

Amy K. Marshall. FREQUENTLY CLOSE TO THE POINT OF PERIL: A HISTORY OF BUOYS AND TENDERS IN U.S. COASTAL WATERS 1789-1939. (Under the direction of Dr. John Tilley) Department of History, February 1998.

The purpose of this thesis is to provide insight into the establishment and administration of the many incarnations of the light house service of the United States, and demonstrate how changes in personalities involved as well as available technological advances were instrumental in providing the conduit for change in buoy and buoy tender designs. While a number of authors have treated the subject of lighthouses, no secondary source has treated the history of minor aids to navigation, the class to which buoys belong.

The thesis chronicles the administrative changes of the light house service in the United States under the Fifth Auditor Stephen Pleasanton, the Light House Board, and, finally, the Light House Bureau under George Putnam in the early twentieth century. The organization and personalities of the service are reflected in changes to minor aids to navigation as technological advances were applied to buoy and buoy tender designs and construction. Nowhere is this correlation more pronounced than in the establishment of the Light House Board which included top scientists and physicists among its members, and the explosion of creative application of available technology for use in buoys and buoy tenders.

The thesis provides information and insight into a subject detailed only piecemeal elsewhere. To understand aids to navigation and changes in the designs of buoys and buoy tenders, it is necessary to understand the administration of each incarnation of the lighthouse service and the personalities that shaped its policies.

FREQUENTLY CLOSE TO THE POINT OF PERIL:
A HISTORY OF BUOYS AND TENDERS IN U.S. COASTAL WATERS

1789 - 1939

A Thesis
Presented to
the Faculty of the Department of History
East Carolina University

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts in Maritime History/Nautical Archaeology

by
Amy K. Marshall

February 1998

Acknowledgments

No endeavor is completed without the influence and encouragement of family, colleagues, and friends. I want to thank the following individuals without whom this thesis would still be hidden among the records of the National Archives, manuscript sources up and down the eastern seaboard, and the files of my own library.

The enthusiasm of my mother and father, Winifred and Kenneth Knowles, and the numerous telephone calls that began with, "so, how's your thesis going?" were a source of motivation that is difficult to express completely. Their unconditional love and support continue to amaze me and constitute a debt I cannot begin to repay. I thank my husband, Tim, for his understanding when the final phase of this project took away most of my time; his understanding and helpfulness were and are more appreciated than he can ever realize.

I would also like to thank Dr. John Tilley at East Carolina University who provided guidance through his many suggestions. Dr. Carl Swanson and Dr. Gordon Watts, also at East Carolina University, were a source of direction in their suggestions and requests for more detailed information. I also thank Dr. Dennis Noble; our shared interest in the history of the Light House Service led to the reciprocal sharing of research for our individual projects. I would also like to thank Dr. Benjamin Trask and the staff of the research library at the Mariners' Museum in Newport News, Virginia, for their assistance both research-wise and financial in their kind extension of the William D. Wilkinson Fellowship for the completion of this treatise. I owe a debt to the patience and understanding of National Archives archivist Angie VanDerReedt who oversees the Civil Service Records that includes Record Group 26. Her familiarity with Record Group 26 and willingness to work with me in providing the records were invaluable.

I want to thank the following individuals at the Coast Guard for their assistance: Lt. James W. Rice III at the National Aids to Navigation School in Yorktown, Virginia; Dr. Stan Walker and Mr. Wayne Danzig of the Aids to Navigation engineering division at Coast Guard Headquarters; the captain and staff of the minor aids to navigation division; the staff of the Coast Guard Public Affairs division—especially the editor and staff of the *Commandant's Bulletin*. I would also like to thank the officers and crew of the CGC *Red Birch* based at the Coast Guard Yard, Curtis Bay, Maryland. During the close of navigation in Chesapeake Bay in November 1995, I had the opportunity to witness the relief of standard lighted buoys and the placement of ice buoys. Freezing on the fog'sle with the Master Chief gave me a new appreciation for exactly what tender crews accomplished and their dedication to the task.

I would most of all like to thank Dr. Robert Browning, Chief Historian of the Coast Guard who suggested this topic with the words, "Have I got a thesis topic for you," during our first meeting in January 1993. His interminable inquiries into the status of this

project were a prime motivating factor in its timely completion. His humor and encouragement were a source of inspiration that drove the project forward when sources were not as detailed as I would have liked. His familiarity with the overall subject, insights into sources, suggestions for further research as my own research progressed, and contacts proved invaluable as I hunted through manuscript collections and archives for information that we knew would be "down among the reeds."

Table of Contents

List of Figures.....	v
List of Tables.....	vii
Introduction.....	1
Chapter 1: A Nascent Service and a Brace of Bureaucrats, 1789-1852.....	10
Chapter 2: Charting a Safer Course, 1852-1910.....	40
Chapter 3: The Age of Putnam: Early Administration and the Consequences of War, 1910-1922.....	93
Chapter 4: The Age of Putnam: The U.S. Lighthouse Service Comes of Age, 1921-1939.....	121
Conclusions.....	152
Bibliography.....	157

List of Figures

Figure 1. Reproduction of <i>An Act for the Establishment and Support of Light-Houses, etc.</i> , August 7, 1789.....	12
Figure 2. Cask buoy from the Rijksmuseum voor Scheepsarcheologie.....	18
Figure 3. Small buoy-tending boat from the 1920's.....	28
Figure 4. William M. Ellis's shackle and mooring system design.....	54
Figure 5. John Moody's floating lighthouse.....	67
Figure 6. James Kane's 1874 buoy design.....	68
Figure 7. James Kane's 1874 buoys design in series.....	69
Figure 8. Richard Pintsch's first patented buoy design, 1877.....	71
Figure 9. John M. Foster's first patented buoy design.....	72
Figure 10. Artist's conception of Foster's buoy in swell.....	73
Figure 11. Julius and Richard Pintsch's compressed gas buoy.....	74
Figure 12. John M. Foster's second patented buoy design.....	75
Figure 13. Foster's lighted whistle buoy, 1893.....	76
Figure 14. Foster's lighted bell buoy.....	77
Figure 15. Buoy No. 5, Gedney's Channel Series, New York harbor.....	79
Figure 16. Brown's Bell Buoy.....	82
Figure 17. Courtenay's Whistle Buoy.....	84
Figure 18. Line drawing of the <i>Goldenrod</i>	86
Figure 19. Side-wheel steamer <i>Willow</i>	87

Figure 20. B III Type Pintsch Gas Buoy, 1913.....	97
Figure 21. Willson Automatic Gas Buoy, 1905.....	102
Figure 22. Unidentified buoy wharf, ca. 1927.....	128
Figure 23. Unidentified crewman standing on the superstructure of a buoy similar in design to the Brown's Bell Buoy.....	129
Figure 24. Chime or "gong" buoy, ca. 1927.....	130
Figure 25. Side-wheel steam tender <i>Holly</i>	145
Figure 26. Lighthouse Service/Coast Guard logo celebrating 150 years of aids-to-navigation service.....	148

List of Tables

Table 1. Unlighted Buoys in the Light House Service June 30, 1922.....	124
Table 2. Types of Buoys Deployed During the Light House Service Administration of the 20th Century.....	150

Introduction

When identifying and studying changes in maritime trade, historians have traditionally described changes in vessel design and propulsion. Few have concentrated on the impact of navigational aids—and those who have noted technological changes have limited their studies to lighthouses. Off-shore, individual aids classified as minor aids, experienced phenomenal technological changes over a 150-year period administered by the light house organization of the United States.¹ From the earliest times, mariners, faced with approaches to unfamiliar shores, realized the need for dependable aids to navigation. Wind-swept lighthouses, so familiar in our history and folklore, represent the largest and most recognizable type of major navigational aid. Long before modern lighthouse structures, such as that of Pharos in the harbor of Alexandria in Egypt (erected in 279 B.C.),² mariners were most likely familiar with beacons in the form of fires

¹Fog horns are also classified as minor aids to navigation. The scope of this thesis is not sufficiently broad to cover these types of aids.

²John Naish, *Seamarks: Their History and Development* (London: Stanford Maritime, 1985), 16. George R. Putnam, Commissioner of Lighthouses, in his 1937 work *Sentinel of the Coasts: Log of a Lighthouse Engineer* (New York: W.W. Norton and Co., Inc.), cites Strabo, Ceasar, and finally Edrisi, an Arabian geographer in 1154 as to the structure and longevity of the Pharos lighthouse. According to Putnam: "there is no full description or representation of it [Pharos], but it appears on many Roman coins. It is known to have been in actual use as a lighthouse for more than fourteen hundred years ... Edrisi [noted that] 'During the night it appears as a star, and during the day it is distinguished by the smoke.'" 163.

arranged on hillsides as guides to port.³ The romance of lighthouses has resulted in much research into individual lights of the world, and the publications of histories including those of Pharos and the hypothesized use of the Colossus of Rhodes as an aid to navigation, to the construction of the towers of Britain's Eddystone Light and similar structures in American and Canadian waters.

But lighthouses represent only a fraction of the story. This fixation on lighthouses and tales of keepers and their mermaids has overshadowed not only those who organized the building of the lights, but also the placement of so-called minor aids to navigation in the waters of the world.⁴ For the scope of this study, minor aids to navigation may be defined as buoys of various shapes and sizes. Administration of lights and buoys has been, for the most part, relegated to the introductions and background chapters of major secondary sources that focus on lighthouses. As of this writing, there is no comprehensive treatment of the history of buoys and buoy tenders. The scope of this thesis is not sufficiently broad to cover the administration of navigational aids on a global

³Francis Ross Holland, Jr., *America's Lighthouses: Their Illustrated History Since 1716* (Brattleboro, Vermont: The Stephen Greene Press, 1972), 1.

⁴Holland devotes some text to the construction and maintenance of Eddystone Light (erected in 1698), and includes the lyrics of a popular folk song:

My father was the keeper of Eddystone Light
And he slept with a mermaid one fine night.
From this union there came three,
A porpoise, a porgy, and the other was me.
Yo, ho, ho, the wind blows free;
Oh, for a life on the rolling sea.

scale, nor does it focus primarily on their administration in the United States; a history detailing changes in buoy and tender design and placement, however, cannot be completely divorced from its administrative contexts. To understand how buoys changed and what forces affected those changes, it is imperative to present concise information about the administration of buoys in American coastal waters under the aegis of the United States government.

The following chapters chart the course of the Light House Service as it sought to fulfill its objective of providing accurately marked sea lanes. The beginnings of the administration under the Department of the Treasury were marked by bureaucratic management and a lack of comprehension of nautical science sufficient to further an effective program of development and implementation of minor aids to navigation. The incorporation of the quasi-military Light House Board in 1852 marked a dramatic change, not only in how the United States administered aids to navigation, but also in the very aids available for experimentation and practical use. The convening of the Light House Board also brought with it an appreciation of the necessity for specialized vessels to handle new, larger buoys with a maximum amount of safety. Technological changes in buoy manufacturing techniques as well as the advent of steam navigation precipitated the need for larger, more visible buoys, and provided the main driving force behind the Light House Board's experimentation program. Steam-propelled vessels proved a boon to the board itself in that these vessels were more highly maneuverable than their sail-rigged

counterparts, thus ensuring more accurate placement of buoys on triangulated stations. The 1910 re-invention of the Light House Board and the advent of commissioner George R. Putnam marked yet another turning point for buoys in the United States. By 1910, buoys were lighted with acetylene and Pintsch gas, and rigged with bells and whistles and experimental audible signals. Putnam recognized the need for even more specialized tenders—vessels that would protect his crews' safety as they relieved highly explosive gas buoys. In many ways, Putnam reaped the rewards of his own determination and the rewards of over one hundred years of successful and steady advances in buoy and tender technology.

Conceding, however, that the United States's light house organizations did not exist in a vacuum, and, therefore, did not make decisions concerning buoy types and tender requirements without consultation, it is important to provide a brief sketch of the history of the administration of buoys and other navigational aids in Europe.⁵

Pharos, the Egyptian lighthouse at Alexandria, was, as far as any surviving documentary and archaeological evidence is concerned, the first such structure of its kind. Its size and visibility earned it a ranking among the Seven Wonders of the Ancient World. The magnitude of the construction effort and maintenance is a tribute to the importance, placed on maritime commerce by Mediterranean civilizations. Pharos would not,

⁵The light house organizations of the United States included the original Light House Service 1789 - 1851, the quasi-military Light House Board 1851 - 1910, the Light House Service under the Department of Commerce 1910 - 1939, and the final incorporation of the service into the Coast Guard in 1939.

however, remain the only fire tower in the Mediterranean. The Romans, intent on maintaining their superiority in maritime trade, followed the Egyptians' lead. The Romans constructed and maintained their own lights in areas of strategic importance including the waterways near Antioch in the Gulf of Iskenderum and the Hellespont.⁶ By the height of Roman dominance, lighthouses ringed the Mediterranean, ensuring the safety of maritime commerce. Yet, by design, engineers constructed lighthouses to be used as navigational aids while ships were a safe distance from the coast. Surely the ancients recognized the need for markers closer to shore—if not actual buoys; there is, however, no extant record of the existence of floating navigational aids during the Roman period.

During the medieval period, upkeep of major navigational aids fell to individual cities, which looked upon a safe sea road as imperative to the survival of their economies. According to *La Compasso de Navigare*, the first buoy ever recorded marked the approach to Seville in the Guadalquivir River.⁷ The year 1323 marked the beginning of reliance on minor aids to navigation in Northern European waters; the Dutch placed floating aids in the Vlie, which leads to the Zuider Zee and the economic centers of Amsterdam and Kampen. The Dutch, in 1358, also marked the Maas River near the

⁶Naish, *Seamarks*, 17-18.

⁷*La Compasso de Navigare* is a volume compiled in 1295 as a mariner's manual complete with sailing instructions for areas not only in the Mediterranean, but also along the coast of the Iberian peninsula.

present-day Rotterdam Europort.⁸ Individual towns collected tolls, called *tonnengeld* in Dutch, from mariners whose own economic and physical well-being relied heavily on the meticulous upkeep of navigational aids in and around the Zuider Zee.

Changes in the organization and administration of aids to navigation in Europe came with the 1514 Charter of the Trinity House in London. The charter itself resulted directly from a petition by the Guild of Shipmen and Mariners to King Henry VIII. The Guild respectfully complained that a profusion of inexperienced young pilots currently plying the rivers were a danger not only to the well-being of maritime commerce, but also to those who had taken the time and effort to become familiar with the art of pilotage. The Guild also warned the king against trouble that could be caused by an influx of foreigners eager to learn England's coastal and interior waters for the purpose of conducting their own trade without English pilotage regulations.⁹

Trinity House, far from being a single-mission entity, was charged with various charitable functions as well as the "superintendence of Navy Stores and Provisions."¹⁰ It was not until 1594, under Queen Elizabeth I, that Trinity House received the right to erect

⁸Naish, *Seamarks*, 51.

⁹Anon., *Trinity House, London* (n.p., n.d.), 1. This history of Trinity House was brought to the author's attention during a research trip to the National Aids to Navigation School in Yorktown, Virginia. None of the officers or staff of the N-ATON School knew where this publication originated, nor did they know the author or date of the publication. It exists as a booklet in their library and as a photocopy in the author's files.

¹⁰*Ibid.*, 1.

“beaconage, buoyage, and ballastage” after the Lord High Admiral surrendered the right to the queen.¹¹ This new power did not, however, nationalize the aids to navigation effort. The crown authorized Trinity House to collect rents and tolls, and issue patents and grants; construction and maintenance of English navigational aids, however, continued in the hands of private individuals and concerns. This state of affairs continued until 1836 when Parliament finally authorized Trinity House to purchase existing navigational aids at a cost of £1,200,000.¹² The organizational makeup of the Trinity Board varied throughout its history, but the one constant in the administration was that the secretary of the board was always assisted by a technical staff comprised of scientists and experienced mariners who worked diligently to improve existing buoys and their accouterments.

The mission of Trinity House was and remains three-fold: as the General Lighthouse Authority, Trinity House commands “certain statutory jurisdiction [that] Commissioners apply for sanction to Trinity House before enacting or altering any seamark”; Trinity House represents the Pilotage Authority for the United Kingdom; and it administers a “charitable organisation dedicated to the relief of aged and distressed master mariners, their widows, and spinster daughters.”¹³ Trinity House also serves as a

¹¹Ibid., 3.

¹²Ibid., 2.

¹³Holland, *America's Lighthouses*, 8.

laboratory and proving ground for inventions designed to advance the effectiveness of aids to navigation—whether lighthouses, buoys, fog signals, or beacons. It was from this tradition of experimentation and invention that the U.S. Light House Board took its reformation in 1852.

Like other areas of the world that depend upon maritime commerce, colonial America possessed aids to navigation. Again, it is the lighthouses that are subject to the most documentation and research. Not surprisingly, the first lighthouse in America was located on Little Brewster Island near Boston. The placement of this light, erected in 1716, followed the established European pattern of aids to navigation concentrated near important trade centers.¹⁴ A system of lighthouses erected along a proven British model, along with a few beacons and several cask buoys, represented the bulk of American navigational aids at the inception of the light house service in 1789.

The creation and 150-year perpetuation of such a government agency as the

¹⁴Ibid., 8. Other major aids to navigation in colonial America included the Brant Point Light (1746 near Nantucket), Tybee Island Light (1748, Georgia), Beavertail Light (1749, Newport, Rhode Island), New London Light (1760, Connecticut), Sandy Hook Light (1764, New Jersey), Cape Henlopen Light (1767 Delaware Bay), Charleston (Morris Island) Light (1767), Plymouth Light (1769, Massachusetts), Portsmouth Light (1771, New Hampshire), and the Cape Ann Light (1771) on Thatcher's Island. See also Robert G. Bachand, *Northeast Lights: Lighthouses and Lightships: Rhode Island to Cape May, New Jersey* (Norwalk, Connecticut: Sea Sports Publication, 1989), 2; and Holland, *America's Lighthouses*, 9-12. These lights, representative of the major aids to navigation acquired by the United States at the end of the American Revolution, are mentioned in this study to facilitate the understanding of the importance of reliable navigational aids to a young country, the economy of which was heavily dependent on maritime commerce. It also illustrates the state of affairs at the beginning of the American light house service and the initial structures under its control.

United States light house service illustrates the importance of maritime commerce to the nation. According to the sentiment of the time, the upkeep of safe and dependable sea roads along the American coasts was not only necessary for the continuation of the nation's maritime traffic, but it was also perceived as an international duty for the preservation of life at sea. It was from this traditional perception of the duties of maritime nations for the preservation of cargo, lives, and the vessels of transport, that the light house service of the United States took its mission; and, while the configuration of the light house service changed from its earliest inception in 1789 to its final incorporation into the Coast Guard in 1939, the mission remained constant: to facilitate commerce by ensuring the efficient lighting and marking of the United States's coast, and to provide safe and reliable navigational aids of all types. The Light House Service under George Putnam which saw re-invention for the last time in 1939 into the incorporated mission of the Coast Guard, was a focused and accomplished agency with a strong corporate memory and a dedication to the preservation of life and property for all the ships at sea.

Chapter I

A Nascent Service and a Brace of Bureaucrats

1789 - 1852

The earliest period of the United States light house establishment can be characterized by a lack of direction and thorough understanding of the fundamentals of nautical science and maritime experience necessary to administer aids to navigation effectively. The first superintendents and bureaucrats followed the English example of constructing lighthouses to benefit major ports and sea lanes. They did not, however, defer to or readily acknowledge the letters and requests of mariners and merchants for larger, more visible, and thereby more useful aids to navigation; instead, these early superintendents deferred to their hired contractors in the ports who, they believed, had the expertise and ability to mark obstructions accurately and preserve shipping.

It would be easy to denounce these early administrators, most specifically Fifth Auditor of the Treasury, Stephen Pleasonton, as bumbling nincompoops or incompetents, and, indeed, several introductory chapters of works about lighthouses do so. The study of history, however, demonstrates that situations that appear to have a monocausal force at work are actually affected by a number of factors. Such is the case with the early light house service. Pleasonton was not the horrible incompetent that Ross Holland and others condemn him to have been. He was a bureaucrat and, by definition, not very creative, in a position that required a creative and inquisitive character. He also fell victim to the

influence of self-serving individuals who persuaded him to adopt inferior apparatuses and ignore the technological changes that continued to be adopted around the world.

