage, H.O. Peterson, Philip S. Carter

Courtesy of Harold Beverage

area that the Beverage antenna and the Beverage-Peterson space diversity system were fully developed.

By 1929, Beverage was made chief research engineer in charge of the reception laboratory at Riverhead, the transmitting laboratory at Rocky Point and the terminal facilities in New York City.[19] During the decade at RCA, he had gained several promotions and obtained patents for two timely



20. Harold H. Beverage, 1930, chief research engineer of RCA Laboratories at Riverhead and Rocky Point, Long Island, New York.
Courtesy of Harold Beverage

21. Faculty and dignitaries at University of Maine, June 13, 1938 when Harold Beverage received an Honorary Doctorate of Engineering. (Left to right) Walter J. Damrosch, Edville G. Abbott, Robert G. Sproul, Gov. Lewis O. Barrows, HAROLD H. BEVERAGE, John Ford, Rachel Field, Olof O. Nylander, Pres. A.A. Hauck. Courtesy of Myers Photography Studio, Old Town, Maine

inventions. He had become recognized as an outstanding engineer in radio research. The University of Maine in 1938, cognizant of the magnitude of his work, conferred upon him the honorary degree of Doctor of Engineering.[20] That same year, he received the Armstrong Medal from the Radio Club of America.[21]

In 1942, RCA research was placed under a new division called RCA Laboratories. Beverage received the title of Director of Radio Research for RCA Laboratories as well as being named Vice President for Research and Development of RCA Communications. At this period the United States together with its European friends was again at war with Germany. Beverage was called a second time to help with communication problems of the military forces. His experiences during the years 1942 to 1946 are covered in a later chapter, "Buzz Bombs and Citations."

5. *The Adventurer*

Six years after leaving a college campus, the RCA engineer found himelf aboard ship bound for a strange land. This early adventure unfolds as it was related personally by Harold Beverage.

In 1921, America, England, France and Germany all wished to establish radio communication with Rio de Janeiro and Buenos Aires. Since there was insufficient traffic to warrant four stations, the countries agreed to share a single center. An agreement was drawn up known as the AEFG Consortium. Beverage was selected to head an expedition to Brazil. His assignment was to determine whether or not it would be possible to establish communication directly with South America. At least one obstacle was anticipated. Strong atmospheric static was expected to exist there during the southern summer months.

Beverage began this venture aboard the S.S. *Aquitania* bound for London. There he discussed details of the undertaking with Marconi and his staff. After reviewing the problems which might be confronted, Beverage and a Marconi engineer, Noel Rust, sailed to Rio de Janeiro aboard the S.S. *Almazora*. With them was equipment assembled by the Marconi Company. The trip required 21 days with arrival at the

designated port the day after Christmas. Years later in correspondence with a young cousin, Samuel Beverage, he reported his reaction to his first view of Rio as he sailed past that harbor. He said that he recognized "the mountains rising out of the sea" that his father had described in his letters home while on a voyage aboard the *Queen of the Pacific*. Although that journey had been made before Harold's birth, family experiences continued to make a lasting impression.

The two engineers spent much of the time at sea learning to speak a foreign language. The first location ashore was to Cabo Frio, about 75 miles east of Rio where only Portuguese was spoken. Beverage confessed that it was one time when his hard learned knowledge of Latin proved to be helpful.

Upon arriving at Cabo Frio, the equipment and men were housed in a tent near the beach. As is usual in the tropics, the natives observed their siesta for several hours starting at noon. Beverage was reminded that "only mad dogs and Englishmen go out in the mid-day sun." Further, he was advised by the natives, "fas doente," (make sick). Beverage and Rust disregarded the warning. The day came when they went swimming at noon. Rust went into the water first. When Beverage arrived at the beach, Rust was far offshore peacefully swimming out to sea. Suddenly it was evident that he had gotten into a strong current. Beverage called to him to start back. Rust at this point, aware of the shore so far away, panicked, swallowed saltwater and yelled, "Help." Beverage was a poor swimmer, but Rust was even worse. Beverage struck out toward his endangered friend. Upon reaching him, he directed Rust to hold on and relax. It took a half hour to gain the safety of shore. Both men were exhausted at the end of a frightening and foolhardy experience. Fortunately, the future of the expedition had been saved. Nearly forty years later, Beverage met again with Rust at a luncheon with Marconi and his men outside London. Rust's first words were, "Bev, do you remember the time that you saved my life?"

As Beverage replied, "I remember," one of the Marconi engineers was heard to quip, "What a pity!"

To continue with the AEFG expedition, it was found that very heavy static in the afternoon made it impossible to communicate with Rio at that time. Accordingly, the engineers packed their equipment and sailed on the U.S. *Oriano* for Recife in the state of Pernambuco. Since the ship had not stopped at any port outside Brazil, no problem was expected in releasing the equipment from customs at Recife. Beverage visited the customs office almost daily trying to gain possession of the equipment. There was always an excuse — "The manifest had not arrived." Next report was, "The manifest had been received but was wrong." Other excuses followed. After three weeks without success, Beverage contacted the chief engineer of the state of Pernambuco. The chief informed Beverage that the solution to the problem was simple. "Give 100 milreis to Senor A and 50 milreis to Senor B, etc." Beverage followed instructions and finally received the equipment out of customs. A bribe of money expedited the release so fast that some of the damaged equipment took a week to repair.

The two engineers went ahead at last to set up the radio station. They were rewarded by finding that reception of European and American signals at Recife was excellent. Later, Beverage attended a meeting with members of the AEFG Consortium in Cologne, Germany. He recommended that a permanent relay station be constructed at Recife. This, he explained, would in turn transfer strong signals to Rio and Buenos Aires. The recommendation was adopted and a station was built by the French.

In the immediate years following this early expedition, new ideas in radio communication was developed rapidly. As a result, the station at Recife was to become obsolete. In no way, however, did the later advances negate the noteworthy aspect of the experimentation by Beverage and his associate in South America.

6. *Buzz Bombs and Citations*

It was 10:00 P.M. at the Grand Hotel on South Hampton Row in London. Out of the quiet night came a piercing screech that alerted the guests to another possible disaster. Dr. Beverage, who was among the guests, was certain that an air raid had begun. He left his room, as he said, " . . . to watch the fireworks." Just as he stepped into the hallway, he came face to face with a maid obviously very frightened. She nervously explained that she had experienced similar situations many times. She said, "That's one of them airplanes that ain't got nobody in it." Slightly confused by the hypothesis, Beverage continued to the lobby where he met the night clerk. It was explained that a German buzz bomb (a robot bomb) had missed the hotel roof by only ten feet. In recalling the incident, Beverage acknowledged that since his room had been on the top floor of the hotel, the first buzz bomb that he encountered, missed him by twenty feet. This was only one of several close misses for Beverage during the period while giving technical aid to the Allied strategy of the war from 1942-1946.

The event of World War II brought new challenges in the life of Harold Beverage. He left the laboratory at RCA for a series of assignments to correct communication problems of

the war effort. Accurate and timely relay messages were vital to the military strategy. From 1942 to 1946 he served as part-time consultant to the Office of the Secretary of War.[22]

An early assignment took him to Labrador, the departure point for United States bombers flying to the battle front. Several bombers bound for Europe had been lost on the Greenland icecap because pilots could not find the airfield in Greenland during bad weather.[23] On one occasion, Major Vaughn, a dog sled expert who had served with Admiral Byrd in the Antarctic, went to Greenland to inspect the ill-fated bombers. He returned to Goose Bay and reported to Dr. Beverage that the bombers he found could not be salvaged. An interesting sidelight was revealed. "The doomed bombers," he said, "were loaded with silk stockings, lipsticks and perfume." He conjectured that the items could have been useful to the crew in making acquaintances with English maidens.

Beverage shared his bunkhouse with Major Vaughn. It is not hard to imagine Beverage's dismay when the Major chained his lead dog to Beverage's bunk. We can visualize the tension rising when the Major went out of the living quarters with the warning, "He's a one man dog. Don't touch."

On a second trip to Goose Bay, Dr. Julius Stratton of Massachusetts Institute of Technology and Dr. Beverage went over the bomber route from Goose Bay to Bluie West (code name, BW1), Greenland, and also as far as Reykjavik, Iceland. The landing at BW1 was especially tricky and potentially dangerous. A pilot must identify an island which marked the mouth of the correct fiord. The fiord ultimately divides in two parts and if the pilot takes the wrong fiord or the wrong branch, he and the crew are lost. At the end of the proper branch of the fiord, there is a sharp rise to an icecap. The pilot must then make a sharp left turn and in a minute or two the landing field is visible on the right.

Before leaving on the inspection flight, Dr. Stratton was

given a map of the airfields marked "security." Upon reaching each lap of the flight, the map was presented at the security office where it was locked in a safe until departure. At 11:00 P.M. one snowy night, the two engineers were notified that they were to leave early the next morning for Iceland. When Dr. Stratton went to the security office to obtain the map, the corporal on watch did not have the combination for the safe. It became necessary to waken the colonel who had the combination. The colonel got out of bed, produced the map and Stratton and Beverage were on their way. They were bemused at leaving the colonel "as mad as a wet hen."

Even on a serious mission, Beverage found humor in their next episode with security. At Reykjavik Airport they were met by the security officer, Colonel Jones. Although Beverage was carrying a permit for his movie camera, it was taken to be placed in the safe. Then Dr. Stratton presented the map to Colonel Jones for safekeeping. The Colonel exclaimed, "Why in h--- are you carrying this map under security? That map, in detail, was published in Life magazine two months ago."

Upon returning to Goose Bay the engineers, in an effort to improve communications for the bombers, recommended the use of low frequencies instead of the unreliable high frequencies. Beverage knew that high frequencies (shortwaves) were unreliable in the far north, sometimes fading out for days during magnetic storms. He was told that the low frequencies had been tried but could not be heard. A horizontal dipole with a balanced input to the receiver had been used. This was the usual arrangement for the reception of high frequencies with horizontal polarization. It was completely balanced for vertical polarization on the low frequencies. Beverage laid out a few hundred feet of field wire and proved that the low frequencies were coming through as expected. He spent many weeks checking the installation at Prestwick, Scotland which was the end of the bomber route. The Beverage antenna was

used at all locations for reception. It had a real advantage in that no towers were required. If it were destroyed by enemy action, it could be replaced rapidly.

Finally, solid communication at all airfields on the North Atlantic bomber route were secured.[24] For the valuable assistance which Dr. Beverage had given, he received the Signal Corps Certificate of Appreciation.

22. Col. Nackburn presents the Certificate of Appreciation from the Army of the United States to Harold H. Beverage, June 15, 1944. W.A. Winterbottom, RCA (left) and Otto Shirer, RCA (right) witness the presentation. Courtesy of Harold Beverage

At Goose Bay the Canadian Air Force had its low frequency receiver in an American hangar with the American coding machine. The interference from the coding machine made it impossible for the Royal Air Force to copy Montreal. An appeal went to Beverage to set up the wave antenna for them near the Hamilton River. Because that location would provide poor reception, Beverage proposed that a receiver be installed at the American message center and the signal "piped"

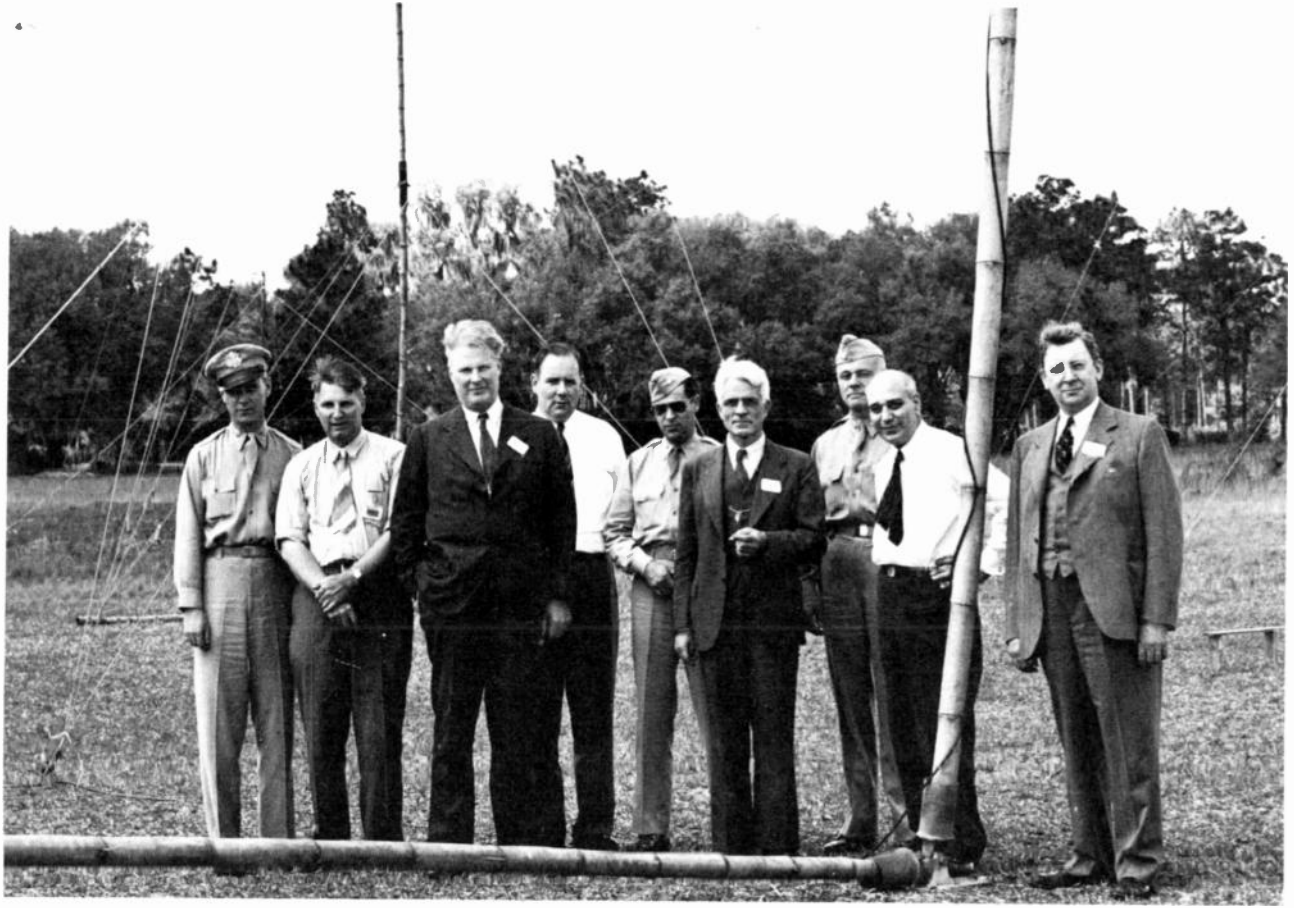
23. Beverage holding Certificate of Appreciation from the U.S. Army Signal Corps.
Courtesy of Harold Beverage

to the Canadian center over the telephone. The outcome proved to be highly successful with one temporary setback. When Beverage checked the input to the line, it was found to be about 1000 milliwatts. The maximum level set by the American Telephone and Telegraph Company for long lines was 6 milliwatts. There was an immediate response from the wire chief who called and asked, "What in h--- is going on?

You have knocked out every telephone in the camp!" Beverage backed the level down to 6 milliwatts. The Canadians still had a fine signal and the wire chief was happy.

On another occasion, Beverage was at Presque Isle installing the wave antenna. He came in contact with a young 2nd lieutenant who was instructing a GI to pull the wire tighter on a pole. Beverage noticed that the wire was already strained about two octaves above the E string on a fiddle. He warned the lieutenant that when the temperature dropped to 40 degrees below zero, as it surely would, the wire would contract, exceed the elastic limit and snap. The lieutenant allowed as how he wanted a nice job to show the colonel. At the message center an hour later when the lieutenant reported that the antenna was ready to test, Beverage found no signals coming through. Upon inspection they found that the antenna had collapsed. Beverage proposed that on his next attempt the lieutenant might tension the wires according to the wire tables. The lieutenant's explosive response was, "What in h--- are wire tables?" Beverage smiled and left the lieutenant alone to ponder that one.

While Beverage was in Florida another amusing event occurred. Realizing that enemy bombers posed a threat to the security of the country, he worked with a Bell Laboratories group setting up a ground observer net. This device would detect the approach of enemy aircraft and in turn report its sighting. The Air Force had battery operated transceivers on a frequency of 37 MHz which had a range of one mile with the use of a whip antenna. By using a vertical half rhombic antenna, the engineers increased the distance to twenty miles. Eight ground observer locations using a common frequency were laid out. Beverage expected everything to work as planned. He soon discovered that one observer had not reported in on schedule. Eventually, the missing member was located. It was found that his half rhombic was erected at right angles to the proper bearing. The ensuing conversation



24. Beverage with group working on ground observer net in Orlando, Florida, April, 1943. (Left to right) Major A. E. Fisher, Army Air Force; R. P. Booth, Bell Telephone Laboratory; H. H. BEVERAGE, RCA; R. V. Crawford, BTL; Lt. Col. W. D. Innis, AAF; P. S. Carter, RCA; Major M. L. Hazelton, "Kent Lab"; A. Tradup, BTL; R. A. Heising, BTL.
Courtesy of Harold Beverage

went something like this:

Beverage, "How did you align the antenna?"

Observer, pointing to the compass on top of the transceiver close to the loudspeaker magnet, "By compass, obviously."

Beverage, "Did you consider that the loudspeaker magnet would throw off the pointing of the compass needle?"

Observer, pointing to a piece of cloth underneath the compass, "See, I took care of that problem."

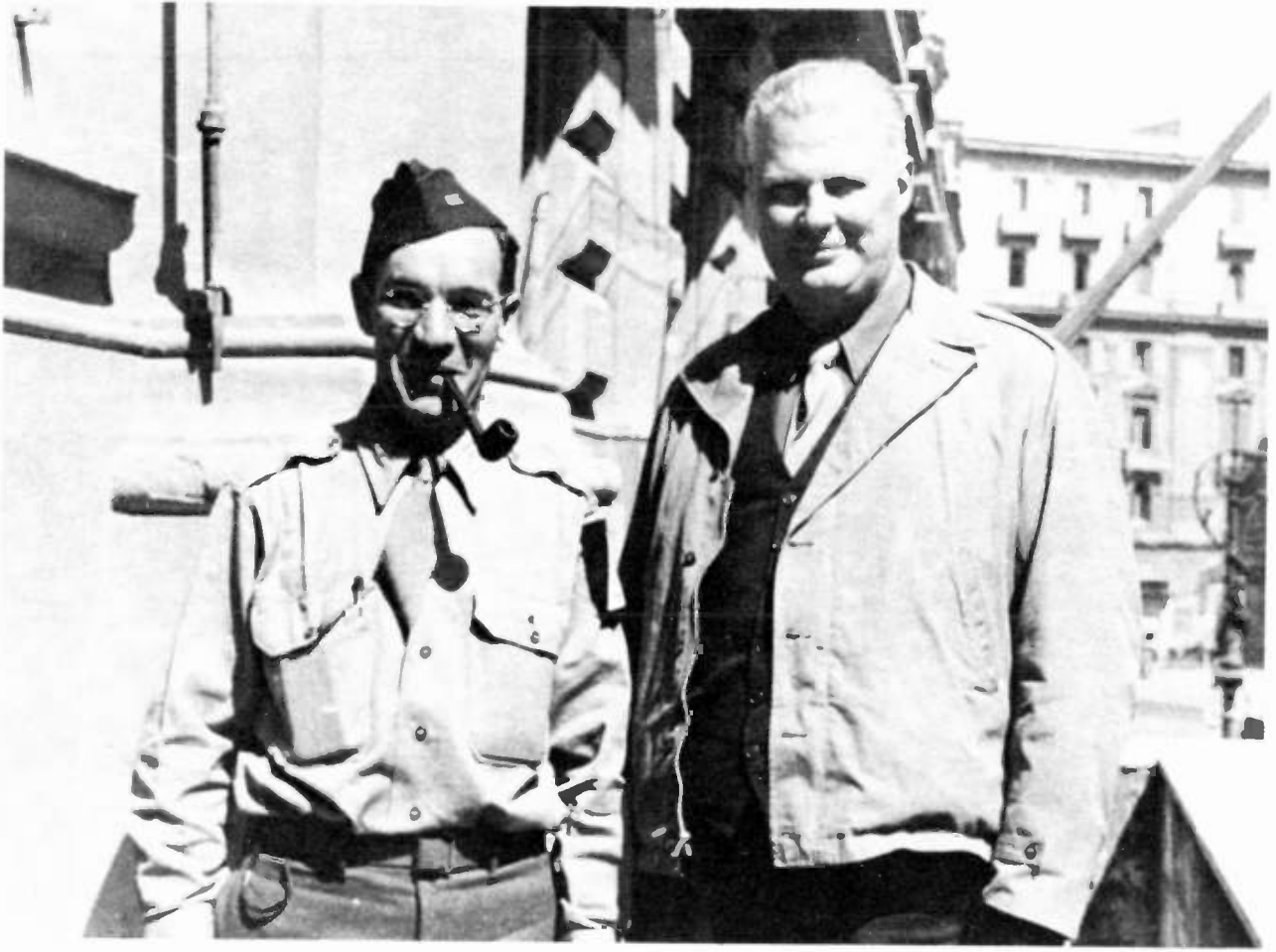
Beverage, "Buddy, where are you from?"

Observer, "I was a sheep herder in Montana."

Beverage was quick to conclude that had the observer depended on a compass under this arrangement, he would have lost his sheep and would himself be lost in the mountains of Montana.

An exceptionally important assignment by the military command found Beverage in the African and European theaters of operation. He was destined to have several near calls with disaster. He recalled a comment by his Air Force friend, Colonel Lee, who defined war as "95% waiting around and 5% having the hell scared out of you." Beverage had a very clear memory of the the times that the Colonel's observation held true. While at the Algiers Airport he met Irving Berlin who was enthusiastic about his show, *This is the Army*. Later at a city outside of Naples, Beverage attended the premier of Berlin's play. While the performance was in progress, a German bomber raid persisted for a long half hour, making numerous passes over the theater. The Allies responded with anti-aircraft guns. Fortunately, the bombs landed on soft earth and failed to explode. After this very realistic adjunct to the show, the entertainment continued. Beverage felt that "Lady Luck" was on his side.

Still again danger lurked close at hand. Beverage was in No-Man's land looking up at Mount Casino. It had been held for several weeks by the Germans in spite of heavy bombing by the Allies. Suddenly, a shot was fired that landed only 200



25. Beverage (right) and "Pop" Long in Naples, April, 1944, working with the U.S. Army. Courtesy of Harold Beverage

feet away. He thought it was a warning for him to get out of there and without hesitation he "took off in a cloud of dust."

On a flight from Casablanca the plane, about fifteen minutes airborne, was in trouble. A stream of gasoline was running off the wing. The pilot decided to return to Casablanca. Since the plane was carrying gasoline to full capacity, it was feared that an explosion might occur when it touched down on the runway. The ground crew had similar thoughts. As the plane swept the field, the fire department and ambulance were waiting. Fortunately, no accident occurred and after draining off gasoline from the auxiliary tank, the plane was once again off to its destination. Beverage was relieved to feel that he had scored once more against the odds.

Beverage, an avid photographer, decided one Sunday morning while in London, to take movies of the changing of the guard at Buckingham Palace. His landlady had suggested that he attend the service in the Guards Chapel which she had found to be very interesting. Beverage may have had some intuition of the pending disaster. As he was still deliberating on a course of action, a buzz bomb appeared out of nowhere and landed on the Chapel. The building was completely destroyed with several hundred people, including his landlady, left dead. He mustered fortitude and proceeded in his determination to take movies of the terrifying catastrophe. When he pressed the shutter of his camera, nothing happened. For the first time ever, he had forgotten to unlock it. While attempting to recover from frustration, the explosion fragments hit him in the eyes, ears, nose, and chest. The impact was like fifty fists and it took several weeks for him to recover. He still felt, however, that the buzz bomb was most interesting to observe. Retelling further of many similar experiences, he drew a compelling picture:

"Sometimes they skim along close to the housetops, snarling and spouting fire. As they pass, their speed and low

altitude make the motor frequency drop more than an octave because of the Doppler effect. As long as you can hear them you are safe, since it is only when the motor cuts off that the elevator fins drop, and the thing slants down to earth. There's a tremendous flash of yellow flame, and the explosion shows its affinity — or enmity — for glass: windows, mirrors and even the glassware in cabinets are shattered. . . . when it lands among buildings, the rush of air is horrible; glass and walls break, casualties are high . . . , and objects — living and inanimate — sometime fly out through windows and doors."[25]

Occasionally the war for Beverage seemed far away and almost unreal. One such time was the two short days that he spent at General Nathan Twining's Mediterranean Air Force headquarters in Bari, Italy. When he, Mr. Clark and Mr. Tradup appeared at headquarters in a combination of civilian and military dress, it posed a question as to where the men should be housed. They were assigned to an old hotel in town. Beverage felt that as long as the roof didn't leak, he could survive. The other two men had different opinions. Mr. Clark, who carried the simulated rank of brigadier general, and Mr. Tradup with the simulated rank of colonel, felt that the old hotel was unsuited for men of distinction. They went to headquarters, emphasized their ranks and with little hesitation were given large bedrooms with baths at the quarters for commissioned officers. They were treated to a fine dinner, enjoyed gift cigars and an evening of entertainment. The euphoria of quiet leisure was short lived. The bursting of a bomb nearby brought them back to grim reality. Beverage was quickly reminded that United States troops were constantly in danger and that he shared a responsibility for their safety.

Beverage had arrived in England two weeks before D-Day where he found communication problems of grave concern. With Clark and Tradup of the Bell Laboratories, he visited the 9th Tactical Air Force installation in Uxbridge near London. Uxbridge was on a common frequency with the S.S. *An-*

con. An Admiral and a General in the Communication Information Center on the S.S. *Ancon* controlled the entire system for getting the troops ashore at Omaha Beach. It was planned that when the troops would make it ashore, they would have a portable transmitter enabling them to enter the communication net and ask for air support. The commanding General at Uxbridge would then reply in a coded message to the S.S. *Ancon* stating the number of bombers assigned and the time of their arrival. Beverage and his associates found that Uxbridge was experiencing problems in getting information through. Beverage gave the following account of the situation:

"We found that a vertically polarized antenna was being used similar to the one on the Isle of Wight overlooking the English Channel. The propagation of vertical polarization over seawater is excellent. Uxbridge, about forty miles over land in the direction of Omaha Beach in France, presented a different problem. The ground wave over land is very poor on both vertical and horizontal polarization. The only solution appeared to be the use of sky wave with horizontal polarization. Many days were spent supervising the change to sky wave. I was worried, with the change, whether or not the signals to and from the S.S. *Ancon* and troops ashore would get through. On D-Day, I was briefly confused as all frequencies had been changed to confuse the Germans. I was greatly relieved of my anxiety when I soon knew that all had performed as planned."

Beverage received a letter from General Brereton, Commanding Officer, 9th Tactical Air Force, Uxbridge. The letter read:

Commendation

Headquarters
Ninth Air Force

It is my desire to officially commend Dr. H.H. Beverage of the Advisory Specialist Group, USSTAF, for service per-

formed for the Ninth Air Force during the period 20 May 1944 to 16 June 1944. Dr. Beverage furnished invaluable technical advice and assistance in the establishment of Ninth Air Force radio circuits utilized in the initial stages of the invasion of the Continent. As a result of this work, no technical failures in cross channel radio circuits were experienced. Such an achievement would not have been possible without his help.

I particularly wish to commend Dr. Beverage for his wholehearted cooperation, his keen personal interest, and valuable technical assistance furnished to officers and men of my command.

Lewis H. Brereton
Lieutenant General, USA
Commanding

Later, Beverage was honored again with the Presidential Certificate of Merit.

It is interesting that the S.S. *Ancon* survived the war and was returned to her owner, the Panama Canal Lines. In the early 1960s, she was sold to the State of Maine to be used as a training ship for the Maine Maritime Academy at Castine. After several years of service there, she was scrapped.[26] She had proven her value during the war and for many years thereafter.

The military forces were fortunate to have had a radio specialist in the right place and at the right time. Upon leaving the war-torn countries of Europe, Beverage thought little of the distinguished honors that were his, but rather spoke with intense feeling about the inevitable consequences of future wars. He felt that they would be still more terrifying than any of the past. Glad that his mission had been fufilled, he returned home expressing great admiration for the men who had served in the fighting ranks.

It can be asumed that Dr. Beverage was involved in many other activities of two world wars that this study did not cover.

It is immediately clear, however, that his expertise in working with communications had a positive effect on the successful outcome of two major conflicts. The citations which he received stand as a timely reminder of the high regard in which he was held by his country.

7. A Personal Conquest

The year was 1946. Dr. Beverage was 53 years old and still a bachelor. One must ask whether or not the shyness of his youth had lingered over half a lifetime. It is certain that a consuming interest in research and the heavy demands upon his time with the military had contributed to a much delayed marriage. It has been said that in the soul of a true engineer, the only thing that matters is being allowed to tinker in peace. Apparently, however, he was aware that an important facet of his life was missing. Many years previous to the war, Beverage had met a beautiful girl whom he was never able to forget. With a vivid memory of this lovely lady, he finally proposed marriage. With like persuasion, this same Patricia Yurgel became Mrs. Harold Beverage.

Patricia's parents had come from Lithuania and settled in Wilkes-Barre, Pennsylvania. Patricia was a social worker by profession and the field of electronics was foreign to her background. Nevertheless, she became her husband's greatest press agent and an enthusiastic fan. Mrs. Beverage confessed that it took time to adjust to their house being "cluttered with miles of wire and a million receivers." She willingly adjusted and proudly declared that Harold's interest had become hers. She once said, "I don't want to be a wife who

26. Patricia Yurgel, 1928, later to become Mrs. Harold Beverage. Courtesy of Harold Beverage

just sits in a corner."[27]

Before her marriage, Patricia had been manager and secretary of the Lithuanian Alliance of America. She spoke fluent Lithuanian and among other responsibilities, made all of the arrangements for the annual banquets which were attended by Lithuanians from all over the world. Dr. Beverage had chosen a mate who possessed widely recognized competence.

Patricia had gone to school with the famous band leader, Tommy Dorsey. On one occasion when Dr. and Mrs. Beverage were dining at the Hotel Pennsylvania, Tommy Dorsey and

his band were playing there. During the evening they serenaded the Beverages with Patricia's favorite melodies.

It is evident that Dr. Beverage was delighted that his wife loved to travel. She accompanied him on trips to many distant places. Beverage was a member of the Union Radio Scientific International. As a result they attended meetings of that group in London, Munich, Rome and Japan. Because it is known that sunspots and other astronomical events have an effect on shortwave propagation, Dr. Beverage had a special interest in the Assembly meeting in Rome where this was discussed. Pope Pius XII was also interested in astronomy and had a large telescope at the papal summer palace at Castel Gandolfo. He invited about 80 of the Assembly delegates of whom Beverage was one to visit Castel where he delivered an address on astronomy. Following the Pope's presentation, the delegates and their spouses lined up to meet His Holiness. Apparently the Pope recognized Beverage's nationality since, as they shook hands, he greeted him in English.

While in Rome, the Beverages also attended an elaborate ceremony given by the Mayor. Thus, on this one trip, Dr. and Mrs. Beverage had the privilege of being presented to both His Holiness Pope Pius XII and to the Mayor of Rome. Beverage readily acknowledged that it was his wife and not he who warranted the honor of knowing both of them. Mrs. Beverage possessed a special gift of easy dialogue and, although time was limited, she was successful in participating in a conversation with both dignitaries. Beverage confessed that he did not have that same talent.