Pleasanton was the first of many individuals who would leave their mark on the administration of aids to navigation. He has the distinction of being the first full-time superintendent; his lack of maritime experience and understanding fueled the debate over his competence and ability to administer the early lighthouse service. During his tenure, the United States fell behind the rest of the western world in technological advances to minor navigational aids. It was not until late in his tenure that Congress realized the need for administrators with maritime experience and leading scientists to provide guidance for the light house service. In true government fashion, Congress thanked Pleasanton for his years of dedicated service while at the same time it, along with congressional appointees, denounced his handling of aids to navigation in numerous reports and debates.

The first Congress faced enormous challenges when it convened in August 1789. Services heretofore funded and supervised by the British suddenly became the responsibility of the new legislative body. A country reliant upon maritime commerce turned expectantly to its new government with requests for maintenance and improvement of vital sea lanes. Congress responded quickly with its August 7, 1789, law, *An Act for the Establishment and Support of Light-Houses, Beacons, Buoys, and Public Piers*. (Fig. 1) This law provided for the acceptance of and jurisdiction over all

pre-existing aids to navigation in the United States. It also arranged for the maintenance of aids and payment of keepers.

Because of its link to customs and revenue, the newly-established Light House Service fell under the direction of the Department of the Treasury, and Alexander Hamilton became the first superintendent. Surviving documents from this period indicate that Hamilton took more than a passing interest in the establishment of minor aids to navigation. Prior to the placement of the Light House Service under the Treasury Department, approval of contracts and appropriations was handled personally by the President of the United States. Presidents Washington, Adams, and Jefferson all personally approved the earliest contracts and appropriations. Hamilton handpicked his Superintendents of the Light House Establishment, and placed them at all major ports and in districts served by primarily riverine navigation.

Not only Hamilton, but the U.S. Congress continued to treat the subject of aids to navigation seriously through the first half of the 1790's. While the federal government supported the maintenance of safe sea roads, there was much debate over where the money should originate. Ship captains, local pilots, and merchants petitioned their representatives for the establishment of lighthouses and buoys in harbors vital to their individual interests. One such successful petition, which later became *An Act to Provide for Placing Buoys on Certain Rocks of the Harbor of New London, and in Providence River, and Other Places*, approved April 5, 1794, required the placement of buoys on a

group of rocks around Black Ledge off New London, Connecticut. The buoys and deployment were limited to an amount not to exceed \$1,200. This law included a number of other petitions including buoyage for Providence River in Rhode Island and the Savannah River in Georgia. Payment for these buoys and beacons arose from "moneys ... from duties on imports, tonnage, the sum of two thousand five hundred dollars for the purpose aforesaid."¹

Aids to navigation, however, did not rely solely on customs and tariff collections for funding. Until 1795, Congress appropriated generous sums to support a Light House Establishment that would rival the British Trinity House. In 1795, appropriations for the Light House Establishment dropped dramatically. It appeared that Congress had abandoned the Light House Service to the Department of the Treasury, and the funds received by collectors of customs slowly became its sole source of support.²

¹*Acts and Laws Relative to the Light House Service 1789 - 1852* (Washington: Government Printing Office, 1853), 7. This compilation includes commentaries about the laws and their effects. That Congress chose to fund aids to navigation through the collection of tariffs and special taxes related to tonnage that would remain to be used in the port in which they were collected indicates that it was influenced by the Dutch practice of collecting *tonnengeld* for the purpose of maintaining aids. Congress continued appropriating money for large aids, e.g. lighthouses, for each port that demonstrated a need. By 1805, however, records indicate that the majority of light house service funding came from congressional appropriations rather than port-specific tariffs. Yet, while these taxes were levied on those who profited from the maintenance of the aids to navigation in specific ports, Congress continued to appropriate money annually for new buoy and beaconage contracts.

²According to the compilation *Acts and Laws Relative to the Light House Service 1789 - 1852*, Congressional appropriations for the establishment and maintenance of aids to navigation between 1789 and 1794 averaged between \$60,000 and \$80,000 annually.

This decrease in financial support can be explained in part by Hamilton's 1792 transfer of his Light House Service to the newly created office of the Commissioner of the Revenue, where it remained until 1802. The seeming disparity between the 1792 transfer and the 1795 drop in funding may be explained by the newness of the federal government and the time needed to clearly define the roles of each bureau. The transfer of the service from the overall administration of the Department of the Treasury to the office of the Commissioner of Revenue had profound funding implications for the new service, but had the service stayed in the Treasury Department, it might have suffered similar funding losses as departments and offices vied for appropriations and faced splitting those appropriations to fit the department's defined mission. There is also evidence that Congress funded new construction through to completion in annual appropriations, and it was not until the appropriation cycle of 1795 that requests for funding for new construction by an office without the clout of the full Department of the Treasury failed to convince Congress. In 1802, the Treasury Department experienced a change of command when Albert Gallatin assumed the responsibilities of Secretary of the

The 1794 act that required collectors of customs to collect special tariffs relative to tonnage and imports marked a change in the funding of both major and minor aids. The appropriation for the support of the Light House Establishment in 1795 contained "a sum of money not exceeding twenty thousand dollars." It also called "for making good a deficiency of appropriation for building a light-house at Bald Head, there shall be appropriated a sum not exceeding four thousand dollars." (p.10)

Treasury, and the full superintendency of the Light House Service.³ The Light House Service remained firmly under the Secretary of the Treasury until 1813, when it was once again transferred to the office of the Commissioner of Revenue. The service continued under his control until 1820 when, after more bureaucratic shuffling, Congress concluded that the administration and advancement of aids to navigation would be more properly served by the office of the Fifth Auditor of the Treasury—one Stephen Pleasanton.

Yet, while the administration of the Light House Service continued its shift through the Treasury Department, provisions continued to be made and contracts let through individual superintendents of lights in various ports. The administration of the Light House Service on its most senior and political level was of little consequence to the local pilot, merchant, or ship captain who increasingly turned to the Light House Service's local representatives in the port for maintenance of local aids. A result of the bureaucratic shuffling was the establishment of more power for local representatives, who increasingly had to rely on their own individual experience and expertise and that of contractors some of whom were trustworthy and others who were not.

The earliest buoys in U.S. waters were most likely the cask buoys as those described in the Delaware River before the American Revolution, and spar buoys such as those described in the waterways of Rhode Island, based on designs from Trinity House

³Albert Gallatin became Secretary of the Treasury in 1801, but no Light House Service documents allude to his superintendency of the service until 1802. It may be that he was unable to address aids to navigation issues until 1802.

and other European buoys (Fig. 2). Buoys were manufactured and deployed on a contract basis in the first quarter of the nineteenth century. Records of contracts from the 1790's are not extant in any of the official Light House Service records; the earliest recorded contract extant in the Light House Service file at the National Archives dates from 1801, when David Stephens, Superintendent of the Light House Establishment in Charleston, South Carolina, entered into a contract with James McIlhenny to service buoys moored on the bar at Charleston harbor. The terms of the contract required McIlhenny to take up all eight buoys on the Charleston Bar every three months (in February, May, August, and November), inspect and certify the integrity of the chains and sinkers, and ensure that all were "well breamed [sic], graved, and sprayed with a good thick coat of Turpentine and Sulphur, or Pitch and Sulphur."⁴ For this service, James McIlhenny received \$520 annually. To guarantee "the due, just, and full performance of each and every part of the foregoing agreement, the said parties [Stephens and McIlhenny] bind themselves each unto the other in a penal sum of One Thousand Dollars."⁵

Comparison of contract budgets for different ports and regions provides insight into the importance of a port being tended. On the surface, the \$520 annual payment appears excessive when compared with the 1805 costs of buoy maintenance in the Neuse and Pamlico Rivers and Albemarle Sound in North Carolina. Those costs were \$96, \$90,

⁴National Archives, Records of the U.S. Light House Service, Record Group 26, Entry 45/NC-1.

⁵Ibid.

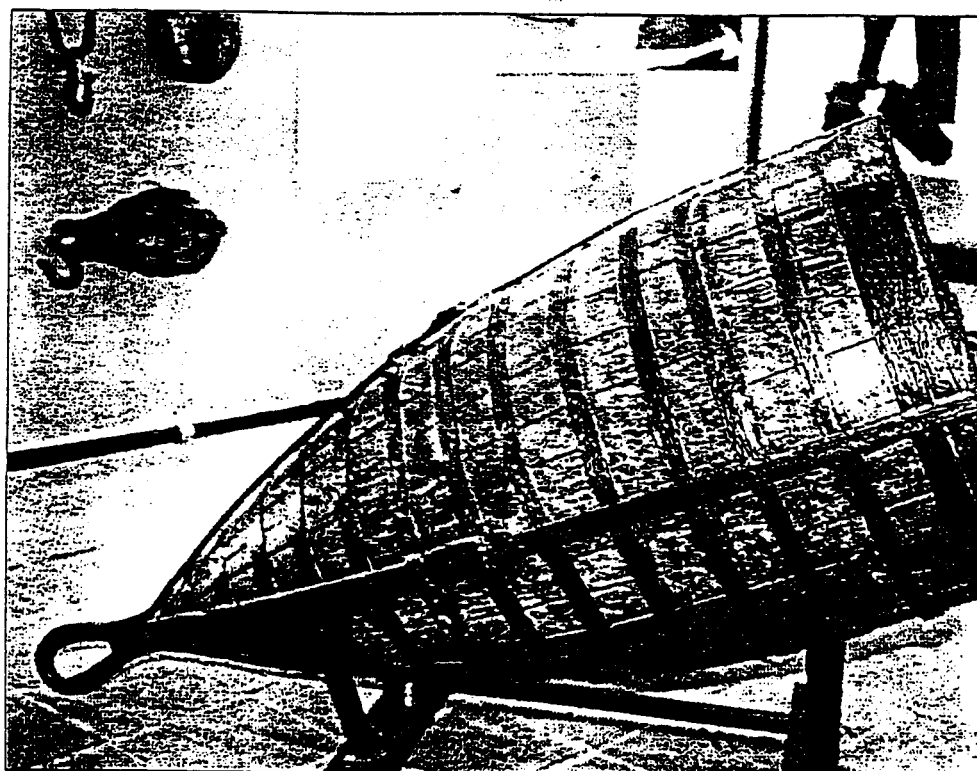


Figure 2. This cask buoy, located at the Rijksmuseum voor Scheepsarcheologie in Ketelhaven, the Netherlands, is typical of those found in northern European waters from the early fifteenth century until the late eighteenth century. This particular buoy marked an approach to the Hansa town of Kampen on the Zuider Zee. Photograph by author.

and \$320 respectively, while in contrast, George Webber in 1804-5 received annual payments of \$500 to keep the buoys on the St. Mary's River in Georgia.⁶ When viewed in light of each region or ports' importance, the records confirm that discrepancies in funding are explained by traffic volume.

While the Treasury Department required an annual letting of contracts, this did not prevent the establishment of monopolies of buoy supply and tending in some major ports.⁷ The two most striking were those maintained by Robert Sutter of Providence, Rhode Island, and Winslow Lewis of Boston. In April 1800, George Olney, Superintendent of Stakeage and Buoys in the Providence River, entered into a contract with Sutter for the maintenance of one buoy and thirty-two stakes in return for a prepayment of \$120. The eight-month contract required Sutter to keep the buoys and

⁶Ibid.

⁷In fact, the prevalence of monopolies for supplying goods and services to the Departments of Treasury, War, and Navy was so conspicuous that Congress attempted, in 1809, to quell the abuses in the system by passing *An Act Further to Amend the Several Acts for the Establishment and Regulation of the Treasury, War, and Navy Departments*. This act addressed the abuses of contractors who specifically supplied these departments, and required that "all purchases and contracts for supplies, or services which are or may, according to law, be made, by or under the direction of either the Secretary of the Navy, shall be made either by open purchase, or by previously advertising for proposals respecting the same: or by annual statement of all such contracts and purchases, and also of the expenditure of the moneys appropriated for the contingent expenses of the military establishment, for the contingent expenses of the Navy of the United States, and for the discharge of miscellaneous claims not otherwise provided for and paid at the treasury, shall be laid before Congress at the beginning of each year by the Secretary of the proper Department. Approved March 3, 1809." *Acts and Laws Relative to the Light House Service 1789 - 1852*, 34.

stakes "fixed at the places hereinafter described," and they were "to be kept in constant repair."⁸ The body of the contract did not specify any buoy type, but Sutter apparently completed his task to Olney's satisfaction, because Sutter continued to hold the contract until 1815.⁹

Winslow Lewis's contract with Samuel H. Smith, Commissioner of Revenue, began in 1815, and gave Lewis a monopoly over the provision of winter pressed Spermaceti oil for lighthouses throughout the eastern seaboard. Lewis apparently continued in his contract after the reorganization of the Light House Service under Pleasanton in 1820.¹⁰

The federal government tossed the administration of the early Light House Service from department to bureau to office until it became clear that the government could not reliably supply and maintain buoys in the coastal waters of the United States.

⁸National Archives, *Records of the U.S. Light House Service*, Record Group 26, Entry 45/NC-31. This type of contract, which required the government to pay cash on the barrel head for services not yet rendered, was one of the factors considered in the 1848 investigation into the Light House Service by members of the U.S. Navy as appointed by Congress. After the inception of the Light House Board in 1852, this type of contracting ceased, and individuals who continued to complete contract work for the Light House Board received payment only after the conditions of the contract were met.

⁹National Archives, *Records of the U.S. Light House Service*, Record Group 26, Entry 45/NC-31. As if to justify the holding of a government contract for 15 consecutive years and address concerns that, perhaps, a monopoly on the maintenance of the Providence River aids existed, Sutter did not receive the contract for 1816. He did, however, receive it in 1817, and continued to hold it until the Light House Service was reorganized under Pleasanton.

¹⁰*Ibid.*

The 1820 appointment of Stephen Pleasanton marked a turning point for the service, and established some semblance of continuity. Pleasanton, in his capacity as Fifth Auditor of the Treasury, continued to administer aids to navigation in the U.S. until the convening of the Light House Board by order of Congress in 1852. Continuity and stability came at a price. The Light House Service was not Pleasanton's sole concern. In his broader capacities as Fifth Auditor of the Treasury, he was responsible for all domestic accounts pertaining to the Department of State and the Patent Office, all bankers, consular and diplomatic accounts in foreign countries, as well as census accounts, claims adjustments for foreign governments, and boundary commissioner accounts. As a result, Pleasanton continued to rely heavily on the collectors of customs who, under his direction, shouldered the responsibilities of district superintendents of lights.

Pleasanton gave his district superintendents the authority not only to select appropriate sites for lighthouse construction, but also to purchase the land for the purpose. According to surviving letters, the district superintendents assumed direct responsibility for the repair and construction of lighthouses in their respective regions. To that end, Pleasanton required his superintendents to conduct annual inspections of all district lights and to submit reports on their conditions. Other superintendent duties included the payment of keepers and conflict mediation.¹¹ Pleasanton was neither reckless nor frivolous with Light House Establishment funds. On the contrary, the report

¹¹National Archives, Records of the Light House Service, Record Group 26. Correspondence, 1785 - 1852, File 17.

of the Congressional inspection of 1838 commended Pleasanton for his thrifty stewardship of Light House Service funds. This thriftiness, however, was brought about at the expense of existing aids to navigation.

Pleasanton was a bureaucrat with no maritime or nautical experience to sustain him in his decision-making role in the Light House Service. Perhaps nothing illustrates this lack of knowledge more than the incident involving the Diamond Shoals Lightship in 1826.¹² A powerful storm blew the lightship from her mooring. Her anchor, along with an extensive section of cable, ripped free and lay on the ocean bottom. Lack of a spare anchor and cable kept the lightship off station for a total of five months. Although the local superintendent immediately dispatched word to Pleasanton in Washington, D.C., of the situation, an incredible two months elapsed before Pleasanton took any sort of action. He had hoped to recover the anchor and cable, and offered a \$500 salvage reward. He believed that, in the long run, the reward would prove less expensive than the projected \$2,000 price of a new anchor and length of chain.

Pleasanton's lack of maritime experience also compromised him later in his friendly business relationship with Winslow Lewis, holder of the whale oil supply monopoly in Boston in the late-1810's. Lewis preoccupied himself in a number of aspects of Light House Service supply. He influenced Pleasanton later to adopt his parabolic and spheroid reflectors that became a main-stay for the Light House. Lewis's

¹²Reference to this incident can be found in the National Archives, *Annual Report of the Light House Service, 1826*, Record Group 26, Entry 6.

of the Congressional inspection of 1838 commended Pleasanton for his thrifty stewardship of Light House Service funds. This thriftiness, however, was brought about at the expense of existing aids to navigation.

Pleasanton was a bureaucrat with no maritime or nautical experience to sustain him in his decision-making role in the Light House Service. Perhaps nothing illustrates this lack of knowledge more than the incident involving the Diamond Shoals Lightship in 1826.¹² A powerful storm blew the lightship from her mooring. Her anchor, along with an extensive section of cable, ripped free and lay on the ocean bottom. Lack of a spare anchor and cable kept the lightship off station for a total of five months. Although the local superintendent immediately dispatched word to Pleasanton in Washington, D.C., of the situation, an incredible two months elapsed before Pleasanton took any sort of action. He had hoped to recover the anchor and cable, and offered a \$500 salvage reward. He believed that, in the long run, the reward would prove less expensive than the projected \$2,000 price of a new anchor and length of chain.

Pleasanton's lack of maritime experience also compromised him later in his friendly business relationship with Winslow Lewis, holder of the whale oil supply monopoly in Boston in the late-1810's. Lewis preoccupied himself in a number of aspects of Light House Service supply. He influenced Pleasanton later to adopt his parabolic and spheroid reflectors that became a main-stay for the Light House. Lewis's

¹²Reference to this incident can be found in the National Archives, *Annual Report of the Light House Service, 1826*, Record Group 26, Entry 6.

"patent lamp" continued to be the subject of severe criticism by mariners, scientists, engineers, and the publishers of navigation manuals. The quality of light produced by these reflectors was the subject of continuous attacks by Edmund and George W. Blunt, publishers of the *American Coast Pilot*. In lengthy correspondence with Pleasanton, they complained of the reflector lamps' inadequacies, the poor quality of the light, and changes in light characteristics without ample notice to mariners.¹³ To clarify their position, they chided Pleasanton by reminding him that France and England had far outstripped the United States in new technology for aids to navigation, in that they had been quick to experiment with and later adopt the lenses perfected by Augustin Fresnel, a French physicist. For good measure, the Blunts forwarded letters they had received from irate mariners struggling to cope with a less-than-ideal American system of aids to navigation. By 1842, the situation deteriorated to the point that Lewis's own nephew, a civil engineer and lighthouse inspector, criticized his uncle for gross negligence and plagiarism. I.W.P. Lewis complained that Winslow Lewis had copied his lighting system from the South Stack Lighthouse apparatus at Holyhead, England. Lewis also demonstrated that his uncle's reflectors were not truly paraboloid. Despite such attacks and criticism, Pleasanton continued to support Lewis and the lamp and reflector design of

¹³Some of their letters survive in the National Archives, Records of the Light House Service, Record Group 26, Letters Sent Regarding the Light House Service, 1792 - 1852, Entry 18.

the lights in his charge.¹⁴

In 1822, Augustin Fresnel perfected a lens *not* based on the old lamp and reflector model. The Fresnel lens, with its unique shape and prisms strategically placed to maximize the intensity of light, represented a departure from outdated technologies and ushered in a new era of aids to navigation. The French and British quickly adopted the new lens, while the United States, almost inexplicably, lagged behind. Pleasanton did not even take notice of the new type of lens until a communication in 1830, in which he inquired about the cost. Cost (\$5,000 for a first order Fresnel lens), coupled with the influence of Lewis, became a deciding factor, and Pleasanton decided that the lamps currently in use were adequate to light the American coast. That decision proved difficult to defend. Pleasanton's blatant disregard for and lack of interest in technological advances in navigational aids, and his support of Lewis's outdated technology, led to the further Congressional investigations and eventual institution of the Light House Board.¹⁵

¹⁴Dr. Robert Browning, chief historian of the United States Coast Guard, presented the theory that Pleasanton continued to rely on Lewis's lamps instead of adopting Fresnel lenses due to the nature of the existing lighthouses along the east coast of the United States. There is evidence that the Fresnel lenses would have proved no better than the paraboloid lamps because of the low height of the lighthouse towers coupled with the Earth's curvature. Because of these factors, lights could only be seen a short distance.

¹⁵As early as 1846, Congress appointed Lt. Thornton Jenkins, USN, to research and report on the state of aids to navigation in the United States as compared to the rest of the world. His report to Congress survives in excerpted form at the Mariners' Museum and in the National Archives, Record Group 26. He fails to support

Records of buoys under Pleasanton's administration are as sketchy as those from the earlier period. Since there was no official standardization of buoy types, collectors of customs in their specific ports let contracts and accepted or rejected proposals on a per-contract basis. Yet, while specifics of buoy design before 1840 are not extant in the Light House Service records, Congress enacted aids to navigation-specific legislation as early as 1825 with the passage of *An Act More Effectually to Provide for the Punishment of Certain Crimes Against the United States, and for Other Purposes*. Sections 7 and 9 of this act concern the vandalism of aids to navigation, and the purposeful wrecking of vessels on American shores.¹⁶ This legislation was also responsible, in its 1850's

any theory of Pleasanton's refusal to adopt the Fresnel lenses other than Lewis's influence. Lieutenant Jenkins, however, was not an engineer, nor did he consult with any of the personnel of the Army Corps of Engineers. The fact that American lighthouse towers lacked the height to project light adequately from a Fresnel lens may have not been considered.

¹⁶Light House Board, *Laws of the United States Relating to the Establishment, Support, and Management of the Light-Houses, Light-Vessels, Monuments, Beacons, Spindles, Buoys, and Public Piers, of the United States from August 7, 1789 - March 3, 1855*, compiled by order of the Light House Board, June 30, 1855 (Washington: A.O.P. Nicholson, Public Printer, 1855), 68-69. These two sections of the act are significant enough to reproduce here:

Sec. 7. "*And be it further enacted*, That if any person or persons upon the high seas, or in any other of places aforesaid, with intent to kill, rob, steal, commit a rape, or do or perpetrate any other felony, shall break or enter any ship or vessel, boat or raft, or if any person or persons shall wilfully and maliciously cut, spoil, or destroy, any cordage, cable, buoys, buoy-rope, headfast, or other fast fixed to any anchor or moorings belonging to any ship, vessel, boat, or raft, every person so offending his or her counsellors, aiders, and abettors, shall be deemed guilty of a felony, and shall, on conviction thereof, be punished by fine not exceeding one thousand dollars and by imprisonment and confinements not exceeding five years, according to the aggravation of the offence."

interpretation, for denying ship masters rewards for recovering wayward buoys.¹⁷

While records concerning senior administration and contracts are extant for the period before 1820, descriptions of the actual buoys used are sketchy and scarce.

Because buoy contracts were let from individual ports without a standardized form from the Light House Service, buoys in U.S. waters continued to be non-standardized. It is not until about 1825 that some buoy descriptions and requirements appear. Even then, these aids were not standardized. Spar buoys, according to hand-written notes in the records of the Fifth Auditor at the National Archives, were primarily cedar or juniper logs

* * * * *

Sec. 9. "*And be it further enacted*, That if any person or persons shall plunder, steal, or destroy, any money, goods, merchandise, or other effects, from or belonging to any ship or vessel, or boat or raft, which shall be in distress, or which shall be wrecked, lost, stranded, or cast away, upon the sea, or upon any reef, shoal, bank, or rocks of the sea, or in any other place within the admiralty and maritime [sic] jurisdiction of the United States, or if any person or persons shall wilfully obstruct escape of any person endeavoring to save his or her life from such ship or vessel, boat or raft, or the wreck thereof, or if any person or persons shall hold out or show, any false light or lights, or extinguish any true light, with intention to bring any ship or vessel, boat or raft, bring or sailing upon the sea, into danger, or distress, or shipwreck, every person so offending his or her counsellors, aiders, and abettors, shall be deemed guilty of felony, and shall, on conviction thereof, be punished by fine not exceeding five thousand dollars and imprisonment and confinement to hard labor not exceeding ten years, according to the aggravation of the offence.

¹⁷There are a number of letters in the Correspondence of the Light House Board Records in the National Archives from captains and merchants claiming salvage rewards for recovering drifting buoys. Some captains went so far as insisting the Light House Board reimburse them for damages to their vessels sustained during the recovery process. The Secretary of the Light House Board stubbornly maintained that buoys were not subject to the laws of salvage, thanked the captains for their service to their country, and denied all compensation.

anchored by lengths of chain secured to stones. Extrapolating backwards from the complaints of pilots and ship captains in the late 1840's, the buoys in U.S. coastal waters were small and useless.¹⁸ Because the same method of individual contracting continued as the standard operating procedure until the creation of the Light House Board in 1852, it is safe to assume that the contractors continued to supply buoys inadequate for navigation, but easy to place and relieve.

Records indicate that contractors set buoys with a combination of small boats and small sailing vessels.¹⁹ Contractors would be less likely to put their vessels in danger for the sake of an adequate buoy accurately marking a rock ledge than a government vessel engaged in the same project. Wooden spar buoys, probably the most numerous markers during this period, or simple, small, riveted cans and nuns could be serviced using a simple hoist mounted forward on a small boat, similar to those used in the 1920's and 1930's (Fig. 3) to service small buoys in secondary river channels. The use of sailing

¹⁸The most vocal critic of useless buoys marking the approaches to major ports on the east coast of the United States was John Maginn, president of the New York Pilot Association. In his capacity as president of such an important maritime organization, he supplied the Fifth Auditor and the local superintendents with correspondence from mariners and pilots who complained bitterly about the state of buoyage in their respective ports. A number of these letters appeared in Lt. Jenkins' report to Congress in 1851.

¹⁹Early contracts did not specify buoy requirements nor the types of vessels necessary for contractors to set buoys. Maginn, president of the New York Pilot Association, maintained that the greatest number of complaints from mariners revolved around the sizes of the buoys. Small buoys are easier to handle from a small boat or sailing vessel. While the government continued to rely on contractors to set buoys according to their own standards, buoys would not improve.

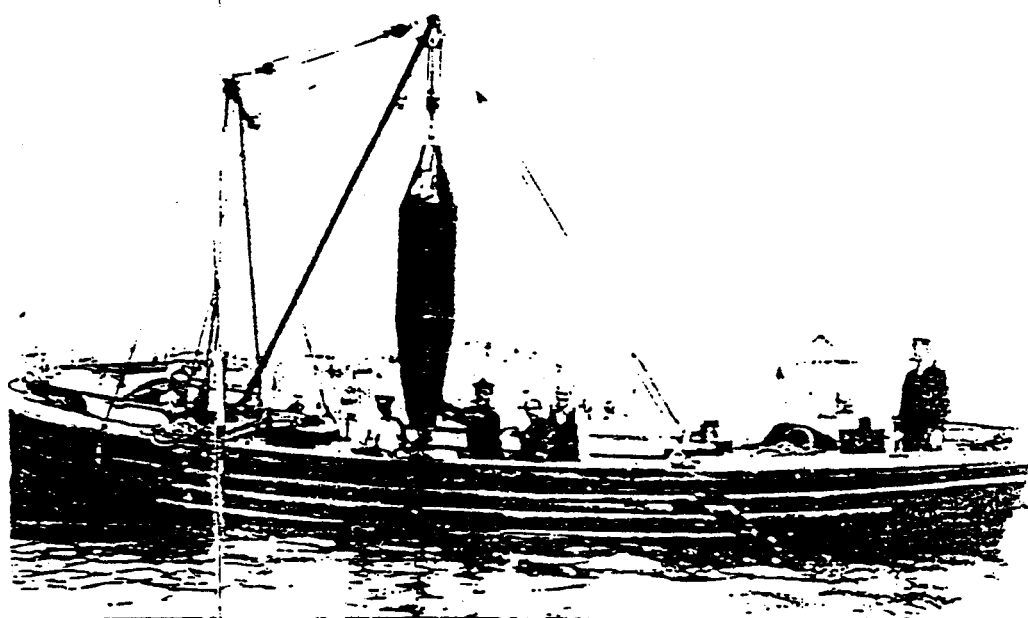


Figure 3. Small boats, like this one in use in the 1920's, were most likely similar in design to those used before 1840 to tend spar buoys in the waterways of the United States. Courtesy of the Coast Guard Historian's Office.

vessels by contractors is merely a hypothesis since there is no recorded evidence of sailing vessels employed in buoy tending before 1830.

The Revenue Cutter Service and the Light House Service were never far from one another in administration or mission. Pleasanton admitted, in an 1851 letter to Secretary of Treasury Thomas Corwin, that he had used the services of Revenue Cutters and their crews to maintain buoys in "waters leading to our principal cities... I gave a few hundred dollars [to the officers] annually, in addition to their ordinary pay, for this service."²⁰

Pleasanton discontinued this practice in 1842 when

all extra pay from every branch of the service was cut off by law and I considered it improper to ask the Secretary of the Treasury to exact this as a duty from those engaged in the cutter service. In the district of New York a vessel is owned by the Department...which perform[s] this and other duties connected with the light house department.²¹

Because the earliest vessels used to tend buoys were privately owned and operated

²⁰Stephen Pleasanton, Excerpt of Letter/Report of Stephen Pleasanton to Thomas Corwin, Secretary of the Treasury, detailing information that he, as Fifth Auditor, handed over to Shubrick and the newly-created Light House Board, June 7, 1851, in *Compilation of Public Documents and Extracts Relating to Light-Houses, Light-Vessels, and Illuminating Apparatus, and to Beacons, Buoys, and Fog Signals, 1789 - 1871* (Washington: Government Printing Office, 1871), 440.

²¹Ibid. The Revenue Cutter Service and Light House Service were both under the umbrella of the Treasury Department, but, as agencies, they were mutually exclusive. Money and manpower from one organization cannot be appropriated from one bureau to another. The situation persists in government today. For example, the U.S. Coast Guard and the Federal Aviation Administration are both contained within the Department of Transportation. While the larger department provides more clout when securing appropriations, the two agencies are mutually exclusive; the FAA may not appropriate funds or manpower from the Coast Guard, nor is the Coast Guard allowed to do the same to the FAA.

by individual contractors, details of their construction and tending capabilities are limited. No mention is made of the specifications for contractors' vessels; the only provisions in contracts called for an adherence to a schedule of buoy maintenance and relief. The first vessel appropriated for use in the Light House Service was the ex-Revenue Cutter *Rush*. A *Morris-Taney* class cutter, the *Rush* was built by Webb and Allen of New York in 1831. She was a topsail schooner, displaced 112 tons, and sailed with a complement of between twenty and twenty-four men.²² The *Rush* measured 73' 4" between perpendiculars with a molded beam of 20' 2" and had a 7' 4" draft.²³ Naval constructor Samuel Humphreys was the designer of the *Morris-Taney* class; his vessels reflected a trend toward the naval schooner concept. Often confused with the Great Lakes vessel *Benjamin Rush*, this vessel was officially called the *Richard Rush*. While still a Revenue Cutter in 1840, the *Rush* was beset by ice and severely damaged in New Haven, Connecticut.²⁴ She was offered to and accepted by the Light House Service on March 30, 1840 for service in the waters off New York.

The availability of the *Rush* to fill a light house tender role may have been more of a deciding factor for her acceptance than her suitability for the task. Indeed, the

²²Donald L. Canney, *U.S. Coast Guard and Revenue Cutters 1790 - 1935* (Annapolis, Maryland: Naval Institute Press, 1995), 14.

²³Anon., draft report of early buoy tenders discovered in the Coast Guard Historian's Office in the Aids to Navigation file, n.d., n.p., 1.

²⁴Anon., draft report of early buoy tenders discovered in the Coast Guard Historian's Office in the Aids to Navigation file, n.d., n.p., 1.

Morris-Taney class cutters were designed for missions requiring the "increasing use of revenue cutters in subsidiary naval-support roles."²⁵ Vessels designed for one type of work often did not translate those talents to tender work well. The *Rush* was a two-masted schooner constructed after the Baltimore clipper-type ship; her ends were sharp and she had a pronounced deadrise. This sharp deadrise made the *Rush* ill-suited for hoisting any appreciable weight.²⁶ The inability to hoist weight at moderate angles of heel plagued the Light House Service tenders and early tenders contracted by the Light House Board. A stable work platform was necessary to hoist and set buoys of any significant size. Such a vessel whose "midship section coefficient is large, with straight sides, and a broad forward deck" is more closely identified with the early steam tenders of the mid-to-late 1850's.²⁷

As long as the Light House Service and its contractors were forced to rely on sailing tenders, the shapes and designs of minor aids to navigation could not progress. Not until the advent of steam tenders, beginning with the *Shubrick* in 1857, did an explosion of creativity occur concerning buoy design. There is a direct link between the ability of tenders to control, maintain, and set larger, more advanced buoys and the development of those aids in the United States.

²⁵Canney, *Coast Guard and Revenue Cutters*, 14.

²⁶Anon, Aids to Navigation file, 2.

²⁷*Ibid.*, 2.

The earliest *printed* call for bids for attending aids to navigation in the Light House Service records comes from John N. McIntosh, collector for the Port of Darien, District of Brunswick, Georgia, and is dated August 13, 1838. This request for bids required the successful contractor to maintain six buoys, their moorings, and chains for twelve months. This contract is the first that specifically mentions *can* buoys. All six buoys are described as can buoys, rather than spar buoys. Unfortunately, there are no specifics about the can buoys—no dimensions or descriptions, and no descriptions of the shackles or moorings.

A later bid proposal broadside, published in the *Baltimore Sun* in 1842, requested bids for “making FOURTEEN SPAR BUOYS for the Chesapeake Bay and the Patapsco River.”²⁸ This call for bids also included a stipulation that the successful contractor provide two bids: one that projected the cost of the undertaking providing the spar buoys were protected with zinc, and another without the protective zinc coating. This suggests that, at least by 1842, the Light House Service had taken note of fouling problems with exposed wood and iron buoys. While there was no central scientific administration experimenting with anti-fouling paints and sheathing, the contractors and superintendents in the field were aware of technological advances in this vein.

By 1847, some collectors attempted to control the types of buoys placed in waters under their jurisdictions. Joseph T. Pease, collector and superintendent of the custom

²⁸National Archives, Records of the Light House Service, Record Group 26, Entry 45, newspaper clipping *Baltimore Sun*, September 2, 1842.

house in Edgartown, Massachusetts, was one such individual. His notice in the March 12, 1847, *Vineyard Gazette* stated:

PROPOSALS will be received at this office until the 27th inst., at 2 o'clock, P.M., for supplying and delivering at this port, as many Spar Buoys, of proper size, well painted, with chains and sinkers complete, or separate, as may be required during one year from the 1st day of April next. The proposals to state for what price, per foot, in length the buoys will be provided also, for what price the iron, of suitable size and of what quality, fitted to the buoys, will be furnished, per lb. Also, for what price, each, as sufficient number of sinkers, drilled and fitted with a bolt to the Buoy, will be furnished and delivered as aforesaid to be of such weight as the superintendent may direct, not exceeding 2,000 lbs.

Separate proposals will also be received, as aforesaid, for attending to and keeping all the Buoys in the District in their proper places when required, and also for taking up and delivering them at this port, when necessary. The proposals to state for what price each buoy will be rightly placed, and for what price, each, they will be taken up.

The undersigned reserve to himself the right to annul the contract at any moment, when the contractor shall fail to execute, strictly and faithfully its provisions.

For further information, inquire at this office.

JOS. T. PEASE
Coll. And Superintendent

While not remarkably detailed, this proposal for bids is certainly one of the most specific from the period before the advent of the Light House Board. The date of this contract is significant, because new forces were beginning to move across the waters that would change the administration of aids to navigation in the United States.

The concern for frugality that governed Pleasanton's decisions concerning the purchase of lenses was not matched in his stewardship of funds relating to the

construction of lighthouses. By 1837, the situation had become intolerable, and Congress stepped in to ascertain the need for all proposed lighthouses. The results of the investigation included the establishment of a Board of Navy Commissioners on March 3, 1837. The Board's duty was to determine the necessity of proposed navigational aids and the best possible sites for their construction. Congress appointed twenty-two naval officers to the project; the results of the investigation found that of the proposed thirty-one light station sites, some of which had already received appropriations, were unnecessary.²⁹ In light of this finding, Congress cut appropriations and canceled *all* the proposed light stations. Although the official report of Congress congratulated Pleasanton on his efforts with the Light House Service, its overall tone reflected the mood of the legislature that something more needed to be done to protect maritime commerce.

On June 7, 1838, Congress passed an act that divided the country into individual lighthouse districts: six on the Atlantic coast and two on the Great Lakes. The act superseded the existing district superintendents by assigning naval officers to each region. These officers were charged with reporting the condition of individual aids to navigation and surveying and acquiring sites for new lighthouse construction. This represented the federal government's first attempt to appoint individuals with solid maritime experience to administer aids to navigation.

Meanwhile, the federal bureaucratic machine was busy churning out studies and

²⁹Robert G. Bachand, *Northeast Lights: Lighthouses and Lightships: Rhode Island to Cape May, New Jersey* (Norwalk, Connecticut: Sea Sports Publications, 1989), 4.

reports on the administration of the Light House Service. In 1841, the House Commerce Committee began its research into whether a light house service under the Bureau of Topographic Engineers could operate more efficiently and less expensively. The House of Representatives took no action on the report. In 1845, Secretary of the Treasury Robert J. Walker dispatched two naval officers, Lieutenant Thornton A. Jenkins, Coast Survey, and Richard Bache, to Europe. Walker tasked them with the examination of improvements adopted by European light house establishments and to inquire into their organizations. They submitted their report to Congress, but the legislature took no action.³⁰ While the excerpt included here is rather long and detailed, it illustrates how far aids to navigation in the United States lagged behind their European counterparts:

There are more than 299 buoys and 48 beacons under the Trinity corporation on the coasts of England, which are supported by a charge upon the merchant shipping, as in the case of the lights. They are under the immediate control and management of the elder brethren; are distinctly marked, and kept well painted in different colors. They are distinguished by their size, shape, colors, and at turning points, &c. By perches placed upon them. The system of having all the buoys of the same color placed on the same side of the main channels leading to harbors, is strictly adhered to throughout the whole coast.

The buoys are of wood - some hooped with galvanized iron, which effectually prevents rust, are changed twice a year, repaired, and painted at the

³⁰This report is no longer extant in the National Archives Records of the Light House Service, Record Group 26. Excerpts of the reports are located in the Mariners' Museum Collection. It is entitled: "Excerpts of Report to Walker (Secretary of Treasury) from Jenkins and Richard Bache concerning how Trinity House works to keep buoys under its care: from report dated June 22, 1846," and is extant in the *Compilation of Public Documents and Extracts Relating to Light-Houses, Light-Vessels, and Illuminating Apparatus, and to Beacons, Buoys, and Fog Signals, 1789 - 1871* (Washington: Government Printing Office, 1871), 482.

same time their moorings are examined, and, if deemed necessary, changed also. Ordinary moorings consist of heavy blocks of stone secured to the condemned chains of the light-vessels. Captain Washington says: 'I am aware that the Trinity Board, within the last ten years, since the last House of Commons committee on light-houses, have done a very great deal towards the improvement of lightage; but I think the buoying of our coasts is still in far from an efficient state.'

The inspection of the buoys, beacons, &c., are made by the agents and elder brethren, in the manner prescribed for lights. Information of a change or loss of a buoy is almost instantly communicated to the Trinity Board by the pilots or coast guard; and others being kept always ready for replacing them. The agents are supplied with buoys for wrecks, which are painted green. They are also authorized to place buoys upon any newly-discovered danger or obstruction to navigation, marked "dangerous" in large letters.

Captain Washington insists that none but thorough-bred seamen can properly place light-vessels and buoys, and that they should be replaced by measuring the angles between three well-established points on shore.³¹

By 1847, Congress became serious about reforming the Light House Service. In that year, and in response to a number of complaints, Congress removed the responsibility for the construction of six new light stations from the Fifth Auditor and transferred it to the supervision of the Corps of Engineers. When it became clear that this would not alleviate the underlying problems in the Light House Service, Congress felt compelled to deal the final blow to the Service under Pleasanton.

The congressional investigation begun in 1847 took more than four years to effect a change in the administration of aids to navigation in the United States. During those four years, congressional appointee Lieutenant Jenkins of the Coast Survey conducted interviews with pilots and mariners, and engaged in research both foreign and domestic.

³¹Ibid.

He was also involved in a number of hearings into aids to navigation administration from the collector of customs level to Pleasanton's and Secretary Walker's levels.