Mrs. Beverage, though interested in traveling, had an aversion to sea voyages. Because she was seasick as soon as the ship left dock, the Beverages usually traveled by air. On one trip by sea, the passage was unusually rough. As they left Le Harve, France, an 80 mile an hour headwind caused the ship to pitch violently. Beverage, who had grown up with the sea at his front doorstep enjoyed the excitement. He took movies

of the wild green water dashing over the bow and found the privacy of the dining room a pleasant change. It was certainly unique, he admitted, to have three waiters at his command. He regretted that his wife could not share the pleasures with him. Mrs. Beverage was unable to leave her bed and Mr. Beverage was certain that had the ship sunk, she would have been thankful for the relief of her distress. Strangely, rough air while flying did not bother her. On one trip as they flew through a violent storm over Idaho, lightning struck the wing of the plane causing it to drop like a rock for several hundred feet. The pillows fell out of the overhead racks and luncheon trays were thrown in all directions. While some women started to scream, Patricia remained calm and perfectly at ease.

During the thirty-three years of married life, Mrs. Beverage was privileged to see her husband achieve many remarkable feats as a radio pioneer. She witnessed his rapid advance at RCA and the high esteem with which he was regarded by the radio community. Although it had taken many years before the Beverages made the decision to enter into matrimony, the outcome was fulfilling. Looking back, he proudly asserted, "We had a very happy life together."

"H. H. BEVERAGE, EX W2BML, FROM THE BURGEONING ERA OF THE BIRTH OF RADIO TO THE COMPLETED STATE OF THE ART OF PRESENT DAY COMMUNICATIONS, THE IDEAS OF THE CREATIVE GENIUS OF HAROLD H. BEVERAGE HAVE WITHSTOOD THE CHALLENGES OF TIME AND CHANGE."

QST Profile

8. The Genius at Riverhead

Following his assignment with the United State military, Dr. Beverage returned to Riverhead to resume the post from which he had been temporarily released. In his dual role as director of research and vice president, his responsibilities in a rapidly expanding corporation took on a new dimension. He was increasingly involved in a supervisory and administrative capacity.

By the late 1940s, RCA Communications had modern buildings, nearly eighty circuits in use and seventy people employed. All of the commercial radio communications between South America, Europe and North America were handled at the station on Long Island.

In the early 1950s when RCA Research Laboratories had outgrown its original quarters, the operation was relocated at Princeton, New Jersey. With the move came expanded experimentation. It was said by those who knew Beverage well that it would be impossible to list completely the contributions which he had made to science. Out of the research had come mathematical classics in antenna design, and in improved transmitting and receiving equipment. Studies of the behavior of radio waves in flight brought international recognition. Testimony to his extensive productivity are the forty patents

filed in his name.[28]

In addition to his responsibilities at the Princeton Center, Beverage maintained a central office for RCA at 66 Broad Street in New York City. An incident is told of a visit by cousins from North Haven, Maine. When the elevator operator took the name of the person of their intended destination, she responded by lifted eyebrows. One could read clearly the thought, "Who are these country hicks calling upon the famous Dr. Beverage?" Upon leaving after their gracious reception, Beverage accompanied them into the hall where he bade them an affectionate good-bye. Surprise was evident on the face of the attendant standing a short space distant.

His personal talents, together with his interest and ability to inspire young engineers, made Beverage an invaluable member of the company. He was, eventually, to be extolled by the company president for his wide range of tutelary efforts. The following account is only one of many situations in which an aspiring engineer won distinction by the Beverage capacity to generate growth and encourage creativity in others. One of Beverage's proteges was a promising scientist named George M. Brown. Beverage recognized the young man's potential and during the depth of the depression, hired him to join the staff. Later, while still in RCA's employ, he became known as the engineer who had contributed in large measure to the development of television. In a book which Brown wrote entitled *And Part of Which I Was — Recollections of a Research Engineer,* he paid tribute to his mentor whom he credited with having given him a start and having provided him with unceasing encouragement. The number of references to Beverage in the volume is impressive.

It seems only natural that the brilliant achievements by Dr. Beverage would be recognized beyond the workplace. In 1945 the Institute of Radio Engineers conferred upon him its Medal of Honor. In 1957 he was awarded the Lamme Gold Medal by the American Institute of Electrical Engineers. In accept-

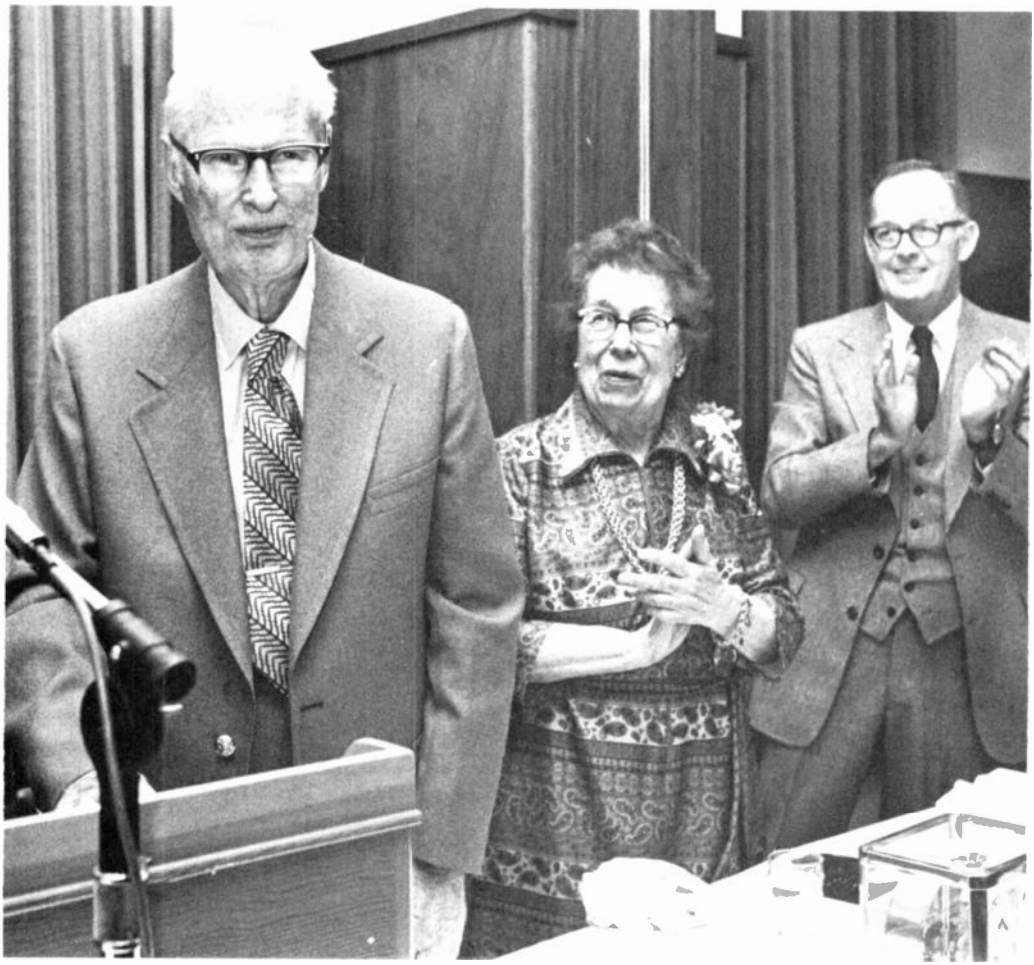
ing the honor, Beverage said in part, "We may fit within the limited radio tomorrow such services as international television, highly personal communication systems and even remote control of our ships and aircraft from electronic traffic centers." These predictions were all to be realized later in his lifetime. Beverage was a visionary but also remained determined to approach a solution to the seemingly impossible. Honors continued to come to Dr. Beverage. He was made a Fellow of the American Association for the Advancement of Science and a Fellow of the American Institute of Electrical Engineers. He is listed in *Who's Who in America*, *Who's Who in Men of Science, Who's Who in American Men and Women* and in Dunlop's *Radio's 100 Men of Science.*

During an interview, Beverage was asked what he considered to be the source of his "spark of genius." In his reply, Beverage gave little credence to the term "genius." With his unassuming manner he explained simply, "In the pioneering days of wireless communication, most inventions were made by members of the experimental school. That is, they were interested in setting up an experiment to test an idea. This often led to an unexpected discovery. The spark of genius was simply to observe the phenomenon and recognize that it was something that could be developed to produce a new and useful result."[29] As one reviews the notable accomplishments of Harold Bevrage, it is most appropriate in this narrative to bestow upon him the title of "The Genius at Riverhead."

The record of Beverage as a research engineer has been well documented. Little has been recorded of his image as a man. One gains the greatest insight to the spirit and soul of this scientist through his deeds. We are constantly reminded of the respect and admiration given him by his friends and colleagues. Frequently we are confronted by his sense of humor which prompted him to find the amusing feature inherent in the commonplace. It is evident that on occasion he could abandon his position as a man of high purpose and step into the role

of prankster. Bits and pieces found in accounts by the various media gave added perception to his personal identity. *The Portland Press Herald,* a leading newspaper in Maine, once described him as " . . . a man of striking appearance with his gray hair and youthful face. Behind his engaging smile there is a quiet modesty that calls for some ingenuity in getting him to talk about himself." Another Maine newspaper referred to Beverage as "a curious sort of industrialist, primarily concerned with the manufacture of an old product commonly referred to as 'dots and dashes.' One is impressed by his informal friendliness with which Beverage carries the honors he has won." Another commentary declared, "Looking at his broad shoulders and powerful hands, one would hesitate to challenge him." His friends have noted remnants of a Maine twang in his speech. It has also been reported that he continued through the years to send to a Maine town for an order of yellow eye baked beans.[30] Although his search for the new led him to associate with the "great" of his time, Harold Beverage has retained his modest island character.

In 1958, after a distinguished career with RCA, Dr. Beverage retired. Upon that occasion a reception was held to which colleagues and representatives from many organizations came to wish him Godspeed. A most appropriate gift marked the special event. The sum of $5000 to endow a scholarship fund in the name of Harold H. Beverage was presented to the University of Maine. The income of the fund was to be used annually for a scholarship awarded to a University of Maine student excelling in the study of communications.[31] Through students chosen in the future, the legacy of a great radio pioneer will continue from generation to generation.



27. Dr. Beverage at the podium receiving the Alumni Career Award from the University of Maine, 1976. Also shown are Mrs. Patricia Beverage and Dr. Neville, President of the University of Maine. Photo owned and used by permission from the University of Maine

9. Retirement Highlights

The Radio Corporation of America which had given Harold Beverage the opportunity to fulfill his boyhood dream, was reluctant to let him go. Because his advice and expertise would be sought for years to come, he consented to continue as a part-time consultant to the company.

Organizations in the radio field as well as others continued to recognize publicly his special engineering feats. In 1974, the Veteran Wireless Operators Association presented Beverage with the coveted Marconi Gold Medal of Honor. Two years later, he received the Pioneer Award from the Radio Club of America.

The year 1976 proved to be the pinnacle of the diverse recognitions which Harold Beverage would receive. He was notified that he was to be the recipient of the Alumni Career Award from his Alma Mater. The award had been created to be presented annually to a graduate of the University of Maine who had exemplified an outstanding record in professional, business, civic or public service.[32] Reading from the presentation address, it said in part:

> "When one identifies the radio pioneers, Alexanderson, Marconi, deForest, Round and Meisner . . . it is with justifiable pride, we include the name of our

> own Harold H. Beverage . . . Honors and awards bestowed upon this man are worldwide in scope, . . . attesting to his brilliance and dedication. His accomplishments have served industry and his country in war and peace. In view of all deserved recognition that is his, we humbly add our praise for one who has shared this campus with us."

It was a momentous occasion for Harold Beverage to return to his beloved state where he received the accolades of the University from which he had been graduated six decades earlier. Upon the event of the Alumni Career Award, Dr. Beverage received a letter of recognition from Elmer W. Engstrom, president of RCA. Several chosen remarks from that letter served a fitting climax to a much deserved honor. Dr. Engstrom wrote:

> "I am pleased and proud to have this part in a well merited tribute to you. Any history of RCA, with which you were associated for four decades, would be woefully incomplete without taking into account your many accomplishments. The same would be true generally, for the broad field of radio and electronic communications. You have earned many awards and international recognition. Now your friends and former associates in RCA salute you on this occasion. We join in honoring you and remembering the important part you played in the development and growth of communications . . . In a broad, fundamental way, we think of the research which you conducted personally to push back the frontiers. We think of the inspiration and encouragement your work gave to others, particularly younger men entering the field. We think of the basic engineering development for which you were a leader and then we think of the very practical way in which you added to the application so as to pro-

> vide new important services . . . As you look backward over the pathway you have traveled you can be justly proud of your handiwork. Thus, in acknowledgment of your accomplishments over a lifetime of service, and as our expression of gratitude and appreciation, we of RCA join in this salute to you, and we send you our very best wishes."

In retirement, Dr. Beverage continued to travel widely. He was a member of URSI (Union Radio Scientific International), which held assemblies worldwide. In 1960, he met with URSI in London, in 1963 in Tokyo, at Munich in 1966 and at Ottawa in 1969. As would be expected, he met many important scientists in his travels. In Tokyo, he became acquainted with Professors Yagi and Uda, inventors of the Yagi-Uda antenna. For several years, Beverage corresponded with them concerning their combined efforts in the development and technical characteristics of an antenna. He noted that the Yagi antenna was eventually used all over the world for the reception of television broadcasts. Beverage had two installed on the roof of his own house.

Even in later years, Dr. Beverage was unable to stay very far away from electronics. He elected to spend time at some of the television studios. At NBC he helped with problems of lighting and microphone placement. One day he recalled when the Ink Spots and the popular singing star, Hildeguard, were on the air, Hildeguard was wearing a polka-dot dress. When she finished her song, she came off the set, rushed over to Beverage and asked, "How did my dress look on television?" Beverage assured her that it was beautiful and what was in it was still more beautiful. He further voiced the opinion that Hildeguard had an outstanding voice as well as being a very beautiful woman.

Photography held a significant place among the hobbies that Beverage enjoyed. He expressed pride in the several thousand feet of 16 mm sound movies which he had assembled.

Some were taken during the war experience in Casablanca, Rabat, England and Alaska. In Rabat's Casbah, with the loan of a camera and the gift of several 16 mm film magazines, he took pictures of natives who under different circumstances might have reacted violently. Knowing that they were superstitious about being photographed, Beverage had the Navy military police as escort. No problem was encountered and as a result, Beverage was successful in adding some unusual pictures to his collection. Much later during his travels to the American West, he delighted in photographing the majestic beauty of the landscape. It may be surprising to learn that with all the unusual and spectacular scenes he had captured on film, he considered his home state of Maine a photographer's paradise.

Before the advent of color television, Beverage was called upon frequently to give travelogues. He expressed satisfaction that his films were joyously received by church, school and civic groups. Requests eventually became so demanding of his time that he admitted to finding excuses for declining invitations.

Harold Beverage has never lost touch with the ever changing phenomena of history. He followed with great interest each new development in television as well as the rapidly expanding field of general electronics. It was with genuine excitement that he observed that when he first worked with radio in its infancy, antenna efficiency was about 20 percent. It was not uncommon years later, by using microwaves, a big dish or horn, to note a gain of 60 decibles.

After the death of his wife, Patricia, in 1979, he continued to maintain his home at Stony Brook, Long Island, New York. One of his pleasures continues to be the bimonthly meeting of the VIF Club at the Three Village Inn nearby. This provides one opportunity for frequent contact with his many friends. An arthritic condition curtails some activities, especially hand-written letters. With the aid of his typewriter, he has

28. The Riverhead staff visits Harold and Mrs. Beverage at their home in Stony Brook, New York, 1975. (Left to right) H. A. Moore, A. M. Braaten, H. H. BEVERAGE, Ferd Schoenborn, Harold Ryden, PATRICIA BEVERAGE, Levere C. Doane, William Hannah, Alton Medsger, H. O. Peterson, Robert Schock. Courtesy of Harold Beverage

kept in touch with his family and friends. He shares a common interest in photography and family history with his nephew, Allan Beverage. From a cousin, Samuel Beverage, he looks forward to receiving news of his home town. When he learned that the Beverage homestead had been sold to a summer resident, he graciously sent a precise description of the house as he had known it.[33] He was pleased that the new owner was anxious to restore the dwelling to its original character.