On March 3, 1851, Congress approved *An Act Making Appropriations for Light House, Light Boats, Buoys, &c.* In accordance with Section 8 of the act:

The Secretary of the Treasury is authorized and required to cause a board to be convened at as early a day as may be practical after the passage of that act to be comprised of two officers of the Navy of high rank, two officers of Engineers of the Army, and such civil officers of scientific attainments as may be under the orders or at the disposition of the Treasury Department, and a junior officer of the Navy to act as Secretary to said board, whose duty it shall be under instructions from the Treasury Department to inquire into the condition of the Light House Establishment of the United States, and make a general detailed report and programme to guide legislation in extending and improving our present system of construction, illumination, inspection, and superintendence.³²

The creation of the Light House Board was the result of this mandate. Its original members were Cdr. William B. Shubrick, U.S. Navy; Cdr. Samuel F. Du Pont, U.S. Navy; Lt. Col. James Kearney, U.S. Topographical Engineers; Professor Alexander Dallas Bache, Superintendent U.S. Coast Survey; Professor Joseph Henry; and Lt. Thornton Jenkins, U.S. Navy, who acted as Secretary.

The creation of the Light House Board essentially and effectively removed the jurisdiction of aids to navigation from civilian control and placed it with a quasi-military

³²National Archives, *Journal of the Light House Board*, Record Group 26, Entry 1, Volume 1, 2.

organization.³³ The convening of the Board on April 28, 1851, marked a new beginning for aids to navigation, but members of the Board faced a significant up-hill battle. Their first task was to address the inadequacies of the existing aids—a task that consumed the Board for its first few years of existence.

Pleasanton had inherited a Light House Service with no defined direction, and a sole purpose to provide guidance through adequate aids to navigation to pilots and mariners attempting to navigate U.S. waters. It would be easy to judge Pleasanton harshly—as a bureaucrat reaching to administer affairs beyond his comprehension. He relied heavily on his local collectors of customs and their knowledge of ports and their needs. He also relied too heavily on a friendship with Winslow Lewis that ultimately cost him his credibility. His concern with the financial bottom line threatened men and ships that approached the coast of the United States. His stubborn reluctance to embrace

³³The board recognized and commended Stephen Pleasanton for his thirty years of service to lighthouse administration. They noted that during his tenure aids to navigation in the United States had grown from twenty-five lights to 300, and that “‘great credit is due to the zeal and faithfulness of the General Superintendent [Pleasanton] and to the spirit of economy which he has shown,’ which spirit, perhaps, accounted for the ‘lack of zeal exhibited for the adoption of modern improvements’: [sic] but they asserted the impossibility that any one man should be able then to handle the system, and the necessity of organization and subdivision, and for a system comprehending the great and varied requirements necessary to a successful administration of the many separate and distinct interests constituting the establishment, and bringing all under consideration and final direction of a central head, which they proposed should be, instead of one man, a board of experts, having, or capable of obtaining, the knowledge necessary to every detail of each branch of the great and still growing establishment.” “The U.S. Light House Establishment” in *Appleton’s Annual Cyclopaedia 1880* (New York: D. Appleton and Co., 1881), 435.

change compromised the safety of mariners everywhere. Although history could conclude that he did the best with what he had, Pleasanton refused to improve upon the resources he managed. This bureaucratic that cost the U.S. dearly in terms of respectability abroad.

Chapter II

Charting a Safer Course

1852 - 1910

Congress recognized the need for change in aids to navigation administration and acted accordingly. Recommendations by naval officers, congressional appointees, and private associations and individuals did much to sway the hand of the legislature to appoint a quasi-military board to oversee aids to navigation and make improvements to the system in 1851. Shubrick, the Board's Secretary, and his fellow officers and appointed scientists convened their first meeting on April 28, 1851, and, with the establishment of that forum, administration of aids to navigation would take its largest leap toward modernization since its inception.

The Light House Board remained firmly under the superintendence of the Treasury Department, but the presence of naval and army officers and two of the leading scientists of the time, Professor Joseph Henry, Secretary of the Smithsonian Institution, and Alexander Dallas Bache of the U.S. Coast Survey, ensured that technological advances and theories would be empirically investigated and submitted to rigorous research and testing. The Board represented the United States's renewed commitment to responsible maintenance of approaches to its ports and waterways. Not only had Congress acted appropriately in appointing such qualified individuals to oversee aids to navigation; it began to provide funds consistently to ensure that those individuals could

provide mariners with the most reliable system in the world. The Light House Board began addressing aids to navigation issues with its first meeting.¹ Among the Board's mandates, which included the placement of aids to navigation and their upkeep, was the requirement that it give notice to mariners "...in regard to changes in lights, beacons, buoys, and seamarks."² This resulted in the publication of annual *Light Lists*, which detailed *all* navigational aids present in the waters of the United States.

The transition of the Light House Service to the Light House Board was neither quick nor smooth. By June 1851, the Board reported that it had encountered some difficulty in obtaining information from the Fifth Auditor. Shubrick called upon Secretary of the Treasury Robert Walker in hopes of pressuring Pleasanton to expedite

¹National Archives, *Journal of the Light House Board*, Record Group 26, Entry 1, Vol. I, 2. The first volume of the *Journal* includes information concerning the structure of the Board, its membership and how it was chosen, and how the Board would address specific issues of aids to navigation. Far from being complete, the *Journal* volumes allude to communications received by and dispatched from the Board to individual lighthouse district inspectors and interested parties seeking information about aids to navigation placement in specific areas. A large number of these communications are not extant in the *Records of the Light House Service*. Therefore, the only extant evidence researchers have of their existence is their inclusion, however sketchy, in the *Journal*.

²National Archives, *Journal of the Light House Board*, Record Group 26, Entry 1, Vol. I, 7. This change is significant. Whereas Pleasanton relied on his individual collectors of customs in their specific ports to give notice to mariners should some change in the characteristic of an aid be made, the Light House Board assumed the responsibility of establishing a central clearing house for such information. Shubrick and his counterparts realized that such information should be disseminated as broadly as possible, since ship captains and navigators would not have similar direct access to potentially life-saving information that local pilots had, and could not rely on the characteristics of aids to navigation to remain constant from season to season.

the transfer of appropriate documents. Along with other information, the Board specifically requested "a list of all the Buoys belonging to the United states specifying the positions geographically, and by number and color of each one, the kind of Buoy [sic] whether spar, can or nun Buoy whether of iron or wood."³ Pleasanton's reply was a less than satisfactory manuscript entitled "A list of Buoys, Beacons, Monuments, Spindles, &c. located in the waters of the U.S. from 1795 to present time."⁴ This was, in effect, a compilation of laws pertaining to buoys and their placements by state. Shubrick lamented that "from this paper no descriptive list can be made, nor can the kind, number, or location of the Buoys and Beacons at present existing be ascertained."⁵ It was then that the members of the Light House Board realized the immense scope of their task.

On January 6, 1852, the Board issued a report on the status of navigational aids in the waters of the United States. Its conclusion was that "the floating lights of this country [U.S.] are comparatively useless to the mariner [as compared with those of France] in consequence of the very inferior apparatus employed in them."⁶ The "very inferior

³National Archives, *Journal of the Light House Board*, n.d., Record Group 26, Entry 1, Volume I, 24.

⁴National Archives, *Journal of the Light House Board*, July 9, 1851, Record Group 26, Entry 1, Volume I, 43.

⁵Ibid.

⁶National Archives, *Journal of the Light House Board*, January 6, 1852, Record Group 26, Entry 1, Volume I, 43. The Light House Board based this statement not only on the lack-luster report provided by Pleasanton, but on research conducted by Lt. Thornton A. Jenkins who became Secretary of the Board. Charged by Congress, Jenkins,

apparatus" alluded to in Shubrick's statement was the lamp and reflector apparatus of Winslow Lewis's design. In order to bring American navigational aids into line with the available aids of other maritime powers, the Board demanded that the secretary of the Treasury "direct the introduction of the Fresnel Lens apparatus into all new lights that are now, or that may be hereafter authorized to be enacted and also into all lights requiring new illuminating apparatus, in conformity with the 7th Section of the Act *making appropriations for Lt. Houses, Lt. Boats, Buoys, &c.* approved March 3, 1851."⁷

October 1852 was a benchmark in the organization of the Light House Board. During October, the Board resolved to arrange the Atlantic, Pacific, Gulf, and Great Lakes coasts into districts.⁸ The Light House Board recognized the strength of consolidated power in Washington, D.C., but also realized the advantage of field personnel to handle daily management and operations. The Board divided the United States into Lighthouse Districts and assigned personnel to each, with the understanding that they would be responsible for aids to navigation in their regions. Each district had an

in the 1840's, conducted a number of interviews with pilots, ship captains, and other interested individuals into the state of aids to navigation in the United States. His report, which now survives only as excerpts submitted to Congress, damned the administration of navigational aids under Pleasanton and led to the creation of the quasi-military Light House Board.

⁷National Archives, *Journal of the Light House Board*, January 6, 1852, Record Group 26, Entry 1, Volume 1, 44.

⁸National Archives, *Journal of the Light House Board*, October 12, 1852, Record Group 26, Entry 1, Volume I, n.p.

inspector "who was either an army or a navy officer, and, as soon as needed, an engineer officer from the army were [sic] assigned to each lighthouse district. The inspectors, under the charge of the naval secretary, who also had charge, in the absence of the chairman, of the office of the Board, were charged with the maintenance of the lights and lighthouses and with the discipline of the light-keepers. The district engineers, under the direction of the engineer-secretary, were charged with building the lighthouses, and keeping them in repair, and with the purchase, the setting up, and repairs of the illuminating apparatus. Both inspectors and engineers made regular and special reports to the Board, acting always under its direction, and the Board made a full annual report to the secretary of the Treasury, who, in turn, made a full annual report to Congress."⁹

Districts were not static; under each reorganization of the Light House Service, the district boundaries were redrawn. Boundaries at this time tended to follow the established naval district lines. As Alaska and Hawaii gained prominence, districts were restructured and renumbered to include them. When the Light House Service merged with the Coast Guard in 1939, inspectors and aids to navigation personnel were assigned to existing Coast Guard districts.

Perhaps the most important senior administrative change occurred when the Board decided to divide its functions among committees. Shubrick, who had been appointed chairman, designated five committees to oversee the business of the Board. These were

⁹"The United States Lighthouse Establishment" in *Appleton's Annual Cyclopaedia 1880* (New York: D. Appleton and Co., 1881), 436.

the Committee on Finance, composed of General Totten and Captain Du Pont; the Committee on Engineering under Colonel Kearney and General Totten; the Committee on Light Vessels (and Buoys), with Captain Du Pont and Professor Henry; the Committee on Lighting, under the aegis of Professor Bache and Colonel Kearney; and, finally, the Committee on Experiments, headed by Professors Henry and Bache.¹⁰ The committees were established in such a way that correspondence relating to any of the subjects was handled by the individual committee, while the Board itself was concerned with the administration of aids to navigation in its broader sense.

The Committee on Experiments, under Henry and Bache, represented a departure from the ideals of the old Light House Service. This committee, specifically charged with the testing and evaluation of improvements in navigational aids, was also required to enhance existing aids to navigation in U.S. waters. These improvements took the forms of revolutionary types of buoys, lenses, beacons, and fog signals. For example, Joseph Henry conducted extensive experiments on a fog signal in the Penobscot Bay of Maine after mariners had complained about the erratic behavior of the signal. According to mariners, a fog signal placed on the rocks above the bay was audible at a range of six miles. At three miles, the signal was lost until the vessel was within one quarter mile of

¹⁰National Archives, *Journal of the Light House Board*, October 22, 1852, Record Group 26, Entry 1, Volume I, n.p.

the source, and, consequently, the rocks. Clearly, this was a recipe for disaster.¹¹

In July 1877, Henry, on Board the tender *Iris*, conducted an investigation into this phenomenon. A direct result of his experiments was the establishment of a dialogue between the Light House Board and its scientific counterparts at Trinity House in Britain. Henry concluded that a phenomenon that he called "ocean echo" caused the acoustical aberration,¹² while Dr. Tyndall (Henry's British counterpart) at Trinity House theorized that Henry's supposed "ocean echo" was actually caused by "the existence of a flocluent [sic] or mottled condition of the atmosphere due to the unequal distribution of heat and moisture which absorbing the sound - produces an atmosphere of acoustic opacity."¹³

¹¹Joseph Henry Papers, *Report to Light-House Board* and undated correspondence between Dr. Henry and d. Tyndall, July 1877. Joseph Henry Papers, Correspondence, Smithsonian Record Unit 7053 (Washington, D.C.: Smithsonian Institution, n.p., n.d.), 13-35.

¹²"Ocean echo...consists in a prolonged echo from the horizon in the direction of the prolongation of the axis of the trumpet. It is always heard with a sufficiently loud blast of sounds and occurs during clear and foggy weather with the wind in different directions. The explanation of the phenomena is very difficult...The only explanation, which is in accordance with all the facts is that they are due to the refraction of the sounds caused by the action of a wind moving in opposition to the motion of the sound wave. The upper strata of such a wind moving more rapidly than the lower would retard the upper part of the sound wave more than the lower and, therefore, on the principle of the refraction of light, would cause the wave to take on an obliquely upward direction so as to pass above the head of the observer." Joseph Henry Papers, *Report to Light-House Board* and undated correspondence between Dr. Henry and D. Tyndall, July 1877. Joseph Henry Papers, Correspondence, Smithsonian Record Unit 7053 (Washington: Smithsonian Institution, n.p. n.d.), 13-35.

¹³Joseph Henry Papers, "Report to the Light House Board" concerning correspondence between Drs. Henry and Tyndall, Smithsonian Record Unit 7053 (Washington, D.C.: Smithsonian Institution, n.p. n.d.). Henry paraphrased Dr. Tyndall's

Other experiments included the testing of various proposed buoys and lenses. These experiments will be treated in some detail. For the first time, the bureau responsible for the upkeep and deployment of navigational aids in the United States participated in technological advances, rather than as a simple profiteer of European nations' progress.

Mariners, insurance companies, and shipping concerns also brought petitions before the Board concerning the placement of navigational aids at various places along the coasts. Requests ranged from mere suggestions (e.g. "we believe a navigational aid would greatly benefit maritime traffic if it were placed at such-and-such a location.") to demands. A letter from lighthouse inspector Capt. A. Ludlow Case prompted a vehement response from the Board. The contents of the original letter are unknown, but according to the entry in the *Journal of the Light House Board*, the reply was abrupt and final:

the Board replies: "From the same [A.L. Case] in relation to service of placing buoys in Sag Harbor District. ---- ORDERED that the Contractor be required to conform to the terms of the contract - or payment refused. The opinions of the contractor in regard to the chart are of no value. This Office regulates the Buoyage &c. Itself - not the contractors."¹⁴

theory of ocean echo.

¹⁴National Archives, *Journal of the Light House Board*, November 16, 1855, Record Group 26, Entry 1, Volume III, 264. The Board firmly believed that this kind of supposition on the part of the contractors coupled with the contractor's ability to convince local collectors of customs or lighthouse inspectors led to the bulk of the problems of the administration on the local level under Pleasanton. This belief is solidly grounded; proof of the abuses were indicated in the report submitted to Congress by Thornton A. Jenkins. The Light House Board, to its credit, firmly continued to administer the contracts and charts from a central authority. The lighthouse inspectors were no longer autonomous, but

In addition to the placement of minor navigational aids, the Board found itself confronted with the problems of buoys picked up at sea after having broken their moorings. In February 1857, the Board concluded, in response to a communication from the Inspector of the Fourth Light House District, that "buoys &c. [are not considered] as fair objects of salvage, but that in cases in which they have been found adrift and proper and satisfactory evidence produced that they had been found actually adrift, a fair and reasonable allowance has been authorized to pay for the time and labor in restoring them to the Offices of the Government."¹⁵

The establishment of the Light House Board as the final authority concerning buoys and their placement led to a revolution of sorts in the 1850's. On the basis of available evidence, it appears that under Pleasanton's administration, contractors manufactured buoys in accordance with the handling capabilities of their own individual vessels. Contractors would surely not place their own ships in danger to set a navigational aid large enough to be useful to pilots.¹⁶ Perhaps no one was more critical

acted as agents of the centralized power in the individual districts.

¹⁵National Archives, *Journal of the Light House Board*, February 20, 1857, Record Group 26, Entry 1, Volume II, 394-5.

¹⁶While it is true that Pleasanton sometimes compensated Revenue Service captains who assisted with aids to navigation, such assistance was sporadic at best and it was not within Pleasanton's scope of power to commandeer Revenue Cutters for such service. Until the purchase of the *Belle* and construction of the *Shubrick*, the *Rush*, based in New York harbor, was the only government vessel entirely dedicated to the light house service. While *Rush* certainly assisted in setting and relieving buoys, she is referred to in

of buoyage in U.S. coastal waters than John Maginn, president of the New York Pilot Association. In a letter to Lieutenant Jenkins in response to his request for information, Maginn detailed the short-comings of the buoys in and around New York harbor:

As regards the buoys in the lower bay. I unhesitatingly say (and such also is the opinion of all ship masters, coasters, pilots, and others navigating that bay whom I have spoken to on that subject) that they [the buoys] are miserable in the extreme, and have been so for many years; but they are now worse than they were before. The buoys that were formerly black are now red. These red* (*The red paint being bad, is the cause of this) buoys cannot be distinguished in their color, even in the daytime, without you are near enough to touch them and at night it is utterly out of the question to tell whether it is a red or a black buoy you have made.¹⁷

Maginn derided the state of the buoyage and its uselessness in foul weather, and pointed out that certain aids on the bar are "mere apologies for buoys."¹⁸ Lieutenant Jenkins condensed the pilots', mariners', and ship owners' concerns about American buoyage in a November 1851 letter to Alexander Dallas Bache: "The buoys in the United States are too small as a general rule; badly painted, of improper shapes, and often improperly

later compilations of vessel documents as being a light house supply vessel, which included such duties as ferrying construction material and supplying goods to lighthouses.

¹⁷U.S. Light-House Establishment, *Compilation of Public Documents and Extracts Relating to Light-Houses, Light-Vessels, and Illuminating Apparatus, and to Beacons, Buoys, and Fog Signals 1789 - 1871* (Washington, D.C.: Government Printing Office, 1871), 791. *Excerpt of Letter from John Maginn, President, New York Pilots Association to Lieutenant T.A. Jenkins, USN from New York, June 30, 1851.*

¹⁸*Ibid.*, 792.

moored."¹⁹

The concept of a system for buoyage in the United States was not new nor unique to the Light House Board. As early as 1846, Secretary of the Treasury Robert L. Walker was writing to Vice-President George M. Dallas espousing the great need for a centralized authority to oversee the proper placement of aids to navigation in accordance with some predetermined system as was currently in place in Europe.²⁰

The most important part of this letter is included here; it is the first official mention of the idea of a standardized system of buoyage be implemented in U.S. waters. Secretary Walker wrote:

The buoys used in the entrances to our harbors are now placed by local authorities, and under loose regulations. A general system should be adopted of coloring and numbering, and should be so rigidly adhered to that the seaman would know his position as soon as he discovered a buoy. This is practicable, as will be seen from the interesting account in the report of Lieutenants Jenkins and Bache, or the intricate approaches to the port of Liverpool, which are rendered quite safe by the system of buoys, lights, marks, and tide signals. The natural marks which disappear yearly from our coast should be replaced by permanent

¹⁹U.S. Light-House Establishment, *Compilation*, 751. *Excerpt of Letter from T.A. Jenkins, Coast Survey Office, Washington, D.C. to A.D. Bache, Superintendent Coast Survey*, November 5, 1851.

²⁰R.L. Walker, Secretary of the Treasury to Vice-President George M. Dallas, August 5, 1846, in U.S. Light-House Establishment, *Compilation of Public Documents and Extracts* (Washington: Government Printing Office, 1871), 444-445.

ones; screw-piles for mooring buoys should in certain cases be supplied. The arrangements for placing buoys and verifying their positions require to be rendered systematic, and to be subjected to some general control. The navigator should have due notice of all changes from a source connected with the whole light-house system.²¹

A letter from Capt. Joseph C. Delano, commander of the *Albert Gallatin*, to the Light House Service in November 1851 indicated that no action was taken on Secretary Walker's request, because

Ignorant men, pilots, captains, coasters, anybody, in fact, are employed by contract to place the buoys, and they are seldom placed alike for two successive years....It often happens that a black buoy will be found ... where the chart calls for a white one, as the person who superintends this operation disdains reference to the coast survey, most likely because he could not understand it.²²

Delano hoped that the appointment of the Light House Board would improve American aids to navigation as to "approach the standard of European excellence."²³

One of the most significant standards of European excellence alluded to by Captain Delano was the existence of a *system* of buoyage as described by Lieutenant Jenkins in his report to Congress, and again by Secretary of the Treasury Walker in a letter to Vice-President George Dallas. Congress acted in September 1850 to remedy the

²¹Ibid.

²²Excerpt of letter from Captain J.C. Delano, Novmber 25, 1851, from New Bedford, Massachusetts in U.S. Light-House Establishment, *Compilation of Public Documents*, 744.