For Harold Beverage, life has never become dull. The many facets of a changing world continue to challenge his imagination and he responds with enthusiasm. He has come full cycle to spend his retirement years on another island. Unlike the isolated one of his birth, it is close to a large metropolis. His home on Long Island, once a desolate wasteland, has become an attractive residential retreat. Dr. Beverage is a man proud of his achievements and happy in the camaraderie of his friends. His verve for living prevails.

10. A Nonagenarian Reminisces

"Early Radio Pioneer Is Still Making Waves." Thus the *Village Times*, a newspaper at Stony Brook, Long Island in December 1980, carried a lead article on Harold Beverage. It highlighted the major contributions that he had made to the development of radio. It noted the forty patents which he had to his credit.* In response to the tribute paid, Dr. Beverage admitted that of the many inventions he had made, he felt there were two of greatest importance. He listed as one the wave antenna which had been developed at Riverhead and later named for him. He further added that in 1930 when RCA switched from long wave to shortwave transmission, the Beverage antenna became obsolete for general commercial traffic. However, it is known that the wave antenna is still very much in use by ham radio operators who consider the "Beverage Antenna Handbook"[34] their Bible. Because of the great distances between some Russian cities, the wave antenna can be used effectively in those situations. It is also still in use by the Coast Guard in Greenland and other places of the far north.

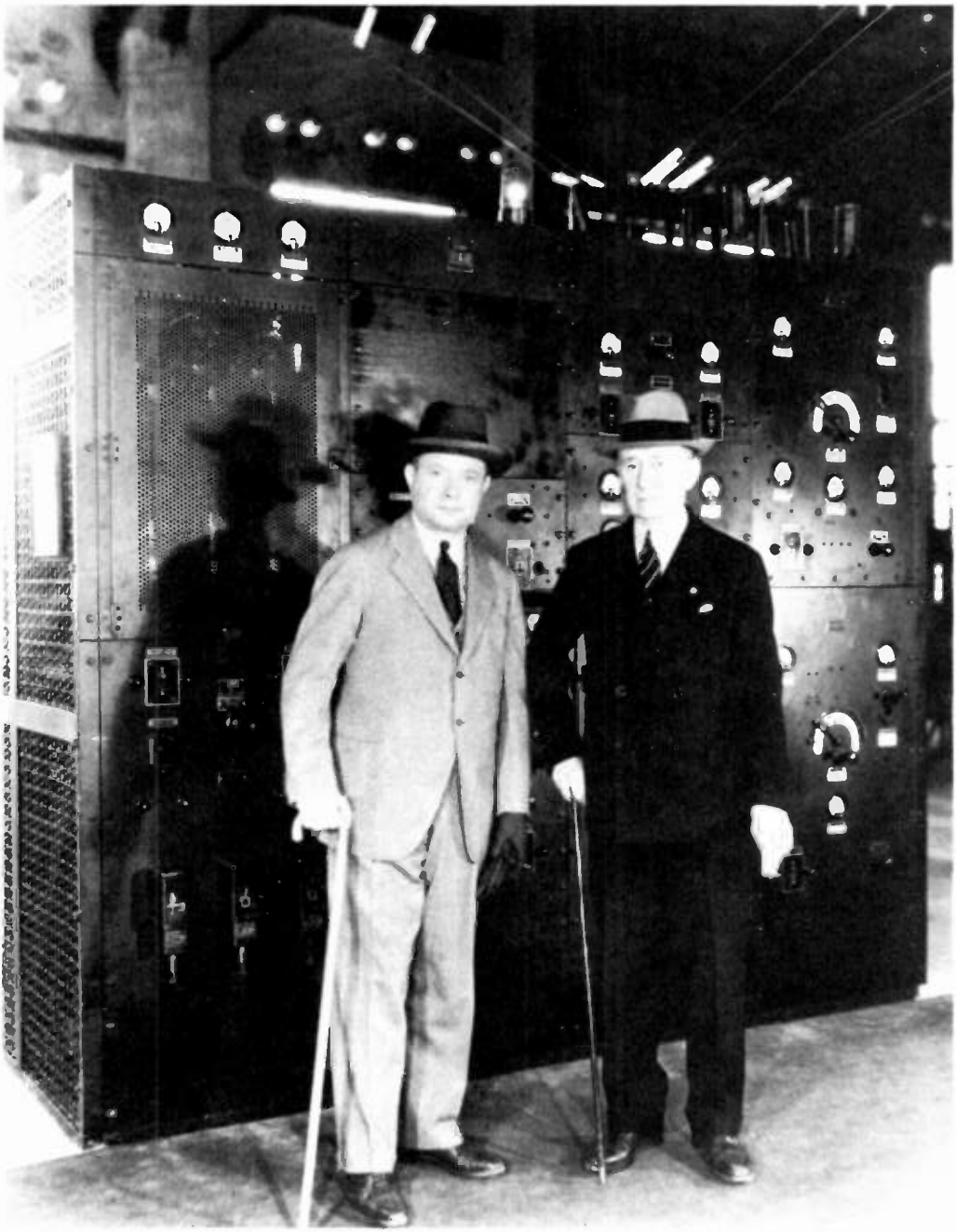
**See Appendix XI for Dr. Beverage's recent comments on his inventions and a list of his patents.*

Diversity reception, which continues to be widely applied, Beverage considered his second important invention. It actually was of greater importance than the wave antenna. Dr. Beverage observed that the greatest invention of the century to date, however, was not radio but television. In voicing further an opinion of conditions in the 1980s, he said, "Probably the radio spectrum could not begin to support the enormous volume of traffic that is handled now. Normal ionospheric radio could never transmit television. It seems commonplace to receive television in color from any place on earth or the moon. Even more amazing is the reception of signals from a billion miles away which a computer turns into beautiful color pictures of close-ups of the planets. Some day we may even communicate with intelligent beings on distant planets."[35]

In still another commentary is revealed the prestigious position in which Dr. Beverage is held. The ham magazine, *QST*, in writing about him declared, "Among those whom Dr. Beverage proudly listed as past associates and friends are Marconi, Einstein, Armstrong, deForest, Sir Watson Watt and Yagi. There are those who feel that Harold Beverage can rightly stand as an equal among such luminaries."[36]

Now, still a youthful man in his 90s, Beverage is quick to recall the many highlights of an eventful life. With a vigorous mind and spirit and in his easy style, he shared with me many of the episodes which remain vivid in his memory. I was also grateful for the privilege of listening to a tape which had been recorded in an interview by Mrs. Dwyer in July 1968. Reference was made to some of the same topics which he related to me. Beverage told of the great scientists with whom he had been associated.

His boss for many years, Dr. Sarnoff, joined RCA in 1919, the same year that Beverage had come into its employ. Sarnoff was immediately named general manager of the company. By 1922 he had become vice president, president in 1930 and chairman of the board in 1949. Beverage discovered that



29. Dr. David Sarnoff (left) and Guglielmo Marconi at Rocky Point, 1933. Courtesy of Harold Beverage

Sarnoff, born in Russia in 1891, had emigrated to the United States in 1900. His beginning jobs included the delivery of newspapers and work as a messenger boy. He later learned Morse code wich led to several placements where a good operator was needed. His initial recognition came in 1912 while at Wanamakers store in New York City. His indulgence in copying the signals of the Titantic disaster for seventy hours straight impressed Beverage whose own attempt had been less noteworthy. Even as a corporate executive, David Sarnoff retained his ability as a wireless operator. On one of his visits to the laboratory at Riverhead, he left a lasting impression on those who watched him copy signals from England at 40 words per minute. This was twice as fast as the average operator's time. Sarnoff had great faith in the scientists in the research laboratory. A case in point illustrates the drive which was manifest in this man of greatness: Beverage estimated the cost of the early development of television to be in excess of $100 million and he felt confident that had it not been for the keen perception and unrelenting determination of David Sarnoff, the event of color television might have been delayed indefinitely.

Dr. Albert Einstein, who spent his summers at Mattituck, Long Island, occasionally visited with Dr. Beverage at the RCA receiving station at Riverhead. One day, Beverage had the pleasure of showing Einstein some of the new developments in the research laboratory. At the entrance, Beverage recalled, was a screen door that he had repaired. Between the layers of screen at the patched portion of the door, were several large dead June bugs. Einstein immediately noticed and pondered, "How did the bugs get between the layers of screen? Were they small when they got in and then grew large? If so, what did they eat? If full grown, how could such large bugs squeeze into the narrow space between the layers of screen?" Beverage confessed that he had never noticed them and that evidently Dr. Einstein had a problem for his special theory of relativi-

ty. Beverage, although making light of this situation, considered Albert Einstein to be the greatest mathematical genius the world has ever known. Beverage also found his friend's humor refreshing. He told the following story which was a favorite of Einstein's and which it was said he delighted in telling about himself:

> Some years ago, two men, strangers to each other, were sitting together on a subway seat. One of the men was reading a newspaper. On the front page was a large size photo of Albert Einstein, with a story about his discovery of the theory of relativity. The other man was twisting himself in curiousity so that his head was almost in front of the first man's who patiently allowed this oafish liberty for a minute or two. Then he quietly pushed the paper over to the other. "Here, you might as well read it more comfortably," he said.
>
> "No, no," the second man protested, suddenly realizing he had become a nuisance. "I was just wondering who that guy with the wild hair could be to get such a big splash in the paper."
>
> "Oh you don't know? That's the great Albert Einstein."
>
> "So what did *he* do to get his mug all over the front page?"
>
> The first man realized he had an ignoramus to deal with. "He discovered the wonderful theory of relativity, that's what."
>
> "Rela — What?"
>
> "Relativity."
>
> "What's that anyway?"
>
> The first man thought for a moment. How could he explain relativity to this simpleton?
>
> "Well," he said, "it's like this: Suppose you're kissing a beautiful girl — the time goes by like

lightning, isn't that so?"

"Sure," the second man said, licking his chops.

"But then suppose the girl pushed your naked behind up against a red hot stove — then a second seems like an hour, doesn't it?"

"That's for sure."

"So you see, it's all a matter of relativity."

The second man looked puzzled. Then he said, slowly, "From such foolishness a man makes a living."[37]

Beverage spoke with emotion about Major Edwin Howard Armstrong who had been a close friend for thirty-five years. Beverage considered him the most outstanding inventor of all time in the field of radio communication. While Armstrong was still in college (Columbia University) he felt that he had made an invention of some merit. When he approached his father for money to establish a patent right, the elder Armstrong's retort was, "How does a young squirt like you get such a bold idea?" Undaunted, Armstrong went on to greater heights before, during, and after his service in the Army during World War I.

At the age of 22, Armstrong had made an important contribution to the development of radio known as the regenerative circuit. The device allowed great amplification, with fidelity, of weak signals. The same scheme is used today in practically every transmitter and receiver throughout the world. This invention was contested by Dr. Lee deForest, another scientist at the time. Although both scientists were working on the same experiment, deForest maintained that his had been perfected at least one month prior to the time of Armstrong's breakthrough. Court cases relative to the rightful owner of patents continued over a decade. The prolonged litigation, which cost Armstrong both financial loss and psychological impairment, ended with a Supreme Court decision in favor of deForest. Beverage and engineers throughout the world,

however, recognized Armstrong as the rightful inventor and they held the view, as did Armstrong, that the courts failed to understand the question involved and consequently grossly underestimated the legitimacy of Armstrong's defense. He was recipient of many high honors from the science community.

Another invention by Armstrong was wide band frequency modulation, referred to as FM. Infringement of his patents on FM led Armstrong to bring suit against the Radio Corporation of America and the National Broadcasting Company. Earlier, RCA had offered him $1 million to purchase a non-exclusive license under the FM patents. Armstrong had refused that offer and during the pretrial hearing for this suit, refused similar offers for cash settlement being convinced that his rightful ownership of the FM patent must be respected by powerful corporations. His unyielding resolve to pursue that goal became so intense that it nearly defied reason. His decision brought about increased tension between the Major and Mrs. Armstrong. She finally left their twelfth floor apartment in Manhattan and went to live with her sister in Connecticut. Life became increasingly stressful for Armstrong and at the age of sixty-four, in frustration and depression, still in the pretrial hearings for the case, he threw himself from his apartment window. The tragic ending came as a severe shock to Beverage.

The suit was eventually settled by agreement and Armstrong's estate was paid $1 million. Some years later, Mrs. Armstrong persisted in bringing suit against other companies using her husband's invention of FM and Beverage gave testimony in one of these suits. Eventually Mrs. Armstrong was successful in collecting $10 million which she claimed was rightfully owed to the Armstrong estate. She had vindicated Major Armstrong's long sought self image as the lawful inventor of FM.

Marconi, another friend, was greatly revered by Beverage. He attributed to the great inventor the major incentive for his

dream of becoming an engineer in radio research. Early in his career, he had several occasions to work with Marconi — the planning for and the aftermath of the Brazil expedition being the first. Beverage found him to be a very personable gentlemen who maintained a low profile with his associates. He became a frequent visitor at Riverhead.

Beverage also referred to Dr. Hazeltine, an engineer with whom he was well acquainted. He admired Hazeltine's inventive competence and mentioned the plate neutralizing circuit from which Hazeltine had earned a handsome fortune. Beverage had conceived the same device prior to Hazeltine's pronouncement. Feeling that it had little importance, he failed to file for a patent. Later, as he was sitting next to Hazeltine at dinner one evening, the conversation came to the widely recognized patent. Hazeltine's final rejoinder was, "I did and you didn't."

H. O. Peterson was frequently mentioned by Beverage.

30. H. O. Peterson (right) visits Harold and Mrs. Beverage at their home in Stony Brook, New York, 1975. Courtesy of Harold Beverage

Their early backgrounds were strikingly similar. Peterson, too, had been influenced by the early experiments of Marconi. At his farm home in Nebraska, as a young boy, Peterson had bought equipment from the Electro Importing Company to build his first radio. He was graduated from the University of Nebraska with a degree in electrical engineering. He then made his way east in search of employment. Both men had entered the research department at RCA where they became not only colleagues, but also co-inventors and close friends. In their conversations one is very much aware of the mutual interest and respect that has endured.[38]

The contacts which Beverage made outside the science community were often with celebrities from many walks of life. At a banquet of Division 15 of the National Defense Research Committee, Arthur Godfrey of radio fame entertained Beverage with the following story — an event which happened while Godfrey was a ship radio operator. It was a cold night when his vessel was near Cape Race, Newfoundland. He had received a strong SOS signal from a British ship which he thought must be nearby. He rang the bell to alert the captain and to relay the message of the ship in distress. The captain requested that Godfrey ask again for the longitude and latitude of the British ship. When the information came back the captain's response was, "Do you know where that ship is? She is in the Mediterranean Sea." Beverage was amused at learning about another of those freak radio transmissions.

It would appear that Dr. Beverage enjoyed reflecting upon the beautiful women he had met or known — putting first his beautiful wife, Patricia. Another, the girl considered prettiest on the island, was possibly the only girl that Beverage dated in his youth. He said people alert on many evenings would have seen him in the company of Edith Hopkins, a classmate. Apparently, common interests and values existed. Edith, too, became a college graduate. Such an accomplishment was unusual for girls at that time and place.

At a celebration at Fort Hancock, Beverage had the pleasure of meeting the guest of honor, Mary Pickford. He confessed to his delight in her friendly, unassuming manner and said that he readily understood why she was known as America's sweetheart.

Beverage reminisced about his lifelong interest in music. He proudly reported that after many years, he still owned the Conn slide trombone which his Grandmother Smith had bought for him in 1911. He acknowledged that he had been intrigued by the Big Band sound. He taught himself to play the saxophone and clarinet as well as several other instruments. He enjoyed playing with the seven-member orchestra which he formed. He pointed out that it often performed at summer resorts on Saturday nights as well as at other occasions. "It was a challenge," he explained, "to imitate the style of Lombardo's orchestra." Beverage confessed to one of his favorite pranks. "I recorded a comparison of our amateur group with an identical arrangement by Lombardo. Then I asked friends to guess which recording was the Maestro's. Their conjecture was often wrong — giving the credit to the big band when it rightfully belonged to our small orchestra. A colleague, Mr. Hannah, once commented, "You had a musical combo of some renown, Bev."[39] Coincidental with his mother's early fears, Harold Beverage was known as "Bev" by everyone outside of his boyhood home.