²³Ibid., 744.

lack of a buoyage system in the United States. The results of this act required that

red buoys with even numbers be placed on the right-hand side, and black buoys, with odd numbers, on the left-hand side of channels approached from the seaward; that buoys placed on wrecks or other obstructions, having a channel on each side, be painted with red and black horizontal stripes that those buoys placed in mid-channel, and which indicate that they must be passed close-to to avoid danger, be painted with white and black perpendicular stripes and, finally, that perches, with balls, cages, etc., when placed on buoys, will indicate a turning-point, the color and number of the buoy showing the side on which they are to be passed.²⁴

Perhaps the most important catalyst to effect changes in the design, sizes, and moorings of buoys was the advent of steam navigation in the 1840's and 1850's. The proliferation of larger, faster vessels demanded larger, more visible, and more accurately placed navigational aids. It is not coincidental that the bulk of complaints concerning American buoyage were concentrated in the late 1840's; nor is it coincidental that the Light House Board convened at a time when technological advances in ship design and propulsion far outstripped the ability of the United States to provide safe sea-lanes.

The Light House Board lost no time in addressing mariners' and pilots' concerns about inadequate buoyage. Environmental and biological effects on buoys were well documented by the 1840's, and contractors and inventors busily worked to apply solutions. Design, size, and experience with wooden spar and cask-type buoys revealed a vulnerability to *Teredo navalis* and its effects. To combat these, contractors began

²⁴Arnold Burges Johnson, *The Modern Light House Service* (Washington: Government Printing Office, 1890), 45.

experimenting with buoys constructed of boiler iron.²⁵ The earliest extant rendering of an iron riveted buoy appears in Patent No. 15,845 issued October 7, 1856, to a Mr. William M. Ellis.²⁶ Ellis, however, was not seeking a patent for a specific nun buoy *design*; his *improvements to buoys* patent involved changes in the shackle system for mooring (Fig. 4). The earliest can and nun buoys were riveted boiler plate iron. As Light House Inspectors noticed the effects of ramming by steam vessels, the standard nuns and cans were re-designed to include a number of compartments—much like the hulls of ships—separated by water-tight bulkheads. The designers believed a buoy of this design, if struck by a passing ship, could remain afloat until a tender could be dispatched to replace it.

The Board recognized the importance of steam navigation and realized the benefits of using a maneuverable platform capable of accurately setting larger buoys. In

²⁵An anonymous, undated manuscript in Record Group 26, Entry 16, Box 8, NC-31 of the National Archives entitled *Specifications for Iron Nun and Can Buoys* describes the construction of these buoys in detail. "The shape of the buoys is determined by the revolution of a partly curved and partly straight line around the vertical axis. All rivets and plates for these buoys must be made of the best quality of charcoal iron. ... The plates must be put together with hot rivets, and the joints be made perfectly water-tight; the use of paint, iron-filings, or any other kind of cement will not be permitted for the purpose of making close joints.", 1.

²⁶Mr. Ellis approached the Light House Board with his design. An entry in the *Journal of the Light House Board* for November 14, 1857, acknowledges receipt of Mr. Ellis's plans and proposal, but regretted "a lack of funds" for experimentation. Whether there was truly a lack of funds or simply a hedge to this effect by Shubrick is unclear from extant documentation. The Board also states unequivocally that it had no desire to change the design or moorings of buoys at that time. In truth, the Board was watching the development of an experimental "screw mooring" being tested by Trinity House.

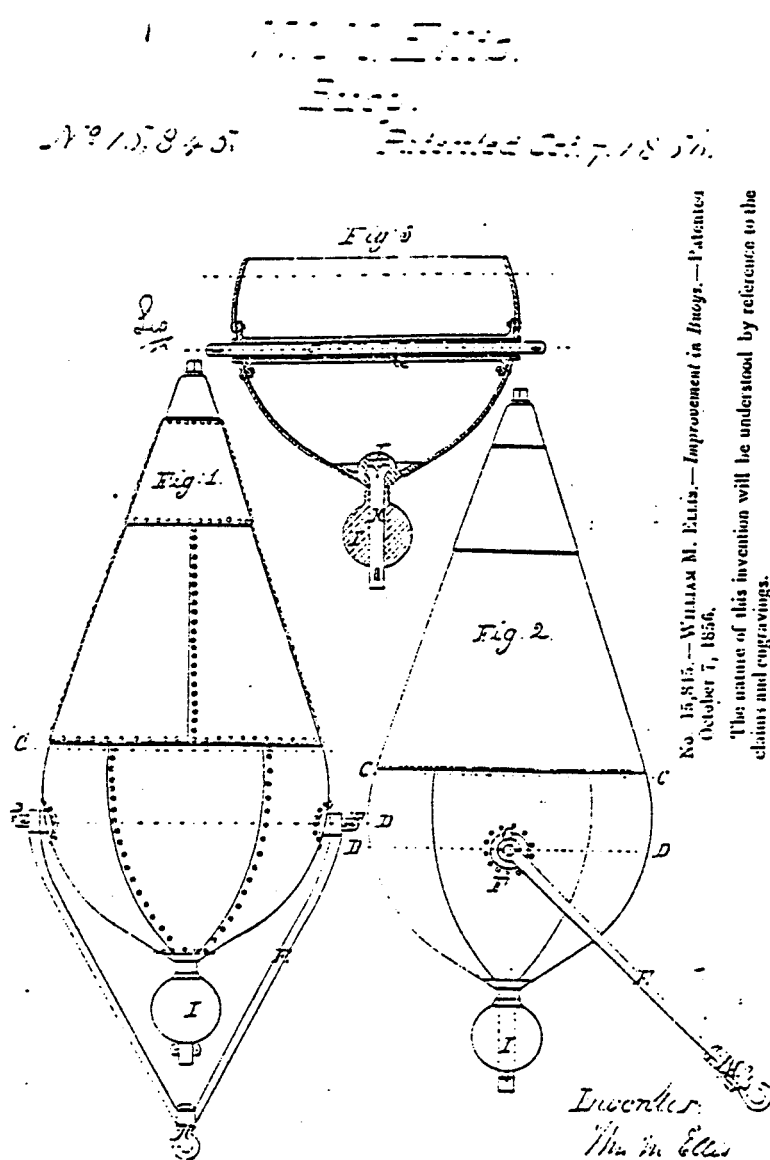


Figure 4. Design of William M. Ellis's shackle and mooring system as applied to a nun buoy in 1856. Patent No. 15,845 granted October 7, 1856. Courtesy of the U.S. Patent Office.

1856, Congress appropriated \$60,000 for the construction of a steam tender for the Light House Board. The *Shubrick*, built at the Philadelphia Navy Yard in 1857, was the first tender constructed from the keel up expressly for lighthouse tender service. A side-wheeler with a harp and steeple single-expansion steam engine, the *Shubrick* was 140 feet long with a 22-foot beam and drew nine feet—a draft which made her able to relieve buoys in relatively shallow water. Her 284-horsepower engine propelled her at a top speed of eight knots. The hull was constructed of Florida live oak and white oak, and she displaced 350 tons fully loaded.²⁷ “To better withstand buoys scraping her side, the *Shubrick*’s hull was painted black, topped with a white ribbon and waist.”²⁸ Like most other steamships of the 1850’s, the *Shubrick* was equipped with auxiliary sail; when in use, her sails were rigged as a brigantine.

Once completed, the *Shubrick* was assigned to the Pacific Coast in belated response to the California Gold Rush of 1849. The gold rush ushered in huge volumes of maritime traffic as commerce sprung up almost overnight. The approaches to San Francisco, before the *Shubrick*’s arrival, were marked with a few lighthouses and no buoys—a situation that could only lead to disaster for the new boom market. The *Shubrick* completed her duties faithfully on the Pacific Coast until her transfer to the

²⁷“Tenders and Light Vessels,” Aids to Navigation file, U.S. Coast Guard Historian’s Office, n.d., n.p. This source states that the *Shubrick*, in 1869, after her rebuilding at San Francisco Navy Yard, displaced 305 tons.

²⁸Richard D. White, Jr., “Saga of the Side-Wheel Steamer *Shubrick*: Pioneer Light House Tender of the Pacific Coast” in *American Neptune*. Vol. XXXVI, No. 1, 1976, 47.

Revenue Cutter Service in 1861. After six years as a Revenue Cutter, the *Shubrick* was transferred back to the Light House Board in 1867. The *Shubrick* continued the task of tending aids to navigation in California until the arrival of the *Manzanita* in 1880; the *Shubrick* was transferred to Oregon where she continued to work for six years. On March 20, 1886 in Astoria, a man from San Francisco purchased the *Shubrick* for \$3,200.²⁹ After twenty-nine years of government service, the first steam lighthouse tender retired from the fleet.

The Light House Board was extremely successful in its early days. The service, however, was hobbled in its early years with the daunting task of bringing contractors into line with new regulations and ensuring that individual contractors realized that the abuses they could perpetrate under Pleasanton would no longer be tolerated. Not until after the Civil War would the most impressive work of the Committee on Experiments and the Light House Board as a whole be accomplished.

This study would be more dramatic if it could assert that the secession of the southern states and the beginning of hostilities in 1861 had a profound affect on the Light House Board. In fact, they did not. Apart from a string of correspondence in early 1861 from southern lighthouse keepers resigning their commissions, the effect of the war, according to Light House Board documentation, was negligible. Early on, the Board temporarily lost one of its members; the Union Navy ordered Cdr. Samuel F. Du Pont to

²⁹"Tenders and Light Vessels," Aids to Navigation File, U.S. Coast Guard Historian's Office, n.d., n.p., 150.

command the South Atlantic Blockading Squadron. The Board did, however, have some difficulty procuring money at times during the war, as evidenced by a personal loan Du Pont made to the Board in order to

relieve the Board from a difficulty caused by the impossibility of obtaining cash for a treasure Draft at Port Royal [As a result] the Board tendered their thanks to Flag Officer Du Pont, Commander of the South Atlantic Blockading Squadron for his kind and effective action in reference to the payments to be made to their employees at Port Royal.³⁰

Save for this once reference to the South Atlantic Blockading Squadron and Du Pont, there is little in the Light House Board records to substantiate that a war was in progress. There are fewer references to navigational aids in southern states, but the content of the documentation does not change. Not included in the Light House Board archives is a February 1862 letter from Salmon P. Chase to Shubrick in which Secretary Chase informed Shubrick of a bill before the Senate that, if accepted, would have transferred the Light House Board to the Navy. Chase closed by requesting comments of the Light House Board concerning the transfer to be forwarded to him. Professor Bache replied rather firmly that "the construction, dimensions, placing, mooring, etc. of light vessels, and proper system of floating lights, the system of buoys, beacons, and sea-marks requires the scientific and practical navigator, who is to be found in connection with our

³⁰National Archives, *Journal of the Light House Board*, June 10, 1862, Record Group 26, Entry 1, Volume II, 641-2.

government, as a rule, in the Navy."³¹ Interestingly enough, a letter arrived from a Mr. G.F. Watson relaying that a Mr. J.T. Gillaspie of Virginia wished to undertake the supply and repair of buoys on both coasts, sea and bay, of the eastern shore of Virginia in December 1862.³² The Board accepted the offer at a rate of \$1,000 per year. In January 1863, a letter arrived from a Mr. T.T. White of Norfolk, Virginia, who proposed to deliver juniper spars for buoys at Baltimore and Alexandria for twenty-eight cents per running foot.³³ This offer was also accepted.

In terms of administering its own navigational aids, the Confederacy was by no

³¹Alexander Dallas Bache, A.D. Bache to S.P. Chase in response to Chase's letter of February 17, 1862, A.D. Bache Papers 1821 - 1869, Smithsonian Record Unit 7053, n.p., Smithsonian Institution, Box 5. As Superintendent of the Coast Survey, Bache, in his reply, appears oddly allied with the Navy. The Coast Survey built its reputation on the accuracy of its charts and in the good standing it achieved in its placement of navigational aids. To turn over such an undertaking to the Navy was ill-advised. While the Light House Board *was* a quasi-military commission, the maintenance and placing of navigational aids did *not* fall to the Navy, but were handled with Light House Service tenders. This was the first time Congress wrestled with the issue of the disposition of the Light House Service in war-time. It was the first time Congress toyed with the idea of placing aids to navigation exclusively under the jurisdiction of the Navy, and was the first and only time Congress failed to transfer the duties and/or personnel of the Light House Service to the Navy during war-time.

³²National Archives, *Journal of the Light House Board*, December 6, 1862, Record Group 26, Entry 1, Volume III, 17. This reference to the Eastern Shore of Virginia is significant in that there has been some debate over the loyalties of this region during the Civil War.

³³National Archives, *Journal of the Light House Board*, January 17, 1863, Record Group 26, Entry 1, Volume III, 25.

means idle.³⁴ According to the Confederates' own documentation, the first official function of the Confederate Light House Board was to procure copies of the latest version of the *Practical Navigator* as well as various books and charts of the South Atlantic Coast. This was quickly followed by a copy of the 1852 Act that created the U.S. Light House Board ("U.S." was crossed out and "C.S." written over it).³⁵ The Confederate Light House Board was thus established along the lines of its Union counterpart. Like the Union Light House Board, the Confederate Light House Board was also relegated to the Treasury Department. Once convened, the agency, as one author has blithely put it "stumbled into action."³⁶

Raphael Semmes, later of C.S.S. *Alabama* fame, became the father of the Confederate Light House Board whether he liked it or not. He, however, was not the bureaucratic type, and, once open hostilities broke out, was openly restless in his newly-assigned desk job. He wrote to Jefferson Davies requesting a vessel, and, on April 18, 1861, Semmes got his wish; he departed for New Orleans and his new command, the

³⁴Records of the National Archives are woefully incomplete and sketchy, but they may be supplemented by records from other collections - most notably the Southern Historical Collection at the University of North Carolina at Chapel Hill.

³⁵National Archives, Nautical Technology and Science: KL. Lighthouses and other navigational aids, Subject File of the Confederate States Navy, 1861-1865, Naval Records Collection of the office of Naval Records and Library, Record Group 45, microfilm M1091, n.p.

³⁶David L. Cipra, "The Confederate States Light House Bureau: A Portrait in Blue and Gray," in *The Keeper's Log*, Volume VIII, No. 2, Winter 1992, 8.

C.S.S. *Sumter*. His replacement was Ebenezer Farrand, who ran the shaky bureau valiantly despite criticism over the need for it and complaints from the Confederate States Navy, which accused Farrand of hoarding supplies it desperately needed.

On June 7, 1861, Farrand dispatched a circular to all the Confederate Superintendents of Lights.³⁷ This circular, sent out from Richmond, Virginia, does much to dispel the Civil War myth of Confederate vandalism of lights and other aids to navigation. It also helps to blow away some of the mist that has hung over what has come to be one of the major assumptions about the Confederacy during the Civil War. The circular reads:

Circular

Confederate States of America
Light House Bureau
Richmond, VA June 7th. 1861

Sir,

I have to request that you will upon the receipt of this communication cause all the lenses, fixtures and appurtenances of the Light Houses within your district together with the Oil and other public property appertaining thereto, to be removed to some place of safety, with as little delay as possible.

The lenses and other machinery should be moved with great care, and when the work shall have been accomplished, you will report the fact to the Bureau. You will also forward your Estimate for the Expenses of removal.

Very Respectfully
Your Obtsvt.
Eban. Farrand
Chief of Lt. Ho. Bureau³⁸

³⁷Most of the Confederate Superintendents were ex-Union superintendents who continued in their previous positions upon resignation of their U.S. posts and allegiance.

³⁸G.C. Memminger, Secretary of the Treasury, Confederate States of America to Eban. Farrand, Chief of the Confederate Light House Bureau and to Jos. Ramsey, June 7, 1861, Southern Historical Collection, Papers of Joseph Ramsey, Collector of Customs

The lenses and other navigational aids were removed for several reasons: to deny any navigational aids to the Union blockading squadrons; to prevent their falling into enemy hands should they be captured; and to ensure that, once the war was won, the Confederacy would have the wherewithal to restore the lights quickly and resume maritime commerce. This image of Confederate stewardship contrasts sharply with the popularly reinforced image of Confederate troops smashing Fresnel lenses and showing blatant disregard for what the Union still believed was federal property.

Common sense decries the Union perception of the Confederates as vandals. The Confederates viewed the lighthouses and other navigational aids as Confederate property. At \$5,000 for a first order Fresnel lens, it is only reasonable that the Confederate superintendents would care for the lenses, if for no better reason than to save money. Also, the South relied heavily on maritime traffic to ship its raw materials to overseas markets. Once the war was won, any significant delays in the resumption of maritime trade due to faulty or lacking navigational aids would mean money lost.

The circular, however, was the source of some confusion over the extent to which the superintendents had to go to carry out the order for removal. Some, like Joseph Ramsey, Superintendent of Lights in Plymouth, North Carolina, simply moved their

and Superintendent of Lights in Plymouth, North Carolina, University of North Carolina at Chapel Hill. This is the actual form that the circular took as it was dispatched to all superintendents of lights. Ramsey's reply to this circular was to move a tender vessel upstream in the Roanoke River, and remove a lens from a light at Plymouth.

tenders upstream and crated lenses to be shipped to warehouses, while others went to further extremes.³⁹ There are records of a superintendent in Galveston, Texas, who reportedly "paid a contractor \$250 to entirely dismantle an 80-foot tower. The iron Bolivar Point lighthouse was taken down, bolt by bolt and plate by plate."⁴⁰

Meanwhile, the Confederate Light House Board continued to crumble. By September 1861, Farrand was returned to active duty with the C.S. Navy and was replaced by Thomas Martin, who remained in the chief position until the implosion was complete.

A major set-back for not only the Confederate Light House Board, but also the Confederacy as a whole, was the taking of New Orleans by Adm. David Farragut in April 1862. The Coast Survey Vessel *Sachem*, Mr. Gerdes commanding, proved indispensable during the planning stages of the passage of the forts of Jackson and St. Philip.⁴¹ Cdr. David Porter wrote to A.D. Bache about *Sachem*'s role as to the success of

³⁹Joseph Ramsey to Confederate Light House Board, June 14, 1861, Southern Historical Collection, Joseph Ramsey Papers, University of North Carolina at Chapel Hill, n.p.

⁴⁰David L. Cipra, "The Confederate States Light House Bureau," *The Keeper's Log*, Volume VIII, No. 2, Winter 1992, 10.

⁴¹Extracts from a letter from Commander Porter, USN, to the Superintendent of the U.S. Coast Survey, acknowledging efficient services rendered. West Gulf Blockading Squadron from February 21 to July 14, 1862, U.S.S. *Harriet Lane*, Forts Jackson and St. Philip, April 29, 1862, *Official Records of the Union and Confederate Navies in the War of the Rebellion*, Series I, Vol. 18 (Washington, D.C.: Government Printing Office, 1904), 395.

the Passage of the Forts, assuring Bache that Porter would

...never undertake a bombardment unless I have them at my side [Messrs. Oltmanns and Harris]. Mr. Gerdes has been indefatigable in superintending the work, laboring late at night in making charts and providing officers in command of the ships with them marking the positions of obstructions in the channel, and making all familiar with the main way. No accident happened to any ship going through, notwithstanding the gentlemen in the forts thought the obstructions impassable.⁴²

Gerdes and his staff were busy *after* the fall of New Orleans "in looking up the numerous buoys which these people [Confederates] have stowed away or wantonly destroyed, as they have nearly everything else. When found he [Gerdes] will put them all down in their proper places."⁴³ What was not mentioned in the *Official Records of the Union and Confederate Navies in the War of the Rebellion* was the fact that the New Orleans Mint housed nearly \$50,000 worth of lighthouse material, "perfectly crated and labeled for quick reassembly."⁴⁴

The post-Civil War years witnessed exceptional advances in aids to navigation in U.S. waters. Since, by the late-1850's, the price of whale and porpoise oil (the primary

⁴²Ibid.

⁴³Cdr. David Dixon Porter, USN in a letter to the Superintendent of the U.S. Coast Survey, A.D. Bache, West Gulf Blockading Squadron from February 21 to July 14, 1862, U.S.S. *Harriet Lane*, Ship Island, May 16, 1862, *Official Records of the Union and Confederate Navies in the War of the Rebellion*, Series I, Volume 18 (Washington: Government Printing Office, 1904), 395.