There was one incident when Beverage was not satisfied with musical recordings in the usual sense. In an article under the title "High in the Ranks," *The Courier Gazette* (a small community newspaper in Maine) reported that Beverage had the opportunity to escort an important visitor from a foreign country to the RCA laboratory for an interview. The meeting was very casual, too casual it seemed for the occasion. It developed that Beverage had worked out a little stunt whereby he was to greet his visitor literally with a brass band. It was not the best known band in the world but certainly it was the

most unique. It was said that Beverage was "pretty handy with almost any instrument that would toot." By a trick of electric recording, he had played a tune on one instrument afterward recording a harmonizing part with another instrument as he listened to a playback through headphones. One by one he assembled the units of a small band in a single multipart rendition. Beverage was the entire band in that combined recording played for the visitor. [40] Some colleagues at RCA thought he had wasted valuable time of an important dignitary. It was known, however, that the visitor was impressed and delighted with his introduction at Riverhead.

Twenty years following his departure from RCA, Beverage returned to the site of his early employment. The laboratory at Riverhead had been long abandoned. From a description of the area, one reads a sad commentary. "Lying like a stricken dinosaur in the brush, a huge red and white radio tower rusts on the ground. It is an eerie sight. Everywhere there are wooden poles, steel masts, cables and broken cement blocks that show where grander things once stood. Now there is nothing left at Riverhead but the dead hulk of a beautiful radio station."[41] Although one sensed more than a hint of nostalgia in Beverage as he reminisced, he was quick to recall a happier day. He was present, he said, at the grand opening of the facilities in November 1921. "A special train brought out several hundred communication people from all over the world. President Warren G. Harding, from his office in Washington, DC, pressed the button that officially opened the center." Years later when the prominent and prestigious Radio Corporation of America was acquired by General Electric, Beverage did not lament the change. Rather, he confessed that inasmuch as General Electric had greater assets, it was a wise move towards new heights in scientific research. It is quite certain that his attitude was influenced also by his early association with General Electric. The company that paved the way to his brilliant future forged an indelible mark on his memory.

How fortunate that a young man's choice of a career remained both gratifying and exciting throughout a lifetime. In retrospect, Dr. Beverage acknowledged that were he to make a career selection again, he would make the same decision. He admitted to having enjoyed his work so much that he would have labored without remuneration. He was proud of his heritage and grateful for an education. Upon receiving the honorary doctorate in engineering he declared, "I graduated from this University and am a native of the Pine Tree State. Who could wish for a better foundation upon which to build a successful career?"[42]

This is the story of a boy with a dream. It is the story of a man with an inquiring mind and a dedication of purpose. It is a saga of a scientist dealing with perplexing problems and making a difference for mankind. For the many contributions by Dr. Beverage to the industry of communications, the world has recognized him as a leading radio pioneer. Not unlike an epitaph, the "Genius at Riverhead" confessed, "On the island of North Haven they think I'm a big shot and I'm willing to let the myth endure."

11. Genesis of a Genius

The ancestry of Harold Beverage goes deep into the past. Tracing his lineage is to relive several centuries of history. From members of knighthood and royalty in Europe to courageous adventurers in the new world came his forebears. We can envision the many and varied influences that might well have formed the nucleus of his character. Perhaps in his ancestry there is a hint of the source of a "spark of genius" possessed by this island boy.

Four tracks in the Beverage lineage have been examined. The records of the families of Tracy, Doty, Lynam-Smith and Beverage have been assembled from many sources. The Tracy line was taken from the work of *Sullivan and Sorrento Since 1760* by Lelia A. Clark Johnson. The Doty history was compiled by Alex B. Frye of Redlands, California. The story of the Lynam-Smith family was found in a letter written by Jennie Smith to Fred Lynam, November 30, 1923. Parts of that family background were verified by Samuel Beverage with help from the book, *Mount Desert — A History* by George E. Street.[43] The Beverage family record was found in the book *Beveridge Families of England and Scotland* by Sidney A. Beveridge.

The authenticity of the early period from 800 AD to 1610

AD in the Tracy line is subject to question by historians and genealogists. It has been noted that names and titles in early times often were taken but not always by descent. Whether all fact or partially fiction, the Tracy ancestry makes fascinating reading. Beginning with the earliest recorded ancestor — Egbert was the Saxon king of all England, who reigned from 800 AD to 839 AD. His son, Aethelwolf, was the father of Alfred the Great, known as one of the wisest princes ever to rule England. Later in 1395 at the time of King Edward III of England, Sir William Tracy's son John was knight of Gloucestershire while his son John became a member of Parliament. By the time of Henry VI, another William Tracy was called to the King's privy council. During the reign of Queen Elizabeth I, Sir Paul Tracy married Anne, an heiress who bore him twenty-one children. Their ninth son, Thomas Tracy, born in 1610 emigrated to America and settled at Salem, Massachusetts. Hannah Tracy, fifth generation from Thomas, was Harold's great-grandmother. This long family line deserves attention, since in addition to other notable aspects, it adds a touch of romance to Harold and his kinfolks.

Reviewing the Lynam family one finds that Harold's mother, Lottie H. Smith, was the fifth generation down from the union of a French officer, named Lynam and a Prussian "princess." They had been secretly married and later when it became known that an heir would soon be born to the Lynams, they sailed to America. Their son, William, was born while the ship was in the Virginia waters and Virginia was claimed as his birthplace. William was educated in Virginia where he became a teacher. He was known as "a gentleman of the Old School." William eventually went to Florida, built a sailing vessel and set forth for Nova Scotia where he planned to establish his home. Another version of this story is on record. It is believed that William did not sail his vessel as planned. At that time in history, Spain had taken possession of Florida. Fearing that the Spanish would confiscate

his vessel, he had it burned and then sailed with friends in another ship.

It may be assumed that he had chosen Nova Scotia as his future home since he undoubtedly had friends or relatives already established there. As he sailed by Mount Desert Island, however, he was greatly impressed by the beauty of Schooner Head and bought a farm there and settled down. Before leaving Florida, William had married Crosha Tanner Hodges. Their son, William, was born in 1795. He eventually married Hannah Tracy. She was Harold's great-grandmother. Harold remembers as a child the exciting trips with his mother to visit his grandparents on Mount Desert Island. They sailed on the old sidewheeler steamer, "Mount Desert." Since this was before a dock had been built at North Haven, "Monte" stopped in mid-channel while Captain MacDonald rowed them out to the ship and then they climbed up a ladder to get aboard. Harold remembers his Grandfather Smith as leading a very precise life. Even his woodpile was arranged in a neat semicircle. A cousin reported that the old gentleman sometimes even painted the outside of the woodpile. The Smiths eventually returned to spend their later years at North Haven. The Mount Desert property was bought by the Rockefeller family and was established as a park.

When the Mayflower landed at Plymouth in 1620, Edward Doty was among the passengers. His daughter, Desire, married a Sherman. Their granddaughter, Abigail Sherman, married Caleb Carver. Their son, Israel Carver, born in 1740 probably was one of the first Carvers to settle on the island of Vinalhaven.* With the event of the eighth generation in direct line to Edward Doty, Olive Carver became a member of the Beverage family. She was Harold's paternal grandmother.

**Until 1846 Vinalhaven and North Haven were a single town.*

The Beverage family has made its home on the island of North Haven, Maine, since 1770. In that year Thomas Beveridge came as one of the early settlers. His father, James, a Scot weaver from the Isle of Jersey, is thought to be the first Beveridge in America. Thomas was mentioned frequently in the records of the island, and quite certainly was a leader in the beginning days of the community. In 1785, when the settlers of North Haven petitioned the General Court at Massachusetts for clear title to their lands, Thomas and his father, James, were among the petitioners.[44] Tradition credits him with service as a privateer during the American Revolution, however, the name of the vessel is not identified. Again, it is said that he participated in the Boston Tea Party, but the book *Tea Leaves* fails to mention his name.[45] It is interesting to observe that Harold was a 3rd great-grandson of James Beveridge who had left his home on the other side of the Atlantic to brave the unknown in the new world.

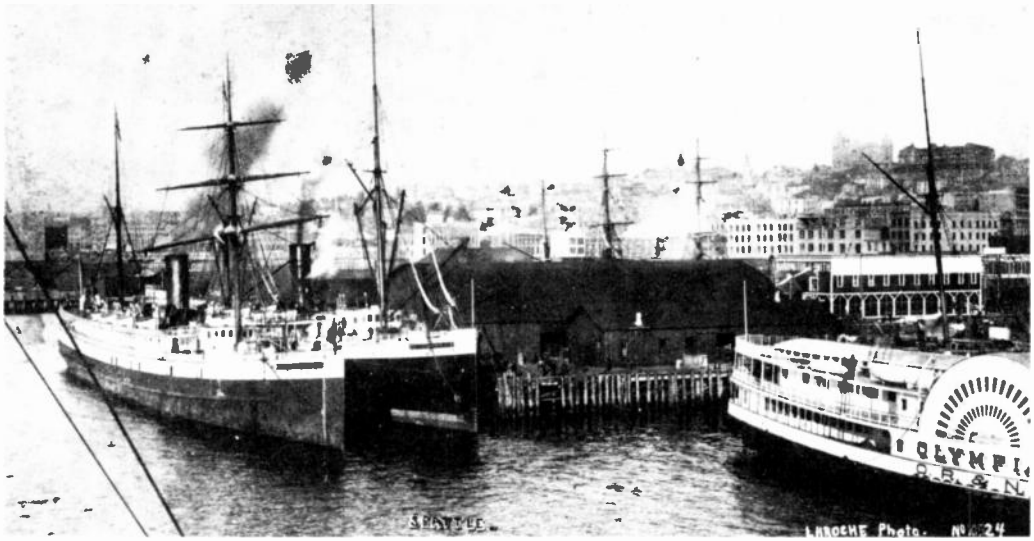
As is common with many family names, the surname Beveridge had at least two spellings; that is, Beveridge and Beverage. It is believed that the Beveridge form may have been the original. The family coat of arms shows two beavers on a ridge, hence "Beveridge." The Beverage spelling was preferred by Harold's family. Quite recently Harold's nephew, Allan Beverage, the family historian, visited Scotland to explore the family homeland. He found that the clan originated in Dunfermline and surrounding towns. There he discovered a great number of Beveridges and Beverages. He was especially gratified in locating the names of two early members. They had been mentioned in the Beveridge genealogy and were reputed to have been arrested for making their beer too weak. Harold felt this not to be unusual as a Scotsman is noted for spending money judiciously. It seems that they had skimped only a wee bit on the ingredients. Allan reported that in his search he had found no record of other miscreants. There were no murderers, horse thieves or bank robbers. Considering the

number of Beveridges involved through the years, there exists an outstanding record of law-abiding citizens.

Years ago, Harold was in the cafeteria line at the Raleigh Hotel in Washington and recognized Sir William Beveridge who was standing directly in front of him. He introduced himself to Sir William and they had breakfast together. As his ancestors came from Dunfermline, Harold found the conversation interesting. Sir William was famous all over the world at that time for his "Cradle to Grave" theory of welfare. As was bound to happen, Sir William asked, "Oh, I say, have you read my stuff?" Harold had read it but disagreed with Sir William's point of view. Not wishing to offend the friendly old gentlemen he replied that he had not read his articles but intended to do so.

Harold Beverage was born into humble surroundings. The place of his birth overlooked the Cubby Hole, a cove on the south shore of North Haven. The farm home had been in the family since 1835, when his maternal great-grandfather, Captain John Smith, purchased the property from Cushing Thomas. When examining Harold's family tree, his parents deserve a prominent place. It was they who must have had the greatest impact upon the nurture of their son.

Harold's father, Fremont Beverage, a native of North Haven, was an adventurous young man. Perhaps he felt the need to be away from the island long enough for the girl he hoped to marry to be sure of her feelings for him. It is quite probable that he dreamed of a greater opportunity for success in the outside world than seemed evident at home. Whatever the objective, he signed as purser on the steamship, *The Queen of the Pacific.* This was the ship's maiden voyage. She sailed down the South American coast, through the Strait of Magellan, and finally north to the coast of California. While aboard ship, Fremont's letters to a Miss Lottie Smith were frequent, and although restrained in his message, were still revealing of his special interest and affection for her. In



31. S. S. Queen of the Pacific (far left) with S. S. Walla Walla and R. Olympia in Seattle, sometime between 1890 and 1900.
Photo from National Maritime Museum, San Francisco, courtesy of North Haven Historical Society, given by Allan Beverage

his letter to Lottie on June 11, 1882, he wrote in part, "I am thinking of home and friends today and among my friends, you occupy a prominent place." — signed, your friend, F. Beverage. Again on August 13, we read from another letter, "Good morning, Miss Lottie, would be my greeting most likely if I should see you personally." — signed, your friend on trial, F.B. Numerous letters, still preserved, were written aboard ship to Miss Lottie, the young woman whom Fremont married upon returning home in 1886.[46]

Before his quest abroad was completed, Fremont taught a term of school in a small town in San Diego County, California. During that same time, Lottie was teaching school at New Harbor, Maine. Harold's father and mother had been graduated from the Eastern State Normal School at Castine. Records show that in addition to Lottie's preparation for teaching, a love for and an accomplishment in music were very much a part of her life. She taught music and for many years played both the piano and organ for the church choir.[47]

32. Eastern State Normal School, Castine, Maine, as depicted in catalogue and circular of that school for the year ending May 28, 1880.

Upon Fremont's return from California, he looked forward to a life as a school teacher. His plans were suddenly disrupted when Harold's grandparents left North Haven for Seal Harbor. Fremont, with little choice, was left to run the family farm. He found time to serve his community in many capacities. At various times he taught school, drew up wills, performed marriages and was equipped as a surveyor. Perhaps his most satisfying public service was the period of years in which he acted as school superintendent. His commitment to education was evident in his school report to the town in 1901. It stated in part, ". . . It (the high school) is a strong agent in waking up pupils, drawing out their latent talents and creating a desire to go higher, and there is always room at the top."

It is apparent that Harold's parents worked hard to provide a comfortable home for their children. They observed the strict Baptist traditions in their daily lives. They held respect for an education and provided the means for their children to receive a good academic preparation for the future. They demonstrated the worthy aspects of making a contribution to their fellow man. One can conclude that these parents were distinguished role models for their son. Harold Beverage,

who, with a prestigious heritage, began life as a member of a farm family in an isolated island home, perhaps was predestined for the eminent place which he holds in history.

33. Fremont Beverage, about 1916.
Courtesy of Harold Beverage

34. Mrs. Lottie H. Smith Beverage, 1900.
Courtesy of Harold Beverage

AFTERWORD

Upon completion of this manuscript, I had the special privilege of meeting Dr. Beverage at his Long Island home. He was the charming gentleman that I had envisioned. I was immediately at ease with his friendly, unprepossessing manner. We visited informally — he answering my many questions and reminiscing about his friends and colleagues of yesteryear. He still retains a fresh sense of humor, is witty, and enjoys a wide range of interests. A myriad array of medals and citations which graced the walls of his den was striking witness to his extraordinary life.

The archives of the North Haven Historical Society are richer for the generous gifts of Harold H. Beverage. A collection of tapes which he prepared was given to the Society. He also presented a copy of the book, *And Part of Which I Was — Recollections of a Research Engineer* by George Brown. Persons interested in the development of color television will find Brown's book both entertaining and expertly informative.

Alberta I. Wallen
1987

List of Appendixes

Appendix I

Graduation Exercises Program, North Haven High School, June 10, 1910.
(Supt. Fremont Beverage's name is misspelled.)

Graduation Exercises

...CLASS OF 1910...