⁴⁴David L. Cipra, "The Confederate Light House Bureau," *the Keeper's Log*, Volume VIII, No. 2, Winter 1992, 10.

fuel for illuminated aids) had topped \$2.20 per gallon, Professors Henry and Bache continued extensive experiments on alternative fuels - mostly lard oil. By 1862, the French had two electrically lit lighthouses, but they were prone to problems and deemed impractical by the Light House Board.⁴⁵ The end of the Civil War meant that funds previously committed to restoring the Union could be used to advance commerce and trade. Technological advances in aids to navigation were part of that boom. The end of the Civil War brought a renewed interest in the advancement of aids to navigation designs. The Committee on Experiments and independent inventors worked diligently to find new ways to make buoys more visible.

The concept of equipping buoys with lights began to form in the 1850's, but it was some time before the technology was available to put the idea into practice. Charles Babbage, Esq. of London, writing in 1851, identified the challenges presented by early floating lights. The primary concern, using available technology, was the ability to supply such lamps with fresh oil and the necessity of trimming the lamps.⁴⁶ More fundamental and theoretical problems arose in that

⁴⁵Dr. Henry's proposed appendix to the 1878 *Annual Report of the Light-House Board*, Joseph Henry Papers, Smithsonian Record Unit 7053, n.p., but associated with articles detailing the Courtney's Buoys experiments and the benefits of Gisborne Anti-Fouling and Anti-Corrosive Patent Paint, Smithsonian Institution.

⁴⁶Charles Babbage, Esq. Excerpts from "Notes Respecting Light-Houses" in U.S. Light-House Establishment *Compilation of Public Documents and Extracts Relating to Light-Vessels and Illuminating Apparatus, and to Beacons, Buoys, and Fog Signals 1789-1871* (Washington: Government Printing Office, 1871), 733. Babbage's report is dated November 1851.

Galvanic processes seem to present a similar difficulty. The chemical discoveries of recent times, however, offer some hope of removing it. By the destructive distillation of peat, or coal, and of shale, as well as other methods, a variety of combinations of hydrogen and carbon have been obtained. Some of these only remain liquid under a pressure of two or three atmospheres. They possess considerable illuminating power, and by confining them in a close vessel, and allowing a very small aperture for their escape in the state of gas, a jet of flame may be produced of uniform magnitude, and without the use of a wick, until the last drop of fluid has evaporated. If such a fluid could be produced at a moderate price, a quantity might be enclosed within the buoy, sufficient to last several weeks, if not months.⁴⁷

Babbage maintained that the problems of trimming and lighting could be addressed by equipping buoys with a mechanism similar to that of clocks. Problems with this sort of mechanism include logistical cost of deploying a tender and crew to wind it.

Babbage proposed that this problem might be solved by

having within the buoy a heavy pendulum, or perhaps two such, swinging at right angles to each other. If the *perpendicular* motion of the buoy could be secured, then the winding up pendulums must be maintained horizontally by means of a powerful spring. These, by the action of the waves, would be continually winding up the springs which drive the mechanisms. This might be so arranged that it would never over-wind them.⁴⁸

In regard to fuel for these buoys, Babbage theorized that, since benzol, spirits of turpentine, and similar compounds are gaseous at low temperatures, if one were to conduct such a gas by means of a heated, thick metal rod, this would be sufficient "to produce a continuous stream of gas to supply the burner until the last drop of fluid is

⁴⁷Ibid., 733.

⁴⁸Ibid., 733.

exhausted.”⁴⁹ While lamps of this type were relatively common ashore, subjecting such a mechanism to the stresses constantly encountered by buoys at sea was risky. While Babbage’s theories were well known by Professors Henry and Bache, it was more than twenty-five years before adequate technology was available to attempt a lighted buoy.

Like most things, a lack of technology sufficient to carry out ideas did not daunt would-be inventors from patenting designs for lighted buoys and presenting ideas to the Light House Board. John Moody and James Kane presented two of the most fanciful buoys ever to go before the Board. Moody patented his floating lighthouse buoy on March 12, 1867. The patent description detailed a star-like shape “for the purpose of preserving steadiness in a rough sea.”⁵⁰ (Fig. 5) Kane’s design (Figs. 6 and 7) received patent No. 151,398 on May 26, 1874. Never before had one buoy proposed to do so much. Kane designed these buoys to be used in a sequence in busy harbors. According to Kane’s patent statement, these buoys worked with a motion sensor, which, upon detecting a vessel passing close-to, lit the buoy’s lamp, sent up a flare, and sounded a fog horn. If the Kane buoy had worked as advertised, a busy night in New York harbor would have resembled a Fourth of July celebration.

The most successful designs of the early lighted buoys relied on compressed gas for illumination. The earliest patent for a buoy of this type was issued to Richard Pintsch

⁴⁹Ibid., 734.

⁵⁰U.S. Patent Record Office, Patent No. 62,870 presented to Mr. John Moody of York, England, March 12, 1867.

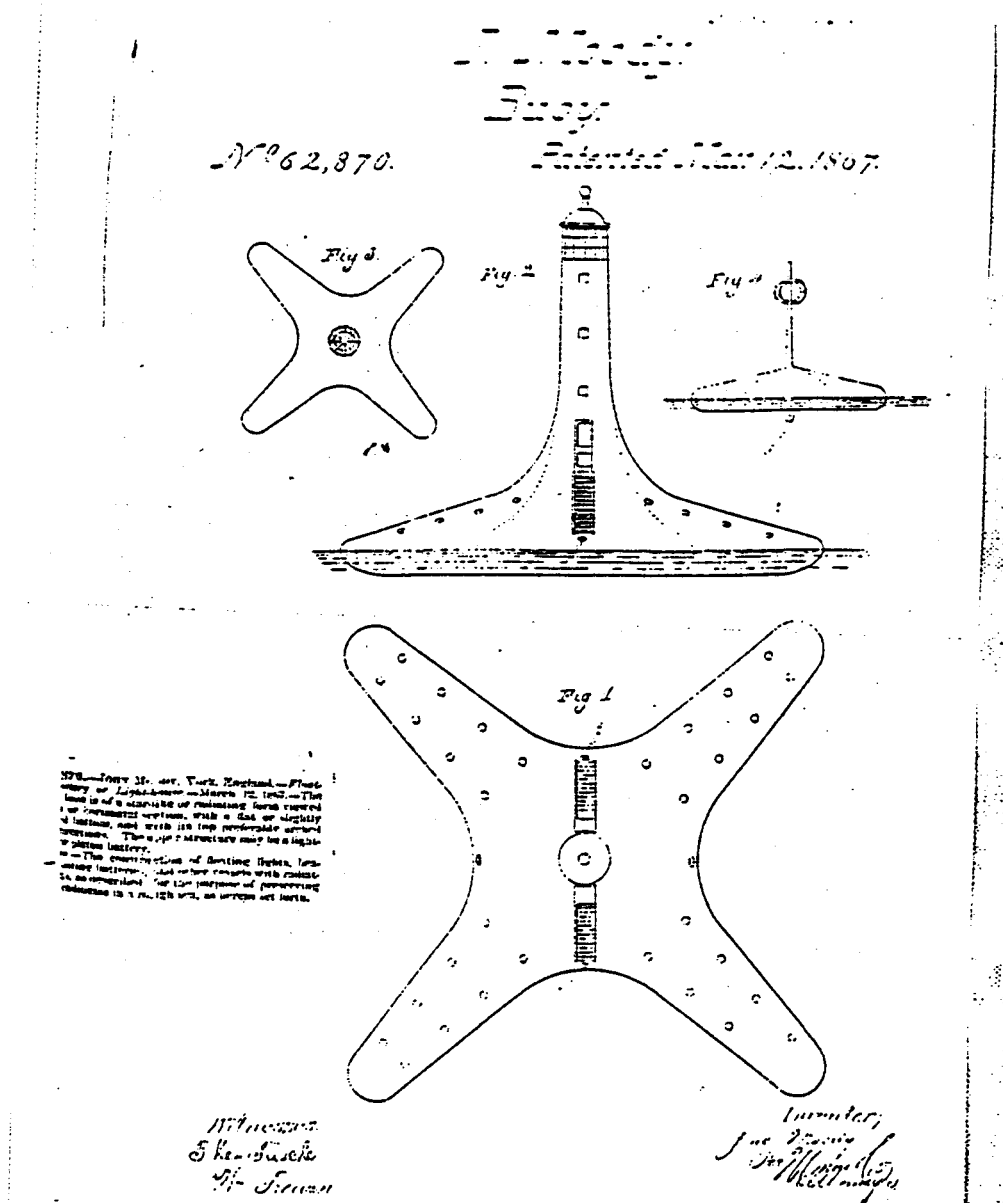


Figure 5. John Moody's floating lighthouse. Illustration from his March 12, 1867 patent no. 62,870. Moody was from York, England; when Trinity House did not adopt his concept, he brought it to the United States's Light House Board. Courtesy of the United States Patent Record Office.

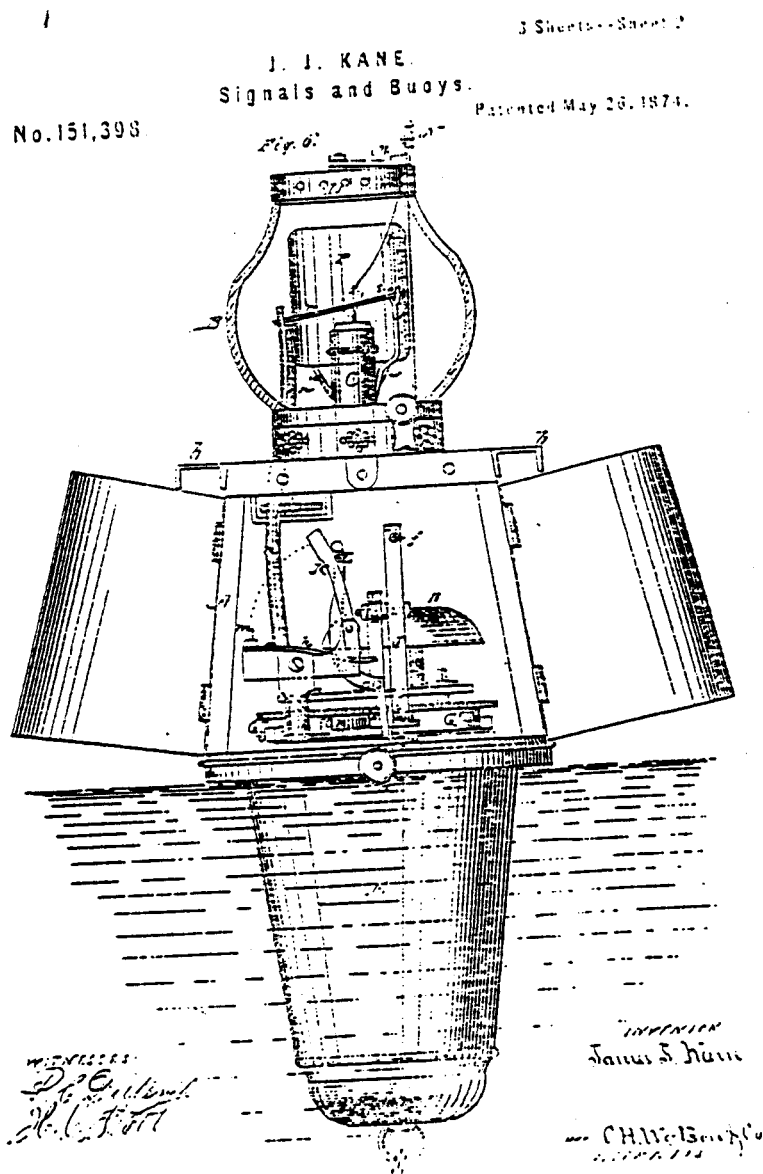


Figure 6. James Kane's buoy design that was the Light House Board rejected in 1874.
Courtesy of the United States Patent Record Office.

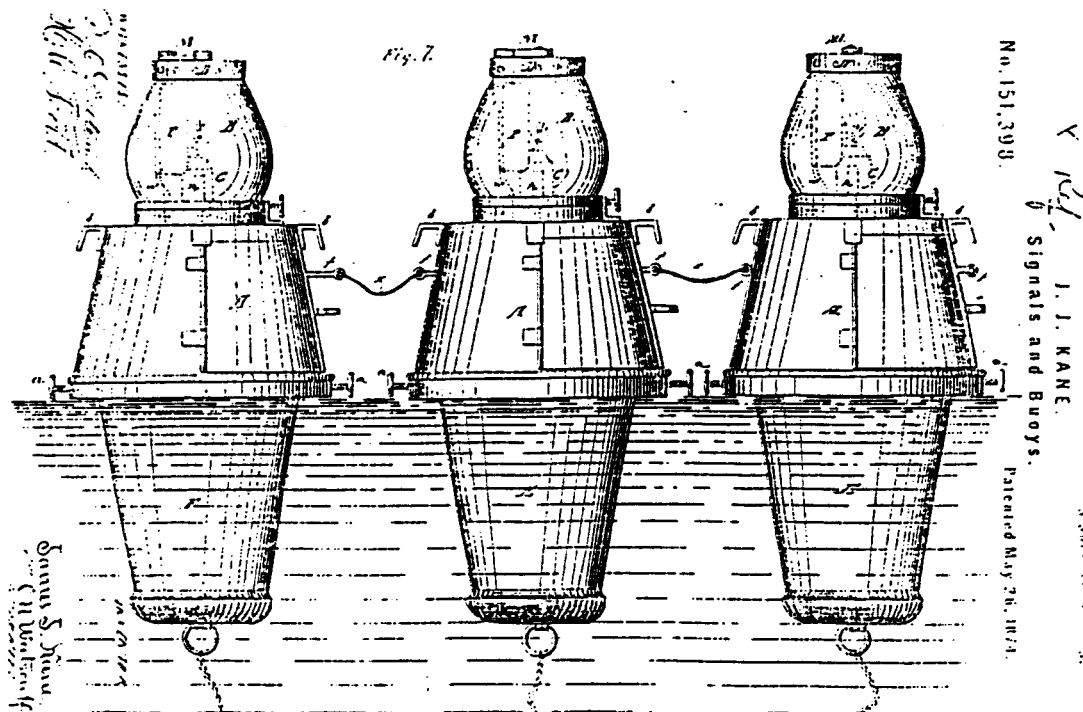


Figure 7. James Kane's buoys as they were proposed to appear when used in a series.
Courtesy of the United States Patent Record Office.

of Berlin, Prussia, in May 1877. The patent, No. 190,979, describes the illuminating apparatus and capabilities of the buoy as "consisting of a recipient for compressed illuminating-gas, with charging inlet closed by a valve, combined with a regulator and gas-burner arranged and operating substantially (Fig. 8)."⁵¹ John M. Foster quickly followed Pintsch with a design of his own (Figs. 9 and 10) using compressed gas.

Pintsch redesigned his compressed-gas buoy in 1883. The new buoy had a hull upon which was mounted an iron framework that supported the lantern (Fig. 11),⁵² This was the first of the modern-looking buoys to be tested and adopted by the Light House Board. Foster patented a series of improvements to his own design after Pintsch patented his design. Foster's first attempt in 1886⁵³ was based solidly on the design of the John Courtenay's Whistle Buoy (Figs. 12, 13, and 14). "Improvements" to the design followed in 1893, when Foster proposed lighted bell and lighted whistle buoys. Foster's designs were complete failures. Among the problems encountered with the design was its tendency to roll in a swell, tip over, and extinguish itself. The Foster design was discarded in favor of the Pintsch design.

⁵¹U.S. Patent Record Office, Patent No. 190,979 presented to Mr. Richard Pintsch of Berlin, Prussia, May 1877.

⁵²U.S. Patent Office, Patent No. 282,115 presented to Mr. Richard Pintsch of Berlin, Prussia, July 31, 1883.

⁵³U.S. Patent Office, Patent No. 355,157 presented to Mr. John Foster.

R. PINTSCH.
FLOATING SIGNAL-LIGHT.
No. 190,979. Patented May 22, 1877.

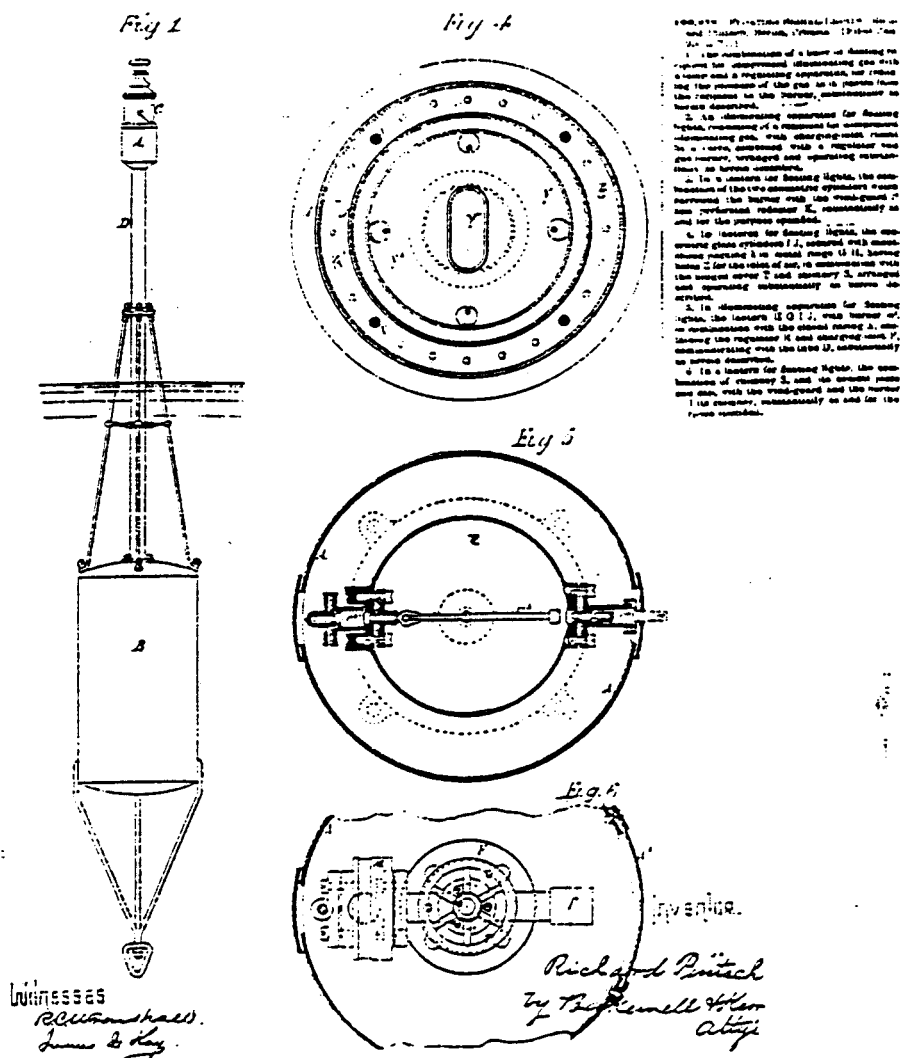


Figure 8. The first of the Pintsch patents, conferred May 22, 1877, for a lighted buoy using compressed illuminating gas. Courtesy of the United States Patent Record Office.

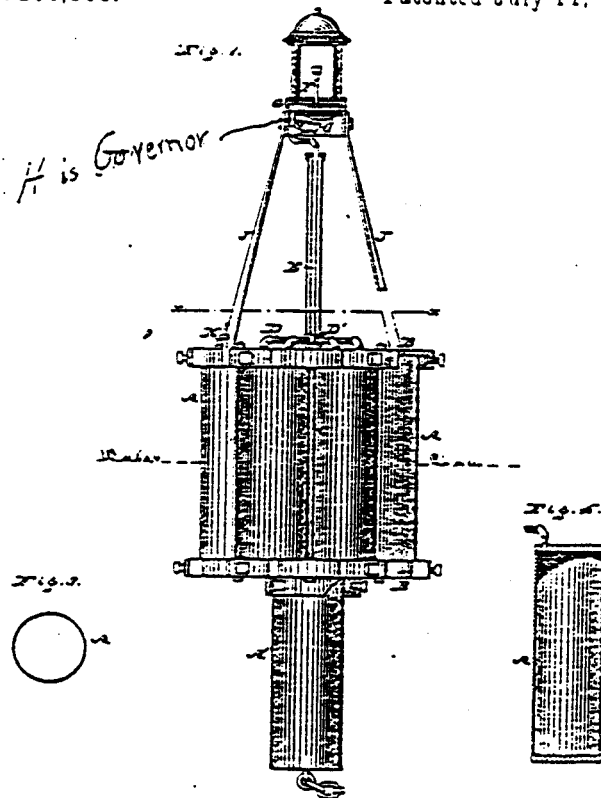
(No Model.)