North Haven High School

FIRST BAPTIST CHURCH

Friday Evening, June 10, 1910

AT 8.15 O'CLOCK

Class Motto—Strive to Succeed

Class Flower—Yellow Rose

Class Colors—Green and Gold

CLASS OF 1910

Hildred Marguerite Ames
Ivan Cecil Ames
Etta Fall Beverage
Harold Henry Beverage
Matilda Bernice Crockett
Edith Lillian Hopkins
Scott Dana Staples

CLASS OFFICERS

PRESIDENT—IVAN CECIL AMES
VICE PRESIDENT—EDITH LILLIAN HOPKINS
SECRETARY—HILDRED MARGUERITE AMES
TREASURER—HAROLD HENRY BEVERAGE

Programme

MUSIC

PRAYER

MUSIC

Salutatory—Discovery and Use of Radium

Scott Dana Staples

Class Will — Matilda Bernice Crockett

MUSIC

Oration—Electricity — Harold Henry Beverage

Class Poem — Etta Fall Beverage

Presentation of Gifts — Hildred Marguerite Ames

MUSIC

Class History and Prophecy

Edith Lillian Hopkins

Valedictory—Strive to Succeed

Ivan Cecil Ames

MUSIC

Presentation of Diplomas

Supt. Freemont Beverage

Class Ode — Class of 1910

BENEDICTION

Appendix II

A Magazine Devoted Exclusively to the Radio Amateur

The Wave Antenna for 200-Meter Reception

By H. H. Beverage

Engineer, Radio Corporation of America

For a year now QST has been endeavoring to secure reliable information on the so-called Beverage Wire or wave antenna, which for special purposes is the best arrangement known today. With the approach of our Transatlantic Tests the matter became of even greater moment and we appealed to the Engineering Department of the Radio Corporation of America. They had never done any practical work with it on amateur wave-lengths but very courteously arranged for a series of special tests at their Belmar station, where engineers were sent and numerous lengthy tests conducted on this special subject. The following article, written especially for the A.R.R.L. and QST, is the result. It is absolutely a classic in the literature of amateur radio, and we are very proud of it. We acknowledge our gratitude to the Radio Corporation and its engineers for their very kind co-operation.

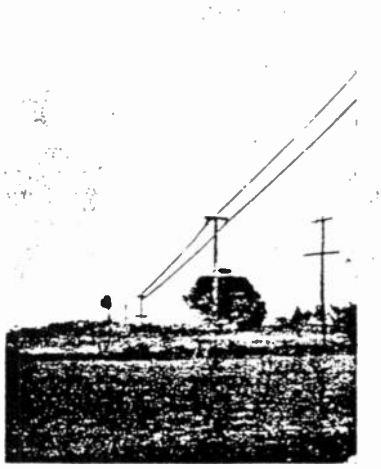
No license rights are to be inferred from the publication of this article, but attention is called to the fact that amateurs are given the privilege of using the wave antenna as set forth and to the extent indicated in the current catalogue of the R.C.A., the owner of the license rights.—Editor.

THE Wave Antenna is a new type of unidirectional antenna which has been developed by the author and Messrs. Chester Rice and E. W. Kellogg of the General Electric Co., and is covered by patents and applications. This antenna has been in existance for some time, but was first brought to the attention of the amateurs by Mr. Paul F. Godley, who described it in his report on the reception of American amateurs at Ardrossan, Scotland. The full theory of this antenna is scheduled to appear in an A.I.E.E. paper for the Pittsburgh convention in November, so this paper will be confined to very elementary theory and practical considerations.

Theory

If a wire is suspended in space, it has a certain capacity and inductance per unit length which bear a definite relation to each other. This relation may be expressed as $1/\sqrt{LC}=V$, where V is a constant. This constant is the velocity of light. For example, if L and C are expressed as the capacity and inductance per meter, then $V=3\times10^{8}$ meters, which is the velocity of light in meters per second. If a larger wire is used, or if two or more wires are used instead of one, in the ideal case the inductance decreases in the same ratio as the capacity increases, so that $L\times C$ is always a constant. This means that, for the ideal wire, the currents induced in that wire will always travel along it at the velocity of light, independent of the size or number of wires.

A practically-constructed wire must be supported at several points and must run horizontally within a few feet of the earth. The effect of the supporting insulators and the proximity of the earth is to



One of the "Beverage Wires" erected at Belmar for these tests.

D E Beale

increase the capacity in a greater ratio than the inductance decreases, so the velocity of the currents on a practical wire is always somewhat less than the velocity of light. On short wave-lengths, however, the velocity approaches very close to the velocity of light, generally between the limits of 85% and 98% of the velocity of light for 200 meters, depending upon the size and number of wires.

In order to make the antenna unidirectional, it is necessary to stop the reflections at the end farthest from the receiver end. This is accomplished very simply by placing a non-inductive resistance between the antenna and ground at the far end. If this resistance is made equal to the "Surge Impedance" of the wire, it absorbs all of the energy and prevents any of it from being reflected back to

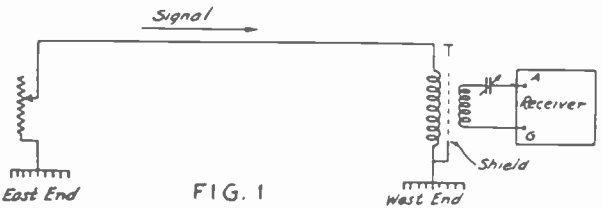


FIG. 1

In Figure 1 is shown the simplest form of Wave Antenna. It consists simply of a wire, at least one wave-length long, stretched in the direction of the transmitting station. For explanation purposes, it may be assumed that the transmitting station is east of the receiving station, and that the receiver is placed at the west end of the antenna, as shown. The travelling wave from the transmitting station moves from east towards the west at the velocity of light. As the wave moves along the antenna, it induces currents in the wire which travel in both directions. The current which travels east moves against the motion of the wave and builds down to practically zero if the antenna is one wave-length long. The currents which travel west, however, travel along the wire with practicaly the velocity of light, and, therefore, move along with the wave in space. The current increments all add up in phase at the west end, producing a strong signal, as shown by curve A in Figure 2. In like manner, static or interference originating in the west will build up to a maximum at the east end of the antenna, as shown by curve B in Figure 2.

If the east end of the antenna were open or grounded through zero resistance, all of the energy represented by curve B would be reflected and would travel back over the antenna to the west end, where part of the energy would pass to earth through the receiver and part would be reflected again, depending upon the impedance of the receiver winding. The horizontal plane intensity diagram would be bi-directional, as shown in Figure 3. The reception from the west is not as good as from the east because some of the energy is lost due to attenuation in the wire as the reflected wave travels back from east to west.

the receiver. The intensity characteristic becomes unidirectional, as shown in Figure 4.

The value of the surge impedance depends upon the size, number, and height of the wires above ground, but is independent of the length of the wire. For practical construction with one or two No. 12 copper wires, the surge impedance lies between the values of 200 and 400 ohms. The surge impedance is theoretically equal to $R = \sqrt{L/C}$, where L and C are the inductance and capacity per unit length.

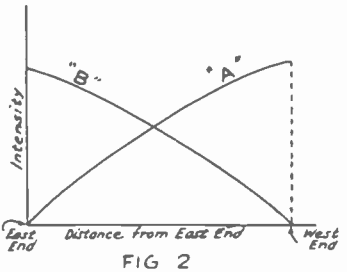


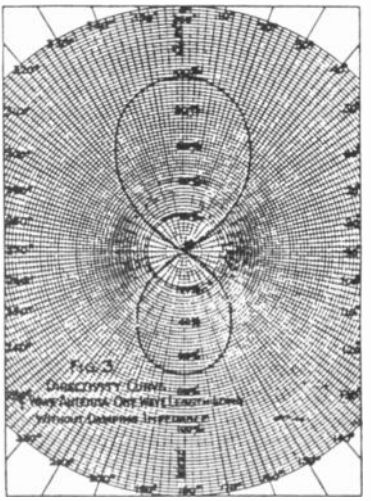
FIG 2

Godley used the simple form of wave antenna, as shown in Figure 1. However, this is not the most practical form as it is necessary to go to the far end to make adjustments of the damping resistance.

Feed-Back Antennae

If two parallel wires are used, the wave antenna becomes very flexible and the receiver may be placed at either end with local control of the damping. In Figure 5, for reception from the east, the receiver

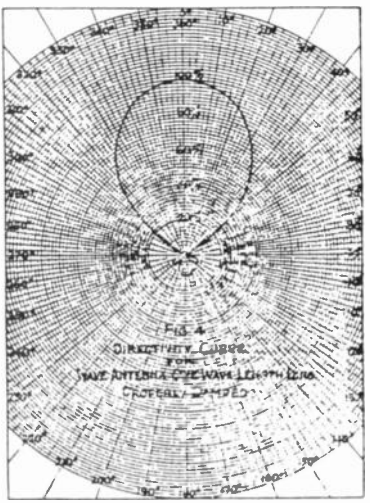
at the west end is replaced by the primary P of a transformer T_1. The primary is coupled to the secondary S as closely as possible, and feeds the energy over the two wires as a transmission line. A second transformer T_2 at the east end feeds the energy from the transmission line into the receiving set. The energy fed over the transmission line circulates around the line



as in an ordinary metallic-circuit telephone line, and, therefore, the currents pass through both halves of the primary of T_2 in the same direction, inducing voltages in the secondary which feeds into the receiving set. On the other hand, currents coming over the wires as an antenna, that is, from the west, are equal and in phase on both wires, and upon passing to ground through the two halves of the primary of the output transformer T_1, they pass through the winding in opposite directions and neutralize. With this circuit, the energy reaching the receiver is the same as it would be if the receiver were placed at the west end, excepting for the transmission line losses, which ordinarily are 20 to 25% with proper design. With this feed-back system, the operator can make adjustments of the surge resistance without leaving the station, and can listen to the signals while he is making the adjustments.

Figure 6 is equivalent electrically to Figure 5, but in this case the transformer T_2 has been replaced by a simpler circuit. By grounding one wire and leaving the other wire open, the energy is reflected on each wire, but the reflected currents on the transmission line are 180 degrees out of phase on the two wires, and, therefore, a difference of potential exists across the terminals of the primary of transformer T_1 exactly the same as when the reflection transformer T_2 of Figure 5 was used. If the ground resistance at the reflecting end is zero, the reflection of energy with the connections of Figure 6 would be 100% efficient, and the only loss would be the transmission line losses. The open-ground reflection connection is preferable to a transformer, on short wave-lengths particularly.

It is possible to damp a two-wire antenna from either end. In the case of Figure 6, the signal from the east built up to a maximum at the west end, and was then reflected up to the east end, where the receiver and damping circuit were placed. In the case shown in Figure 7, the receiver is placed at the west end as in the case of the simple antenna of Figure 1. Instead of placing the damping circuit at the east end, however, it is placed across the transmission line at the west end where the receiver is. This damping circuit is practical-



ly just as effective as it would be if actually placed at the far end. This circuit also has the advantage that the desired signals do not pass over the transmission line, and the transmission line losses are avoided.

In order for the damping circuit to be effective, it is necessary that the two wires of the antenna be joined through an in-

ductance which is of high impedance compared with the impedance of the damping circuit. The best way to acomplish this result is to use a coil with a mid-point tap, as shown at *N* in Figure 7. With respect to the transmission line, the two halves of this coil are adding, so the inductance across the line is high. With respect to the receiver, however, the two halves of the coil are oposing, so that the impedance in series with the output transformer amounts only to the leakage reactance of the coil *N*, which can be made very small. A satisfactory coil for *N* for 200 meters was a 24-turn coil seven inches in diameter, with a tap at 12 turns for feeding the output transformer *T*. This coil was about 0.3 millihenries across the line, or 1900 ohms at 300 meters, and nearly 3000 ohms at 200 meters, which was high enough to have no appreciable influence on the damping circuit, and yet had low enough leakage reactance to allow the signals to pass to the receiver without noticeable weakening.

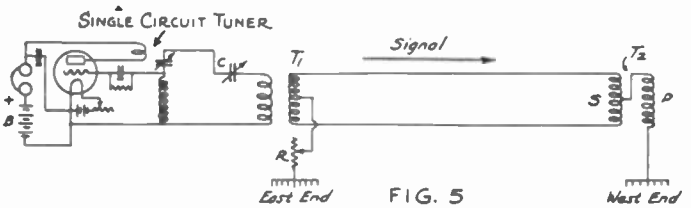


FIG. 5

eliminate. This is made possible by making the damping-circuit reactance, either slightly capacitive or slightly inductive, instead of purely resistive. In some cases it may be desirable to reflect a small amount of energy to neutralize undesirable signals from the back end. This is readily accomplished by adjusting the resistance and capacity of the damping circuit. The capacity and inductance in this damping circuit are usually found to practically neutralize each other for the best adjustment; that is, they should tune approximately throughout the band of wavelengths it is desired to receive. If the wave-length being received is varied over wide limits, it is necessary to readjust the damping circuit condenser for best results, although the adjustment is usually quite broad. The resistance does not need readiustment except in special cases.

For a range of 180 to 360 meters, the damping circuit consists of an inductance of about 0.08 millihenries, a variable con-

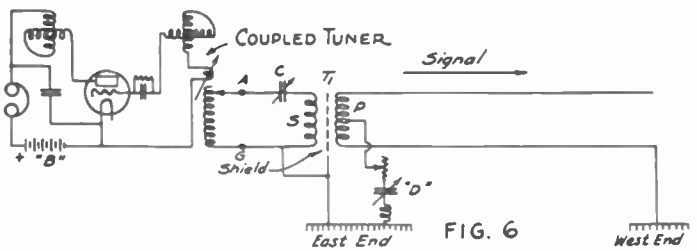


FIG. 6

Damping Circuits

In Figures 6 and 7, damping circuits "*D*" are shown which consist of resistance, inductance, and capacity, in series. Due to distortion on the antenna, to back-wave effects, to interfering signals or static coming from such a direction as to be received on one of the little "ears" on the back of the antenna, as shown in Figure 4, etc., it often happens that there are appreciable residuals which it is desirable to

denser of 0.0015 mfd. maximum capacity, and a non-inductive resistance variable in steps of one ohm from 0 to 500 ohms. A General Radio decade box is ideal for this purpose. However, ordinary resistance wire potentiometers, inductively wound, have been used with entire success in damping circuits. It is necessary to select a potentiometer with sufficiently low inductance to tune well below the shortest wave it is desired to receive; then the induct-

ance of the potentiometer is taken into account when calculating the value of inductance to be used in series with the resistance and capacity. In this manner the inductance of the potentiometer used for the variable resistance may be tuned out, and the damping circuit may be made pure resistance for any one particular wave-length.

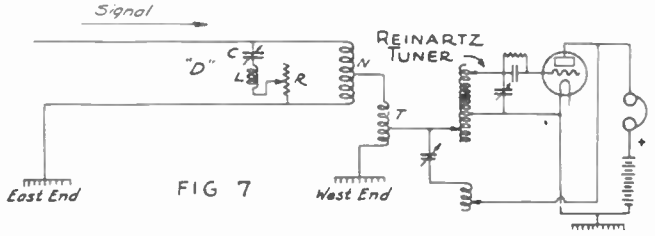


FIG 7

When the damping circuit is placed across the transmission line as shown in Figure 7, the value of the damping resistance may vary considerably with wave-length, becoming lower for short wave-lengt s, due to the increase in attenuation at short wave-lengths partially damping the antenna. In other words, the transmission line acts as a resistance in series with the damping circuit, and the transmission line resistance becomes appreciable at short wave-lengths.

Antenna Design

It is obvious from the theory of the wave antenna just given that it must either point towards the desired signals or that it must point directly away from the desired signals. In case the antenna is pointed away from the signal, then the maximum signal occurs at the far end and must be brought up over the transmission line to the receiver, as shown in Figure 6. In case the antenna is pointed towards the signal, it is necessary to put the damping circuit on the transmission line, as shown in Figure 7. It is possible to use a single antenna for reception from either direction by switching arrangements to change to either the connection of Figure 6 or that of Figure 7 at will. It is preferable on short wave-lengths to point the antenna towards the signal, using the connections of Figure 7, but the feed-back of Figure 6 gives practically the same results, excepting that the signals are not quite as loud due to the transmission line losses.

It is necessary to run the wave antenna in as straight a line as possible and not nearer than 200 feet to other parallel wires, such as telephone and power wires, as the influence of these wires is liable to distort the directive characteristic of the antenna. Other wire lines may be crossed at right angles without undesirable effects. In cases where it is not feasible to run the wave antenna in line with the desired signals, it is possible to get good reception with the antenna somewhat off line by sacrificing signal intensity. By referring to Figure 4 it is seen that for the average antenna one wave length long it is possible to be 45 degrees off line before the signal drops to half intensity. Beyond 45 degrees the signal falls off very rapidly. Twenty degrees off line, the signal intensity has fallen off only 10%, so very good reception may be obtained. If the antenna is two

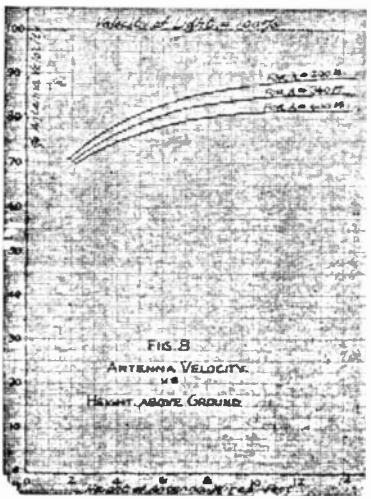
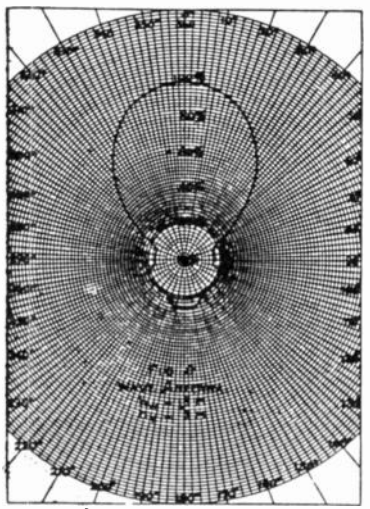


FIG. 8

wave-lengths long, it is more directive, and it is not possible to receive well if it is more than 25 or 30 degrees off line.

The antennae are constructed of copper or other non-magnetic material, although

Mr. Cutler of 7IY reported in the October *QST* that he has obtained good results on a galvanized iron wire. The size of the wire is usually between No. 10 and No. 14 B.&S., although it is possible to get fair results even with No. 18 bell wire. The usual construction is to put up two wires



on a cross arm about two to three feet long. The wires are suspended by porcelain cleats, or in more permanent construction standard telephone pins and high grade insulators are used.

The height of the wires above ground has a marked influence on the velocity of the currents along the wires when the wires are close to the ground, but if the wires are ten feet above the ground there is very little to be gained in velocity by making them higher, as shown in the curves of Figure 8. These data were taken on an antenna at Belmar, N. J., by Mr. H. O. Peterson. This antenna extended over fairly conducting soil The character of the soil underneath the antenna influences the velocity to some extent, but the data of Figure 8 are about the average velocity. These curves show that the velocity becomes lower at longer wavelengths.

If the velocity is too slow, then the currents in the wire lag in phase behind the wave in space, and a point is soon reached when the current in the wire from the far end is so far behind in phase that it not only does not add to the increments from points close to the receiver, but may actually subtract. The maximum length that it is feasible to use is that length at which the current in the wire lags 90 degrees behind the wave in space. This length is given by the formula:

$$L = \frac{\lambda}{4\left(\frac{100}{C} - 1\right)}$$

where

λ = wave-length in meters.

C = signal velocity on antenna expressed in per-cent velocity of light.

For example, from Figure 8 we find that the velocity of the currents in the two wires suspended at a height of 10 feet is about 88% of the velocity of light for 200 meters, so the maximum usable length is:

$$L = \frac{200}{4\left(\frac{100}{88} - 1\right)} = \frac{200}{.544} = 367 \text{ meters.}$$

Therefore it is not feasible to use a two-wire antenna suspended at a height of 10 feet more than two wave-lengths long for 200 meters. By increasing the height, the velocity will increase, and longer wires may be used. Figure 8 shows that the velocity increases slowly with height above 10 feet, so the wires must be much higher to be of material advantage. Making the wires too high introduces a difficulty on short waves which does not occur on long waves, and that is the "end" or vertical-antenna effect. The effective height of a 200 meter wave antenna is about 5% to 10% of its horizontal length, depending upon the nature of the earth beneath the antenna, etc. If an antenna is 200 meters long, therefore, its effective height will be between 10 and 20 meters. If the antenna

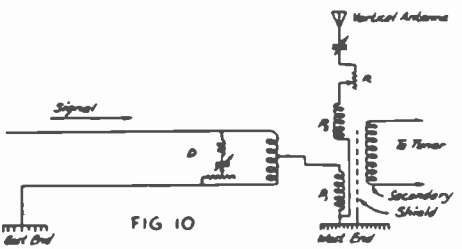


FIG 10

is on supports 10 feet high, the vertical or end effect may be equivalent to an effective height of nearly 3 meters, distorting the directive curve. In Figure 9 is shown

the directive curve of a wave antenna of 15 meters effective height with a vertical or end effect of 3 meters superimposed upon it. It will be noted that the end effect may mount up to very serious proportions if the antenna is made too high. It is, however, possible to balance this end effect by means of a separate vertical antenna, as shown in Figure 10. P_1 is the standard primary, while P_2 is a second primary coil of about the same number of turns, which is wound over P_1 but in the opposite direction. How-

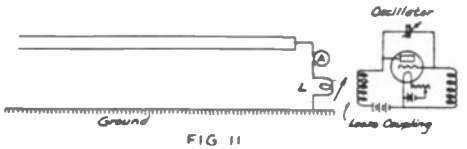


FIG 11

ever, in practice, the end effects seem to be very much smaller than predicted theoretically, so as a general rule if the antenna is not over 10 feet high the end effects are so small that it is not worth the trouble to balance them. From the above considerations, it is evident that 10 feet is a good average height for short wave antennae.

Design of Transformers

With the feed-back circuit of Figure 6 only one transformer is necessary. The output transformer T_1 was made up on a 7-inch cardboard tube. The primary P was 20 turns of No. 24 B.&S. D.C.C. copper wire, with a tap at ten turns or the exact center. Over the primary was placed a shield consisting of a piece of tinfoil insulated from both windings by paper. This shield was grounded to cut out capacity currents between primary and secondary. It is important that the tinfoil be not quite a complete turn around the primary; the ends must not touch or it will act as a short-circuited turn and introduces high losses. The secondary consisted of five turns of No. 18 bell wire wound over the tinfoil shield. The center of the secondary winding was lined up carefully over the center of the primary winding; otherwise the transformer would not be balanced. With the circuit of Figure 6, the transformer balance was tested by opening both wires at the west or reflection end. When the transformer T_1 was properly balanced, the receiver was quiet, indicating that the two halves of the primary were perfectly symmetrical with respect to the secondary.

Transformer T_2 of Figure 6 was designed to work with a coupled receiver. The secondary of the output transformer was connected in series with the primary of the receiver and was tuned by the series condenser C. This same transformer can also be used with a single-circuit tuner like the Westinghouse RC or the General Electric AR-1300 tuner. For 200 meters, it is usually better to use a separate condenser C outside of the tuner condenser, as shown in Figure 5, but for longer wave-lengths this series condenser may be omitted.

When the circuit of Figure 7 was used, the transformer described above was used with success but better results were obtained by cutting the primary turns down to 15 turns instead of 20 turns. This transformer is shown in Figure 1, but may be used with the connections of Figure 7. A tinfoil shield is used between primary and secondary, and is grounded as shown. In all of these transformers the coupling between primary and secondary should be as close as possible.

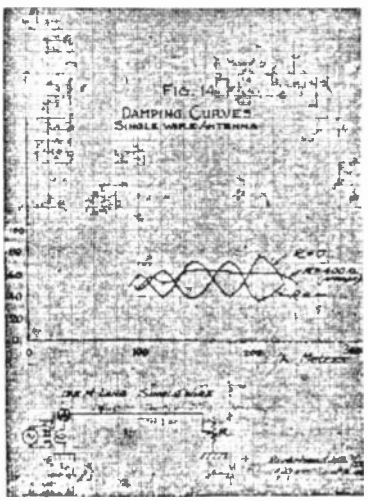
In Figure 7 an auto-transformer T is shown. The total turns are 15, and the receiver is tapped off at 5 turns. The diameter of the turns is 7 inches, but smaller diameters have been used by increasing the number of turns to make the same inductance. This auto transformer connection has been adapted to a Reinartz tuner with excellent results by Mr. Bourne at 2BML.

Determination of Surge Resistance and Velocity

The velocity and surge resistance were easily determined by oscillator tests. An oscillator was coupled to the antenna, as

These antennae were arranged with switching such that the connections of Figure 6 or Figure 7 could be selected at will on either antenna. That is, the west antenna could be used for reception from either the east or the west, and the south antenna could be used for reception from either north or south. For comparative purposes a flat-topped single-wire antenna 40 feet high was erected. The effective height of this vertical antenna was estimated as approximately 8 meters. The signals on the wave antennae were about 50% stronger than on the vertical, giving an effective height for the wave antennae of 12 meters. This figure corresponds to about 5½% of the horizontal length of the wave antennae.

Listening tests on these antennae showed marked directive properties, as expected. Listening south, most of the stations heard were in the 3rd and 4th districts, but careful adjustments were necessary to eliminate 2nd district stations to the north. With the antenna directive towards the



north, the best reception was from the 1st and 2nd districts, although several 8th district stations were heard. The east-west antenna worked better than the north-south antenna, probably because the ground resistance at both ends was less than an ohm, whereas the ground resistance at the far end of the north-south antenna was very high, nearly 300 ohms, making it difficult to operate the damping circuit effectively. The reception from the west was excellent, great numbers of 3rd, 8th, 5th, and 9th district C.W. stations being heard without interference from 1st and 2nd district stations. With the antenna directed east, only local 2's, Long Island 2's, and a few 1's were heard. There was considerable static reduction at times on the eastward reception, as the static was often heavy in the south or west.

On the 360-meter broadcast station wavelength, very good results were experienced in eliminating interference, particularly when using the antenna for west reception, and cutting out New York and Schenectady interference. Station WOC at Davenport, Iowa, was received particularly well on the wave antenna at times when reception was impossible on the vertical antenna due to local interference.

Even on 600 meters, these wave antennae showed very good directivity, particularly for reception from ships at sea.

Mr. Bourne's antenna at Riverhead, L. I., runs in a direction about ten degrees north of west. He reports his results as follows: "Signals from the south and southwest come in with about 25% to 50% increase in signal strength over a vertical antenna 60 feet high. Signals from New England are, in general, very weak, and in some cases cannot be heard at all when using the wave antenna. No interference from ships or shore stations using commercial wave-lengths has been noticed. WSA, at Easthampton, about 20 miles away, at times has a very strong harmonic on about 225 meters, which interferes seriously with 200 meter reception when the ordinary antenna is used, but due to the fact that this station is southeast, no interference is experienced when using the wave antenna. Radiophones on 360 meters come in with about the same intensity as with the vertical antenna, but often the signal-static ratio is much improved with the wave antenna, and, as with 200 meter reception, interference from WSA and WBC (East Moriches, 10 miles away) is entirely done away with."

The amount of static reduction experienced with the 200-meter wave antenna at Belmar depended entirely upon the distribution of the static at different times. On several occasions very marked improvement was noted in the signal-static ratio when receiving from the east and north, and sometimes when receiving from the west, but it was rarely observed to make any marked improvement when receiving from the south.

The author wishes to acknowledge the valuable assistance received from Messrs. H. O. Peterson, R. B. Bourne, and A. B. Moulton, in the collection of these data on the 200-meter wave antennae.

Appendix III

A Page from a Fremont Beverage Letter to Miss Lottie Smith

Steamship Queen of the Pacific.

South Atlantic {Lat 16° 16' S / Lon. 37° 23' W} June 25th 1882

My Friend— Another week has quickly passed away and has been by far the most pleasant to me of any other since we left the land. One thing is very favorable I have not been sea sick yet. The most remarkable event of the past week was the making of land, the little Isle of "Ferdinand Noronha" about 2° S. of the Equator. It is about 6 sq. miles in extent belongs to Brazil and is used as a convict station, being about 200 miles from the land. I am told there are about 200 convicts there for life. We saw quite a village on the N. side. I viewed it with considerable awe. Of course the Island interested us as it was the

Appendix IV

Class List of 1880, Eastern State Normal School at Castine, Maine

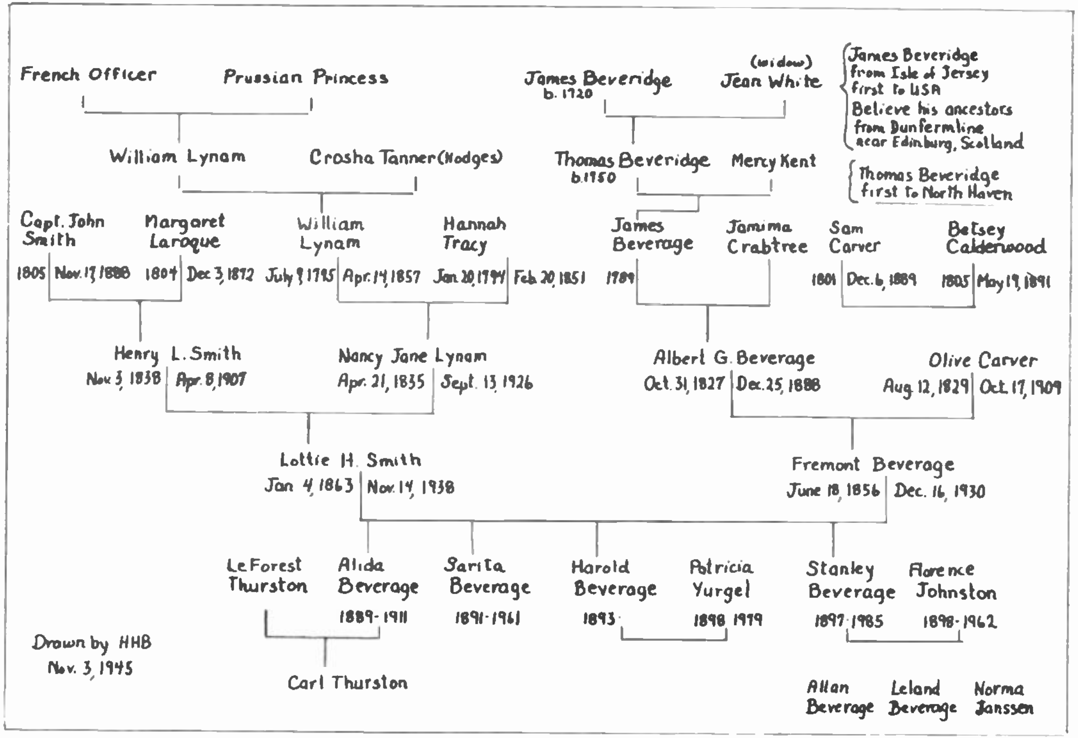
SPRING TERM, 1880.

A CLASS.

NAMES.	P. O. ADDRESS.
Ames, Cora F	North Haven.
Andrews, Laura R	West Camden.
Batty, Kate S	Portland, 47 St. Lawrence [St.
Beals, Caro M	Searsport.
Beverage, Fremont	North Haven.
Bracket, Fannie L	Dexter.
Carver, Angie N.	Searsport.
Damon, Lyman R	North Monroe.
Eaton, C. Lillian	Green's Landing.
Emerson, Helen F	North Castine.
Folsom, Ida C	West Washington.
Grey, Alice P	Castine.
Ham, Timothy E	Cambridge.
Hutchings, Ada F	Penobscot.
Jack, Etta S	Richmond.
Kelley, James E	Unity.
Laughlin, Nellie C	Portland, 45 Atlantic St.
Leland, Rose W	Woodford's.
Light, Elmer E	North Union.
Lyford, Cora F	Corinna.
Mosher, Hattie L	Bangor.
Mower, Ella J	Dexter.
Pendleton, Mattie J	Searsport.
Robinson, Nancy A	South Hope.
Sherman, Carrie I	Lincolnville.
Simmons, Lillian A	Stockton.
Stone, Dora A.	North Haven—27.