J. M. FOSTER.

SIGNAL BUOY.

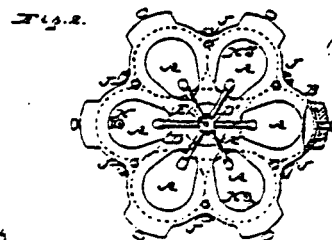
No. 260,963.

Patented July 11, 1882.



2. In a gas-lighted buoy, gas-burner B, pipe A, and coupling C, in combination with central cylinder, A', a concentric series of applying cylinders, A, and the pipes D, whereby each cylinder has independent communication with said coupling.

3. A buoy having gas-holding cylinders formed of seamless wrought-iron tubes, the bodies of the tubes being lap-welded and the heads welded to the bodies, substantially as and for the purposes herein.



WITNESSES

J. P. Brown
H. B. Offenberg

INVENTOR

John M. Foster.

W. O. Biederman

Figure 9. The first patent conferred upon John M. Foster for his design of a lighted buoy using compressed gas. This buoy was to be marketed in direct competition to the Pintsch buoy. Design flaws in Foster's buoy, however, caused it to heel over in rough water and extinguish itself. Courtesy of the United States Patent Record Office.

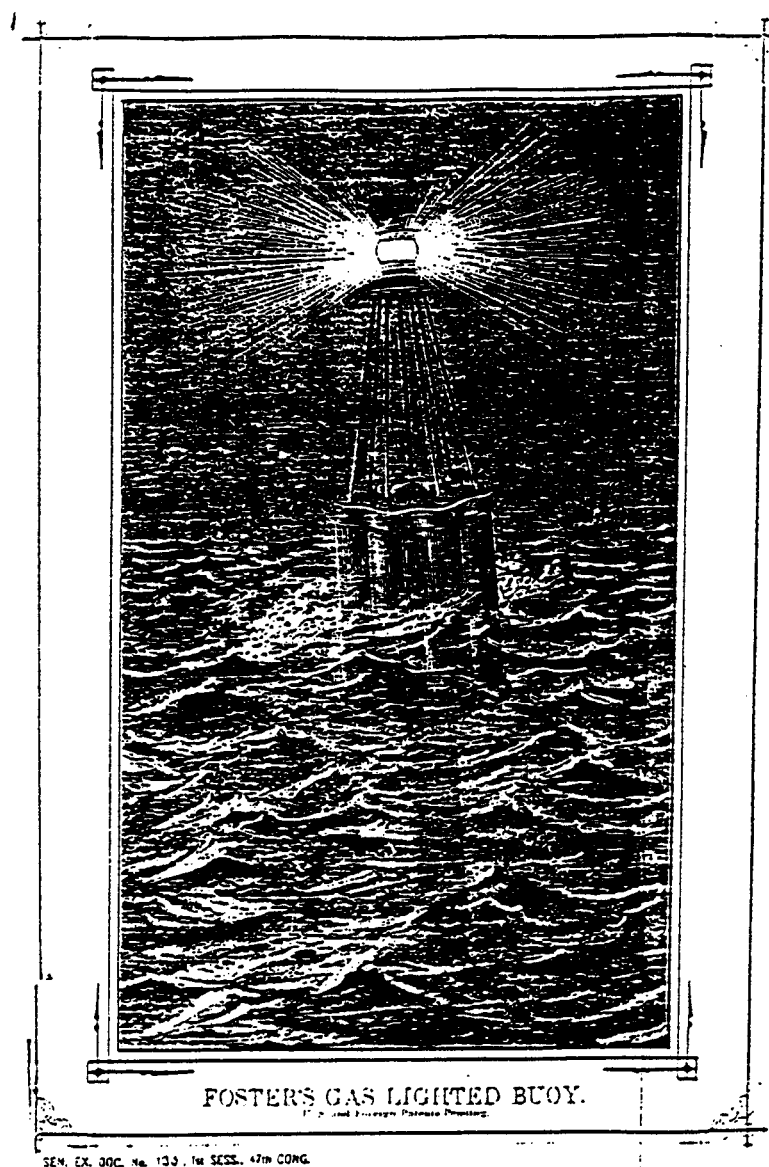
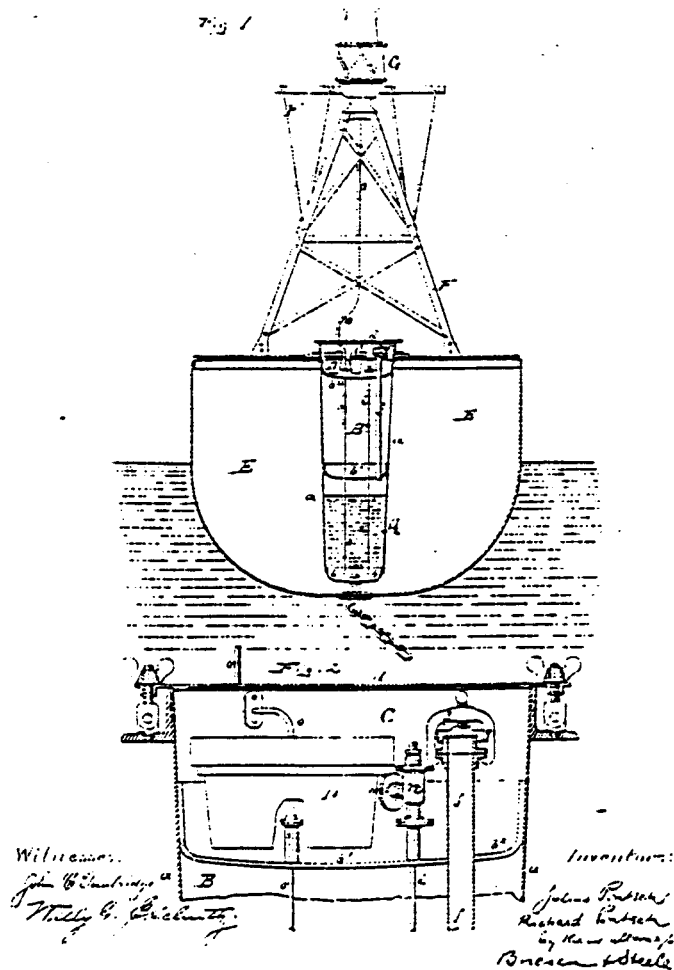


Figure 10. Artist's woodcut conception of how the Foster buoy would appear on station.
From Senate Executive Document No. 135, First Session, 47th Congress.

(No Model)
 J & R PINTSCH
 ILLUMINATING APPARATUS.
 CROSS REFERENCE
 No. 282,115. Patented July 31, 1883.



282115
 OR IN 431/344

Figure 11. Julius and Richard Pintsch's second patent for a lighted buoy using compressed gas. This design is a prototype for more modern buoys that would see use in the early-twentieth century. Courtesy of the United States Patent Record Office.

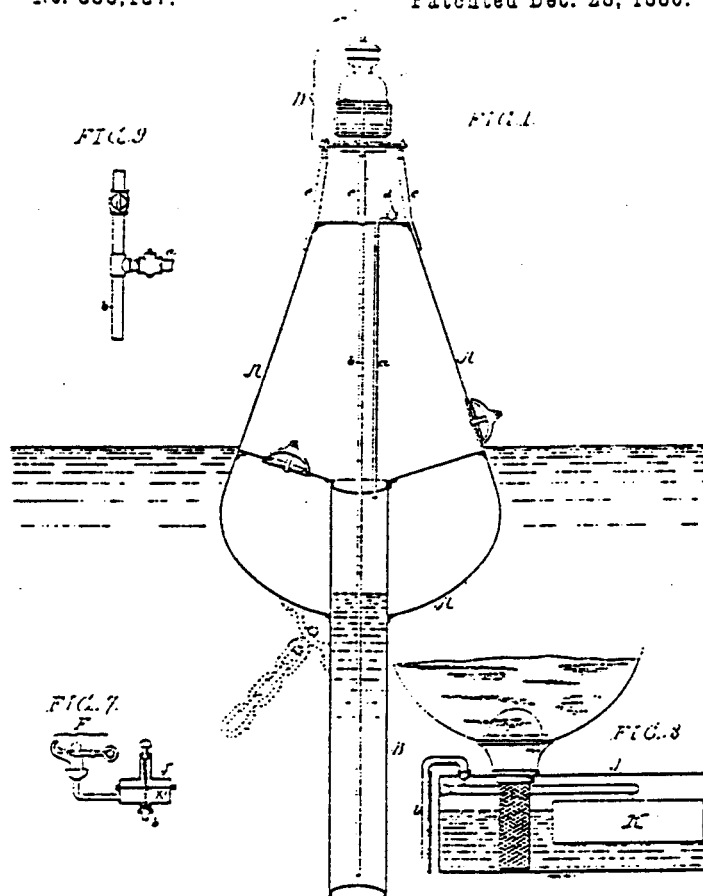
(No Model.)

4 Sheets—Sheet 1

J. M. FOSTER.
BUOY AND BEACON.

No. 355,157.

Patented Dec. 28, 1886.



Witnesses:
Samuel H. Tamm
William F. Lewis

Inventor
John M. Foster
 by *his Attorneys*
Stouten and Co.

Figure 12. The second patent conferred on John Foster for a lighted buoy design. This design is solidly based on John M. Courtenay's whistle buoy design of a decade earlier. Like Foster's initial design, this one proved susceptible to heeling over in heavy seas and extinguishing itself. Courtesy of the United States Patent Record Office.

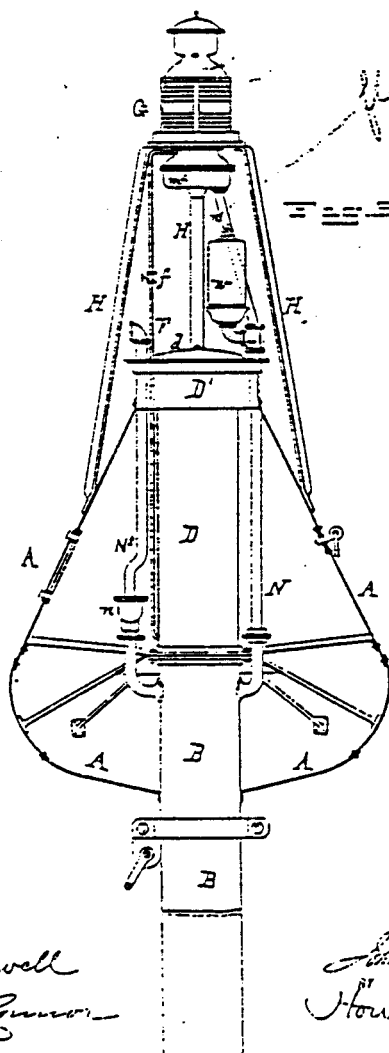
(No Model.)

No. 498,256.

J. M. FOSTER.
BEACON OR BUOY.

2 Sheets—Sheet 2.

Patented May 30, 1893.



WITNESSES

John Revell
S. C. Connor

INVENTOR

John M. Foster
Howden and Howden
 ATTORNEYS

Figure 13. Foster's lighted whistle buoy based on Courtenay's earlier design. Patent conferred May 30, 1893. Courtesy of the United States Patent Record Office.

(No Model.)

2 Sheets—Sheet 1.

J. M. FOSTER.
BEACON OR BUOY.

No. 498,2

Patented May 30, 1893.

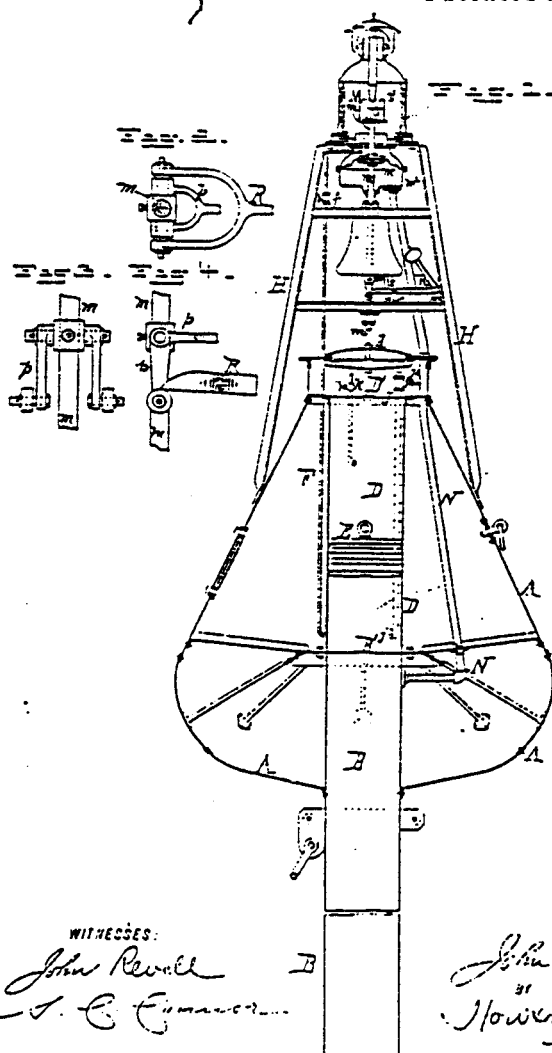


Figure 14. Foster's concept of a lighted bell buoy based on Courtenay's design. It suffered from the same design flaws as his previous submissions and was never adopted by the Light House Board. Courtesy of the United States Patent Record Office.

In 1888, the Light House Board began conducting experiments with electrically lit aids to navigation. Rather than use a design like those advocated by Pintsch and other inventors, the Light House Board chose the familiar spar buoy as its test design for an electrically lit buoy.⁵⁴ The first spar buoys with lamps affixed to their tops (Fig. 15) were placed on station in Gedney's Channel in New York harbor. These buoys were connected to Sandy Hook by a series of cables. The spar buoy was chosen because

experience has shown that a buoy in the form of a long spar fixed in place, having its lower end shackled direct to a heavy anchor or sinker resting on the bottom, is best adapted to withstand the effects of heavy seas and floating ice, and least liable to be displaced or broken adrift or being run down by passing vessels, and this form of buoy was therefore adopted as a support for the proposed light.⁵⁵

The Annual Report of the Light House Board for 1888 contained an appendix detailing the electrically lit spar buoys in Gedney's Channel. The system of buoyage for the channel was lit "at night by means of electric lamps operated through submarine conductors connecting with a generating apparatus on shore, for the purpose of defining the main entrance to the harbor of New York."⁵⁶ The Light House Board felt the lighting

⁵⁴These buoys were used in series—five in all. One of the original Gedney's Channel buoys is currently in the possession of the Montauk Museum, Long Island, New York.

⁵⁵Lieutenant Commander M.R.W. MacKenzie, US Navy, and First Lieutenant John Mills, Corps of Engineers, US Army, "Report upon the Electric Lighted Buoys in Gedney's Channel, New York Harbor," Appendix No. 3 of the *Annual Report of the Light House Board* (Washington: Government Printing Office, October 29, 1888), 193.

⁵⁶M.R.S. Mackenzie and John Mills, "Electric Lighted Buoys in Gedney's Channel, New York Harbor" in *The Annual Report of the Light-House Board* (Washington: Government Printing Office, 1888), 191.

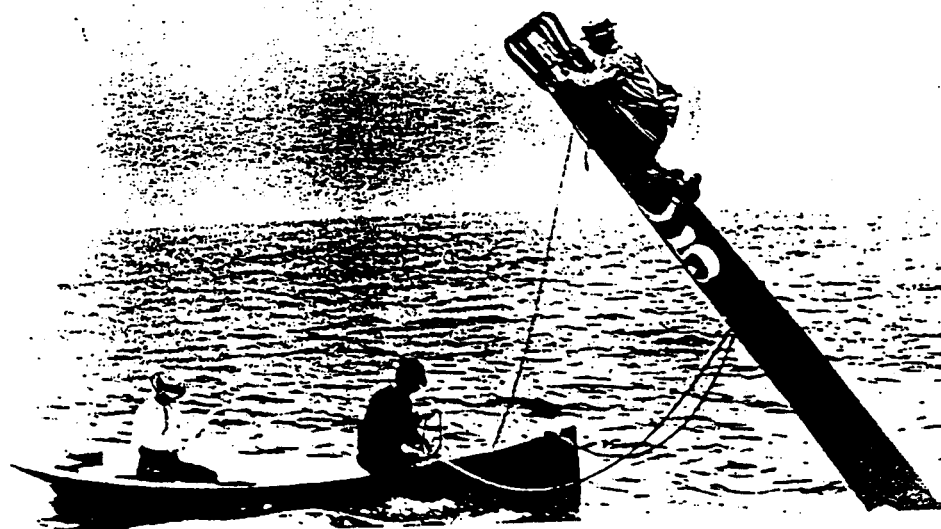


Figure 15. Crewmembers from the Third Lighthouse District at New York work on Buoy No. 5 of the Gedney's Channel Series. These buoys were tested for nearly two decades before the Light House Board proclaimed them less than adequate in 1903. District engineers removed them and began experimenting with other means of harnessing electricity for lighting buoys. Courtesy of the Coast Guard Historian's Office.

of this channel was the responsible thing to do since the majority of approaches and anchorages in New York harbor were lit by range lights, lighthouses, or other beacons. Strangely enough, at a time when Pintsch and Foster were experimenting with their compressed gas buoys, the Light House Board believed that the "most practicable form of light for the purpose was an incandescent electric lamp operated by a current generated on shore and conveyed through a cable laid on the bottom of the sea."⁵⁷ The Light House Board differentiated the individual buoys by using different colored glass for the lanterns. Lt. Cdr. M.R.S. Mackenzie, U.S. Navy, and 1st Lt. John Mills, Army Corps of Engineers, assured Congress of the continued success of the lighted spars in that they believed "that this method of establishing a light at sea has been put in a form which, if not the most efficient possible, is at least practicable, and it is hoped that besides answering the purpose in the particular locality for which it was designed, a similar system, with such changes as experience may suggest and other conditions require, may have a more extended application."⁵⁸ What the designers and engineers had not counted on was the fact that propellers from passing deep-draught ships were responsible for severing the cables. Although the experiment persisted until 1903, the Gedney's Channel buoys proved to be failures.

⁵⁷Ibid., 193.

⁵⁸M.R.S. MacKenzie, "Electric Lighted Buoys in Gedney's Channel, New York Harbor" in *The Annual Report of the Light House Board* (Washington: Government Printing Office, 1888), 231.

Lighted buoys were not the only navigational aids affected by advances in technology. The Light House Board actively sought new technology and designs for audible signal buoys. The Light House Board had experimented with bell-boats as early as the 1850's; Arnold Johnson, chief clerk of the Light House Board in 1890, described one of them as "a most clumsy contrivance, liable to be upset in heavy weather, costly to build, hard to handle, and difficult to keep in repair."⁵⁹ The first audible buoy adopted by the Light House Board was the Brown's Bell-Buoy (Fig. 16) designed by an officer in the Light House Establishment.⁶⁰ The buoy itself had a diameter of six feet six inches; the buoy body was decked over in order to provide a platform for the erection of a three-inch angle-iron frame, which stood nine feet high. A 300-pound bell was rigidly attached to the frame.

As the buoy rolls on the sea this ball rolls on the plate, striking some side of the bell at each motion with such force as to cause it to toll. ... the bell-buoy sounds the loudest when the sea is roughest, but the bell-buoy is adapted to shoal water ... and if there is any motion to the sea, the bell-buoy will make some sound ... the bell-buoy is preferred in harbors, rivers, and the like, where the sound range needed is shorter and smoother water usually obtains [sic].⁶¹

By 1889, there were seventy buoys of this type in the waters of the United States.

⁵⁹Arnold Johnson, *The Modern Light-House Service* (Washington: Government Printing Office, 1890), 44.

⁶⁰According to extant records, this buoy was never patented.

⁶¹Johnson, *The Modern Light-House Service*, 44.