Appendix V

The Lynam — Smith — Beverage Line of Descent



For information back to about 1100, see <u>Beveridge Families of England and Scotland</u> by Sydney A. Beveridge published by Mclaren & Co Proprietary, Ltd., 156 George Street, Fitzroy, Melbourne, Australia (1923)

Appendix VI

THE BEVERAGE LINE

Beverage Ancestors of Harold H. Beverage

1st **James Beveridge** (b. ca. 1720) Married Jean White (widow)
children, **Thomas,** Matthew, Sarah, Mercy

2nd **Thomas Beveridge** (b. 1750) Married Mercy Kent
children, John W., Nathaniel, Benjamin K., **James,** Josiah, Mercy, Abigail, Sarah, Lydia

3rd **James Beverage** (b. 1789) Married Jamima Crabtree
children, Benjamin C., Harrison, **Albert G.,** Lucy

4th **Albert G. Beverage** (b. 1827) Married Olive Carver
children, Ellen, **Fremont,** Nora, Frank, Samuel, Lucy, Julia W., Nettie

5th **Fremont Beverage** (b. 1856) Married Lottie Smith
children, Alida (b. 1887), Sarita (b. 1891), **Harold H.** (b. 1893), Stanley F. (b. 1897)

6th **Harold H. Beverage** (b. 1893) Married Patricia Yurgel (1946)
no issue

Appendix VII

LYNAM — SMITH — BEVERAGE LINE

Ancestry of Lottie H. Smith —
Mother of Harold H. Beverage

1st **French Officer** Married a Prussian Princess
son, William Lynam

2nd **William Lynam, Sr.** Married Crosha Tanner Hodges
son, William Lynam

3rd **William Lynam, Jr.** (b. 1795) Married Hannah Tracy
daughter, Nancy Jane

4th **Nancy Jane Lynam** (b. 1835) Married Henry L. Smith
daughter, Lottie H. Smith

5th **Lottie H. Smith** (b. 1863) Married Fremont Beverage
daughters, Alida and Sarita
sons, **Harold H.** and Stanley F.

6th **Harold H. Beverage** (b. 1893) Married Patricia Yurgel
no issue

Appendix VIII

THE TRACY LINE

1st **Thomas Tracy** (b. 1610) Emigrated to America 1636
Married Mary *(unknown)*
son, Jonathon

2nd **Jonathon Tracy** (b. 1646) Married Mary Griswold
son, Christopher

3rd **Christopher Tracy** (b. 1680) Married Lydia Parish
son, Jonathon

4th **Jonathon Tracy II** (b. 1713) Married Abigail Riggs
son, Wheeler

5th **Wheeler Tracy, Sr.** (b. 1765) Married (1) Sarah Clifford, (2) Sally Wakefield
daughter, Hannah — d/o Sarah (Clifford) Tracy

6th **Hannah Tracy** (b. 1794) Married William Lynam, Jr.
daughter, Nancy Jane

7th **Nancy Jane Lynam** (b. 1836) Married Henry L. Smith
daughter, Lottie H.

8th **Lottie H. Smith** (b. 1863) Married Fremont Beverage
daughters, Alida and Sarita
sons, Harold H. and Stanley F.

9th **Harold H. Beverage** (b. 1893) Married Patricia Yurgel
no issue

The early Tracy line is believed to have started with Egbert, the first Saxon king of all England (reign 800-839). From this date to the 27th generation, Thomas Tracy, the authenticity is held in question by historians and genealogists. It has been pointed out that names and titles were often taken or given but not always by descent.

Appendix IX

THE DOTY (MAYFLOWER) LINE

1st **Edward Doty** Arrived in America in 1620 aboard the Mayflower. Married Faith Clark
daughter, Desire

2nd **Desire Doty** Married William Sherman
son, Ebenezer

3rd **Ebenezer Sherman** Married Margaret Decro
daugher, Abigail

4th **Abigail Sherman** Married Caleb Carver
son, Israel

5th **Israel Carver** Married Margaret Sherman
son, Israel, Jr.

6th **Israel Carver, Jr.** Married Susanna Jewel
son, Samuel

7th **Samuel Carver** Married Betsy Calderwood
daughter, Olive

8th **Olive Carver** Married Albert Beverage
son, Fremont

9th **Fremont Beverage** Married Lottie Smith
son, Harold H.

10th **Harold H. Beverage** Married Patricia Yurgel
no issue

Appendix X

Harold H. Beverage
Awards and Honors

1923	Liebmann Memorial Prize — Institute of Radio Engineers
1928	Fellow — Institute of Radio Engineers
1937	President — Institute of Radio Engineers
1938	Armstrong Medal — Radio Club of America
1938	Honorary Doctor of Engineering — University of Maine
1940	Modern Pioneer Award — NAM
1944	Certificate of Appreciation — U.S. Army Signal Corps
1945	Medal of Honor — Institute of Radio Engineers
1948	Presidential Certificate of Merit
1948	Fellow — Institute of Electrical and Electronic Engineers
1952	President — New York Electrical Society
1954	Fellow — American Association for Advancement of Science
1955	Eminent Member — Eta Kappa Nu
1957	Lamme Gold Medal — American Institute of Electrical Engineers

1958	Endowment Award to the University of Maine
1958	Achievement Award — IRE Communications Group
1959	Honorary Member — Tau Beta Pi, University of Maine chapter
1974	Marconi Gold Medal of Honor — Veteran Wireless Operators Association
1976	Fellow Pioneer Award — Radio Club of America
1976	Alumni Career Award — University of Maine
1984	100th Anniversary of the IEEE Medal

Undated Honors:

Honorary Member — U. S. National Committee of URSI

Member
- New York Academy of Sciences
- American Radio Relay League
- Old, Old Timers Club
- Society of Wireless Pioneers
- Veteran Wireless Operators Association

Listed in
- *Who's Who in America,*
- *Who's Who in New York*
- *Who's Who in American Science,*
- *Who's Who in American Men and Women,*
- *Radio's 100 Men of Science*

Appendix XI

Partial List of Patents by Harold H. Beverage and Recent Comments on Some from Dr. Beverage

Patent No.	Date Issued	Subject
1697945	Jan. 8, 1929	Phasing of antennas with artificial lines
1989965	Aug. 5, 1931	Means for testing recorded sound — automatic check film
1819589	Aug. 18, 1931	H.H.B. & H.O. Peterson — Means for eliminating fading on high frequencies (filed 1/2/26)
1849608	Mar. 15, 1932	Frequency modulate or mark/space for AGC (automatic gain control)
1874865	Aug. 30, 1932	Acoustic combining system — mix reflections
1874866	Aug. 30, 1932	Method for eliminating fading — basic rectifier telegraph

1888065	Nov. 15, 1932	Differential volume control for diversity artificial line
1917290	Jul. 11, 1933	H.H.B. & H.O. Peterson — Rotating switch, diversity
1917291	Jul. 11, 1933	H.H.B. & H.O. Peterson — Artifical line pickup delay, diversity
1987889	Jan. 15, 1935	H.H.B. & H.O. Peterson — Means for eliminating fading switch or different beats
2014581	Sept. 17, 1935	Remote control system for relay stations
RE19784	Dec. 10, 1935	Aerial system — balanced bridge to reduce engine ignition noise of aircraft
2025190	Dec. 24, 1935	Multiplex signaling — commutator and frequency change for multiplex
2028860	Jan. 28, 1936	Receiving system-rectifier high frequency for C.W. Hansell electrolytic recorder
2034738	Mar. 24, 1936	Radio telegraph repeater — electronic, no relays
2067432	Jan. 12, 1937	Radio communication — frequency diversity
2069831	Feb. 9, 1937	H.H.B. & H.O. Peterson — Fading eliminator — different beat notes
2070418	Feb. 6, 1937	Multiplex cable code with diversity receivers
2076361	Apr. 6, 1937	Crystal oscillator monitor for centralized control
2081730	May 25, 1937	Television system — AGC based on density of film

2084760	June 22, 1937	System for radio spectography, horizontal sync on oscillograph
2095050	Oct. 5, 1937	Signaling-space between carrier and sidebands, phone
2112877	Aug. 5, 1938	Centralized control relay stations
2138134	Nov. 29, 1938	H.H.B. & G.S.W. Short signaling — antennas cancel reflections
2144215	Jan. 17, 1939	Electrical energy measuring system — frequency modulation
2146301	Feb. 7, 1939	Warren Knotts & H.H.B. — Frequency assignments for relay stations
2173156	Sept. 19, 1939	Amplitude modulation reception — change to phase modulation
2247743	Jul. 1, 1941	Antenna — phased loop, basis RCA TV receiving antenna
2255374	Sept. 9, 1941	System for noise reduction — noise random, signal in phase
2271909	Feb. 3, 1942	Ultra short wave noise elimination — balance local noise vertical suppressor
2405991	Aug. 20, 1946	Secrecy system — shift signals between multiplex channels
2416791	Mar. 4, 1947	Radio receiving system — local oscillator varied by signal-noise bursts

2487513	Nov. 8, 1949	Radio relay system — frequency selection for relay stations

Harold H. Beverage's Recent Comments on Some of His Patents

1819589 H.H.B. & H.O. Peterson. Means for eliminating fading on high frequencies.

"As I recall it, this patent covered every means that we could dream up for eliminating fading at high frequencies, including spaced antennas and vertical vs. horizontal antennas for polarization diversity. Polarization diversity is used with the reception of signals from satellites wherein the polarization varies due to the Faraday effect when the signal passes through the ionosphere."

2028860 Receiving system-rectifier for C.W. Hansell's electrolytic recorder.

"It would require a book to fully describe this system. It consisted of a very fine stream of ink which was sprayed onto a moving tape. My contribution was the means to turn on-off signals into plus and minus direct current pulses which deflected the ink stream for recording the signals on the moving tape."

2081730 Television system-AGC based on density of film.

"Years ago news events were recorded on 16mm sound film. It was rushed to the studio where it was developed as quickly as possible to beat the competition. There was no time to check the film. When a brightly lighted scene followed a darkly lighted scene the television transmitter would be overloaded and would sometimes automatically shut down. In my invention I measured the light intensity on the frame 24 frames ahead of the frame being broadcast. That allowed one second to automatically adjust the level of the bright scene

when it reached the film gate. It could be accomplished in several ways. For example it could actuate a diode in series with a resistance shunted across a transformer winding. The same idea can be applied to video cassettes by using a playback with the pickup heads separated by one second."

General Electric Co. Patents —

"The General Electric Co. did not send the expired patent disclosures to the inventors so I must rely on memory alone. I think that the basic patent on the Wave Antenna was issued in my name. Patents were issued to Chester Rice and Edward Kellog covering suggestions which they advanced."

"The Wave Antenna was used at all RCA stations during the period when the Very Low Frequencies were used. It is still used in the far North on low frequencies because the high frequencies are very unreliable due to the effect of sun-spots. The United States Signal Corps and Air Force use Wave Antennas in Alaska and Greenland. A Russian friend told me that many Wave Antennas are used in the far North in the Soviet Union. Amateurs use the Wave Antenna on several of their bands, 160 thru 20."

Another recent use for the Beverage Antenna has been the experiment of communication with submerged submarines. "Permanent solution — use ELF (Extremely Low Frequency) in the range of 30 to 100 HZ, but how can one radiate energy at ELF? Solution — use modified Beverage Antennas. In order to radiate at ELF with buried ground antennas, the ground conductivity must be very low to great depths. An experimental antenna about 100 miles long was established in North Carolina. Measurements made by the Rocky Point Lab, at sea, off Long Island, indicated that the signals could be received as predicted by theory and that the attenuation vs. distance was very low."

Appendix XII

Chronology of Events in the Life of a Radio Engineer
Harold H. Beverage

1914	Member, Institute of Radio Engineers
1915	Bachelor of Science Degree in electrical engineering from the University of Maine
1916	General Electric — test man
1917-1920	General Electric — laboratory assistant to Dr. Alexanderson
	Assisted in development of Alexanderson alternator system and multiple tuned antenna for very low frequencies
	Developed the Alexanderson barrage receiver
	Invented the Beverage wave antenna
1919	Member, Union Radio Scientific International
1919	Installed the receiver and some audio equipment aboard the S.S. *Washington* carrying President Woodrow Wilson on his return trip from France
1922	Established the first radio station in South America
1920-1929	Radio Corporation of America — in charge of radio station reception systems
	Co-inventor with H.O. Peterson of the diversity reception system

1929-1941	RCA Communication, Inc. — Chief Research Engineer
	In charge of Riverhead, Rocky Point, and New York laboratories
	Many inventions and patents filed
1941-1958	RCA Communications, Inc. — Vice President, Research & Development and Director of Radio Research with three groups at Princeton, N.J. in addition to Riverhead, Rocky Point and New York laboratories.
1942-1945	Member, Division 15 of National Defense Research Committee
1942-1946	Consultant, Office of the Secretary of War
1958	Retired from RCA and continued as consultant to RCA for several years
1959-1965	Member, Polaris Command Communication Committee for Submarines
1959-1967	Member, Joint Technical Advisory Committee of AIEE-NAM

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Harold H. Beverage, 99, Radio Communications Pioneer

By Cathrine Duffy
SPECIAL CORRESPONDENT

Dr. Harold H. Beverage, a pioneer in radio communication, died Wednesday of heart failure at John T. Mather Memorial Hospital in Port Jefferson. He was 99.

Dr. Beverage, a resident of Stony Brook since 1955, received a bachelor's degree in electrical engineering from the University of Maine in 1915. He came to Long Island in 1919 to work at RCA Corp.'s Riverhead Receiving Station, where he developed the Beverage Wave Antenna. This was instrumental in the development of overseas communications, and a precursor to other uses of wave antennas at higher frequencies, according to longtime friend and associate Marshall Etter.

Dr. Beverage's biography, "Genius at Riverhead," by Alberta I. Wallen, is about his work there.

In 1941, Dr. Beverage was named Vice President in charge of Research and Development, a position he held until 1958. He amassed 40 patents and was an expert consultant to the office of the Secretary of War from 1942 to 1946.

Made an honorary Doctor of Engineering by the University of Maine in 1938, he was the recipient of the Marconi Gold Medal of Honor from the Veteran Wireless Operators Association in 1974.

Dr. Beverage's wife, Patricia, died in 1979. Survivors include two nephews, one grandnephew and four grandnieces.

Visitation will take place today and tomorrow from 2-4 and 7-10 p.m. at O.B. Davis Funeral Home in Port Jefferson Station. The funeral will be Monday at 10 a.m. at O.B. Davis, with a service to follow at Washington Memorial Park in Coram. The remains will be cremated.

Donations in memory of Dr. Beverage can be made to Deborah Johnson, President, The Museums at Stony Brook, 1208 Route 25A, Stony Brook, N.Y. 11790.

Louis F. Sikorsky, Was Raceway Engineer

By Tony Schaeffer
STAFF WRITER

Louis F. Sikorsky of Greenvale, a retired operating engineer, died Tuesday at his daughter's home in Hudson, N.Y. He was 75.

Mr. Sikorsky worked for 46 years at Roosevelt Raceway. He was a member of Operating Engineers Union Local 138 and operated heavy equipment at the track, including driving the starting gate, which he had helped build.

Mr. Sikorsky grew up in Roslyn Heights and was a lifetime resident of that area. He had lived in Greenvale for about the past 15 years. He was a member of the Roslyn Highlands Fire Company for more than 40 years.

Mr. Sikorsky is survived by a daughter, Betty Lou Towart; a brother, Anthony of Westbury; a sister, Pauline Sherry of Hicksville; and a grandson. Also surviving is his longtime close friend Mary Pascucci of Greenvale. A mass was scheduled for 10 a.m. today at St. Mary's Catholic Church, Roslyn, with burial in Holy Rood Cemetery, Westbury.

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