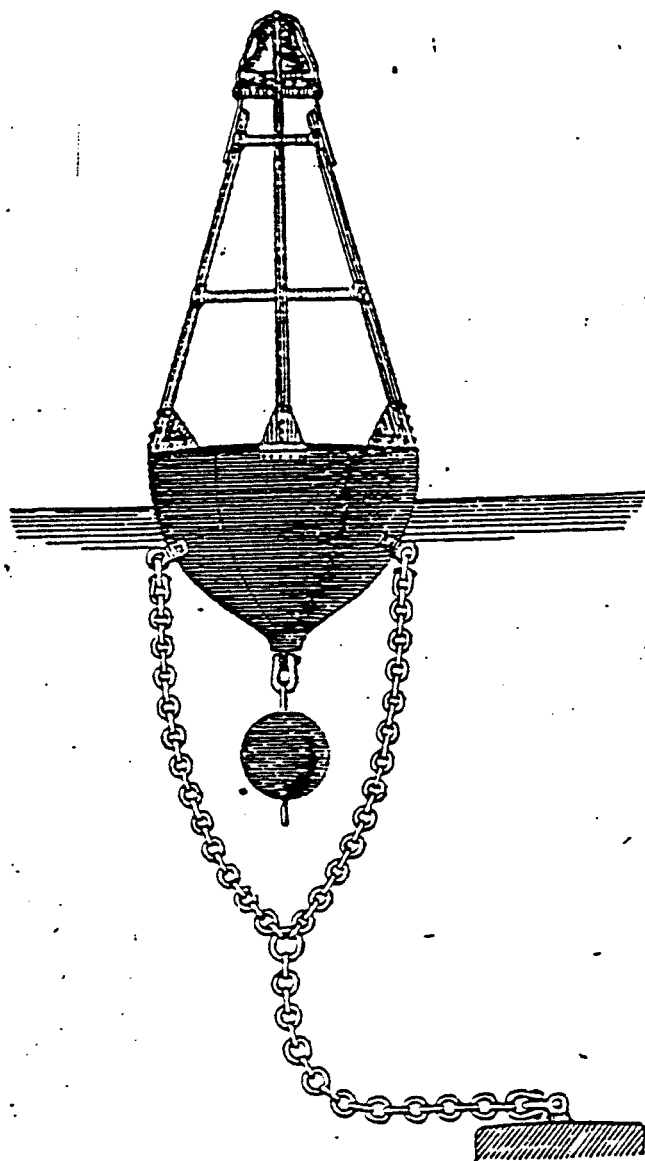


Figure 16. Artist's conception of the Brown's Bell Buoy from Arnold Burges Johnson's *The Modern Light House Board*, published in 1890. This rendering appears in other Light House Board publications as well as in "The U.S. Lighthouse Establishment" in *Appleton's Annual Cyclopaedia* 1880.

Beginning in 1876, there was a sharp increase in audible buoys of various designs. The most successful of these designs belonged to Mr. John M. Courtenay for what would later become known as the Courtenay's Buoy. Arnold Johnson, in his 1890 *The Modern Light-House Service*, maintained that Mr. John M. Courtenay of New York patented this buoy. There are no records in the United States Patent Office or the National Archives that support this claim. F.E. Chadwick, writing in 1881,⁶² stated that Courtenay had been involved in the East India Company before emigrating to the United States, and during his tenure with the East India Company he developed the buoy that bears his name (Fig. 17).⁶³

According to F.E. Chadwick, Courtenay got the idea for his buoy by

observing that the water in the interior of a steamer's smoke-pipe which was being hoisted aboard [the vessel on board which he served] at the cape of Good Hope, remained at a comparatively constant level whatever the motion of the sea about the exterior. Thus when the buoy rises with the sea there is a large air space in the cylinder to be filled with air from without; with the buoy begins to fall, the

⁶²F.E. Chadwick, "Aids to Navigation" in *Naval Institute Proceedings*, Vol. 7, No. 17, 1881, 255-296.

⁶³There are many different types of buoys that were patented in the U.S. in the late-19th century. A majority of these buoys were never considered for experimentation or investigation by the Light House Board. It may be that since the Courtenay's Buoy was not subject to patent laws that it was so readily adopted by the Light House Board - an adoption that came as early as 1878 when Professor Henry conducted experiments with the buoy and reported favorably in what would become his last appendix to an *Annual Report of the Light House Board*. Dr. Henry died on May 3, 1878.

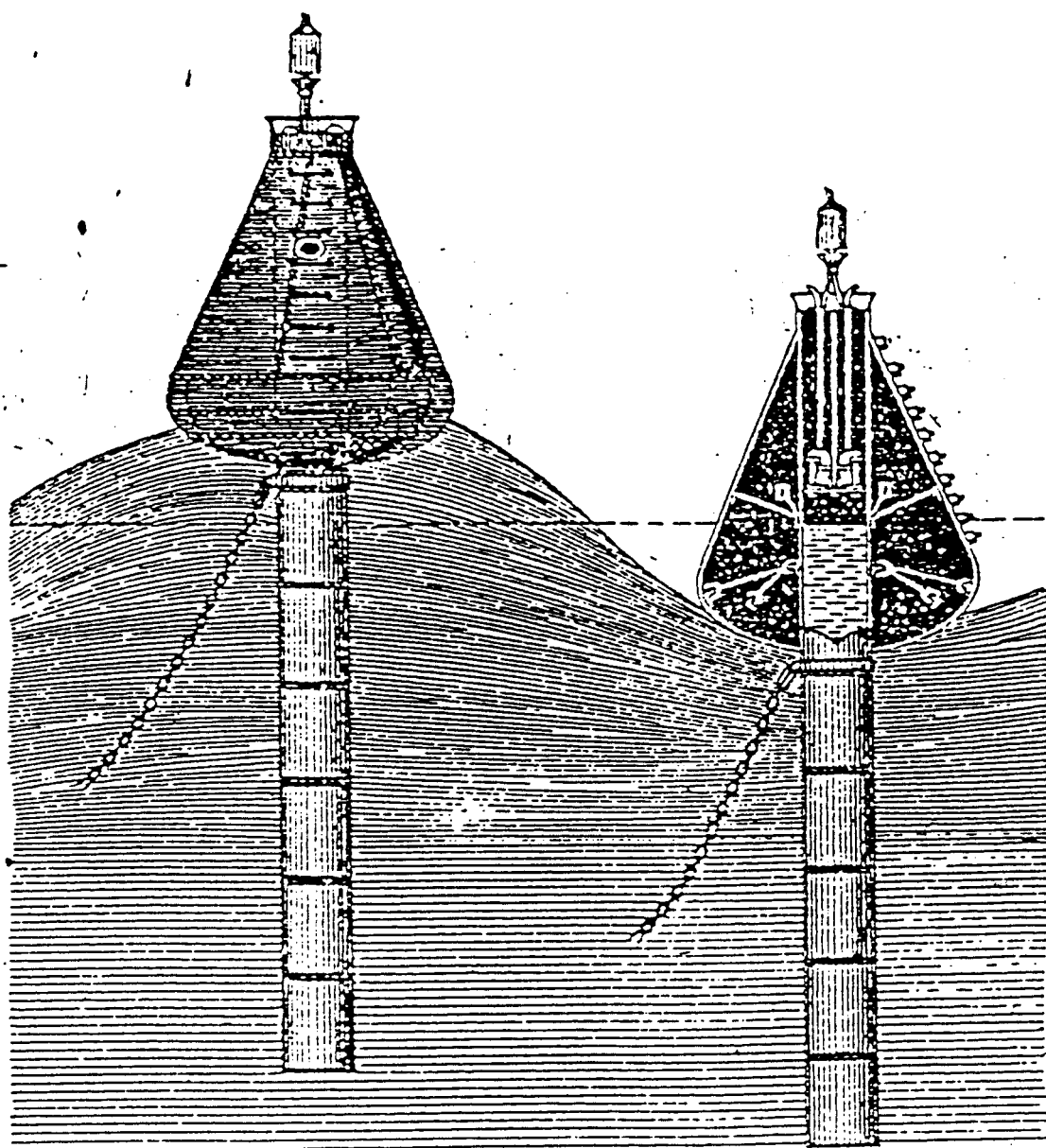


Figure 17. Artist's conception of a Courtenay's Whistle Buoy as it appeared in Arnold Burges Johnson's *The Modern Light House Board*.

valve attached to the tube permitting the ingress of air is closed, and the air is forced out through the whistle, which is the ordinary one, such as is used for steam whistles.⁶⁴

Professor Joseph Henry documented his tests on the Courtenay's Buoy; he concluded that, while the physics of the buoy had not been perfected, the Courtenay's Buoy should be adopted by the Light House Board, which should take the responsibility to "introduce them at all points where their presence will be of importance to the navigator."⁶⁵

The appearances of whistle and lighted buoys did not sound the death knell for the familiar nun, can, and spar buoys. In fact, spar buoys continued to be heavily used in the waters of the United States. A children's book entitled *All Among the Lighthouses: The Cruise of the "Goldenrod,"* written by Mary Bradford Crowninshield in 1886, includes a rare, if not the only, extant description of setting a spar buoy from a steam tender.⁶⁶

⁶⁴F.E. Chadwick, *Aids to Navigation*, 255.

⁶⁵Joseph Henry Papers, handwritten notes for his proposed appendix to the 1878 *Annual Report of the Light-House Board*, Smithsonian Record Unit 7053, n.p.

⁶⁶According to "Tenders and Light Vessels" from the Coast Guard Historian's Office, Congress did not make appropriations for the *Goldenrod* until 1887, and her planned construction was such that she would be used in western rivers (Fig. 18). The *Willow* (Fig. 19), also used on western rivers details how the *Goldenrod* would have appeared after her construction. There is some confusion over the identity of the tender on board which Ms. Crowninshield observed the buoy setting, and it may be simply that she liked the name *Goldenrod* and used it in place of the tender's real name. The *Iris* was the tender in use in the waters off Maine in 1886. Built in 1863 and originally named the *Willet Rowe*, the *Iris*, acquired from the Navy, was a steam propeller-driven vessel measuring 85 feet in length and 19 feet in the beam. The vessel's draft was 9 feet 6 inches, and she displaced 280.50 tons. Her acquisition from the Navy in October 1865 cost \$13,000, and her 1871 refitting cost the Board an additional \$27,945. During the course of her repairs and refitting, the contractor, Dialogue and Wood of Philadelphia,

U.S. Lighthouse Tender
GOLDENROD
1888-1925

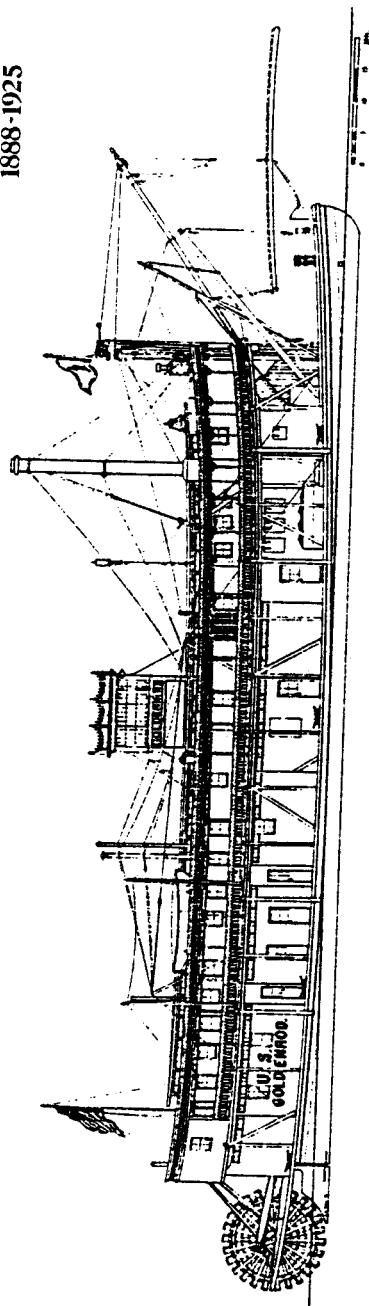


Figure 18. Line drawing of the river tender *Goldenrod*, by Dr. John Tilley. Courtesy of the Coast Guard Historian's Office.

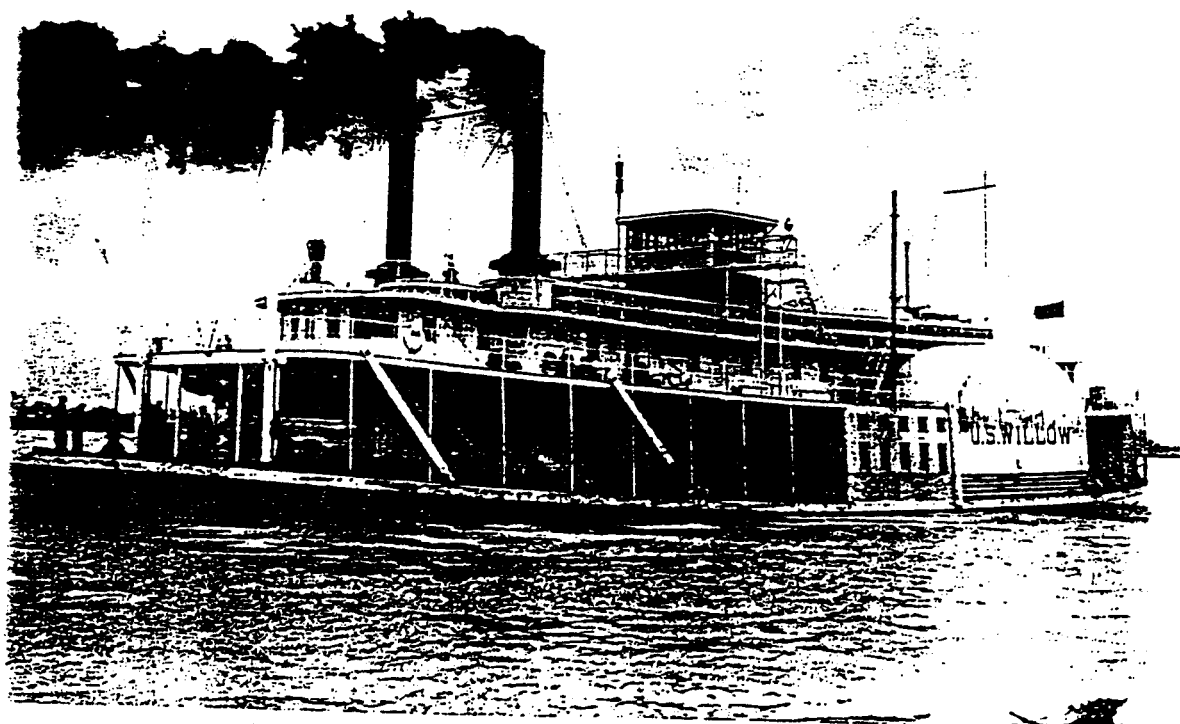


Figure 19. The side-wheel steam tender *Willow* illustrates the approximate configuration of the *Goldenrod*. Courtesy of the Coast Guard Historian's Office.

Because Ms. Crowninshield's narrative is unique in all of light house service literature, excerpts are included to describe the setting of a spar buoy off the coast of Maine:

..the boys noticed there was unusual activity on the forward deck.

"What is going on down there in front, Violet?" asked John.

"I think they must be getting ready to set a buoy. They seem to be pulling a long one forward, even with the opening, and they've taken away the rail."

"What sort of buoy?" asked Courtland.

"A spar buoy, I suppose, of course," returned Violet. "We haven't any other on board. It's that long, red, mast-looking thing that you see sticking out past the opening there."

"How long is that buoy, Uncle Tom?" asked John.

"About forty-five feet long, my boy. It is a red one, as you see, and we shall set it on the starboard side. After that, we shall have to set a black one, so you will have a good opportunity to see the operation; and what you fail to comprehend during the first trial, you can inquire about on the next."

The boys looked over, and saw that the rail on one side of the forward deck had been unshipped, leaving that side quite open to the sea. It looked very unsafe as the men walked carelessly past this opening, stepping sometimes on the very outer edge of the deck, the blue water rushing past below them, making the boys dizzy to look at it.

"Do you see the red buoy sticking forward there, past the opening? It has, as you see, an iron strap fastened high up on either side; and at the bottom the strap hold, as you see a strong iron ring. Now look at that enormous block of granite on the deck there. That is what we call a sinker. That is the buoy's anchor, and moor it in its place."

"How much does it weigh, Uncle Tom?"

"About three ton, I guess sir, that one," [replied the captain]. "Sometimes we hev'em [sic] weigh five ton when we are puttin' down a big thing like a bell-buoy, 'specially ef [sic] the weather's likely to be rough out there."

There came the rumbling sound of the working of the steam winch.

"Now, boys, the derrick comes into play. See the derrick," the boys looked upward, "how it is swinging around. Now the tackle lowered, and Mr.

"proposed to build a *new hull* complete and place the old machinery, properly repaired therein, and fit-ready for the sea. This was done." ("Tenders and Light Vessels"). Professor Henry used this vessel in his "ocean echo" experiments in Penobscot Bay in 1877, and *Iris* continued to serve the navigational needs of the First District until her sale in 1897 for \$2,200 to an unnamed buyer.

Guptil puts the heavy iron hook into the ring on top of the stone [sinker]."

"Hoist away!" shouted the captain. "Go ahead with the winch!" And the immense stone was lifted as if it were but a feather's weight, and, was deposited close to the edge of the steamer.

"Now look at Robson," said Uncle Tom. "He hands Mr. Guptil that short piece of chain; and now Mr. Guptil is fastening it to the end of the buoy with a shackle, and Robson shackles the other end to the ring in the sinker."

"Stand clear!" shouts Mr. Guptil. The lines that hold the buoy in place, by men stationed for the purpose, are slipped; and at the same moment the great rock, pushed from its position on the edge of the deck, tips over the side, and, with a great splash which send the water high overhead, sinks swiftly to the bottom. The steamer starts ahead and the buoy bobs and jerks and whirls round about for a moment, and then settles down as a channel guide in its proper place, until broken off by some reckless vessel, or swept away by some overwhelming sea.⁶⁷

After the Civil War, the Light House Board continued its program of buoy tender construction. The Board was not averse to taking advantage of the Navy's construction projects during the war. Some tenders, such as the *Cactus*, originally built by the Navy for the Union blockading effort, were purchased by the Light House Board and rebuilt after hostilities ceased.⁶⁸

⁶⁷Mary Bradford Crowninshield, *All Among the Lighthouses or the Cruise of the "Goldenrod,"* (Boston: D. Lothrop Co., 1886), 183-5. While this description is rather long and detailed, it is important to note that spar and ice buoys continue to be placed today under similar circumstances. While tenders today rely on differential global positioning capabilities to fix accurate positions, they continue to place the buoys in a manner consistent with those available to the crew of the *Goldenrod* in 1886. The differences between the tenders in the late-nineteenth century and those of the late-twentieth century are many: construction and design advances, as well as differences in boom capabilities. There are also many safety features available to crews of late-twentieth century tenders, but the fundamental procedures for setting these kinds of buoys are not so far removed from those of the late-nineteenth century.

⁶⁸"Tenders and Light Vessels" mentions the *Cactus* as a side-wheeled steamer built in 1863 in Brooklyn, New York, and sold to the Navy. She measured 129 feet in length with a 21 foot six inch beam and a five foot draught. She displaced 200 tons, and

The Light House Board followed the lead of the Navy, but where the Navy exhibited its conservative nature in the hesitant adoption of steam propulsion, the Light House Board saw the advent of steam as a boon to the more accurate placement of buoys. Sailing tenders were at a distinct disadvantage when attempting to place buoys; steam-propelled vessels were more maneuverable, and tender captains could be more confident of accurate placement. Like the Navy, however, the Light House Board did not abandon auxiliary sail completely. The tender *Manzanita*, built in 1878, was schooner rigged, even though it had a capable 300 horse-power steam engine and was screw-propelled.⁶⁹ Even as late as 1897, the Light House Board refused to abandon auxiliary sail; the *Mangrove*, which had a double-screw propeller, is also described as being schooner rigged.⁷⁰ The Light House Board's innovative construction program ensured that the service was well-equipped with tenders. By 1890, the fleet numbered twenty-eight steamers and two schooners "ranging from 18 to 550 tons burden."⁷¹

The Light House Board continued under the aegis of the Treasury Department

the Light House Board purchased her in 1865. She was not rebuilt and refitted until 1870. The *Cactus* continued to serve as a tender until her decommissioning in January 1909.

⁶⁹"Tenders and Light Vessels," n.p.

⁷⁰"Tenders and Light Vessels." The Crescent Ship-yard of Elizabeth, New Jersey built *Mangrove* for \$72,000. She measured 165 feet in length with a beam of 30 feet. She displaced 392 tons and was equipped with a 650 horse-power engine.

⁷¹Arnold Johnson, *The Modern Light House Board*, n.p.

until 1903, when it was transferred to the Commerce Department.⁷² A more serious reorganization came in 1910. Holland, in his work *America's Lighthouses*, maintains that "the nine-member Light House Board proved too cumbersome an administrative head to manage effectively and efficiently the country's aids to navigation."⁷³ This notion is incredible when one considers the accomplishments of the Light House Board in its fifty-eight years of administration. It single-handedly raised the United States from an aids to navigation backwater to one of the leading forces for advanced navigational support in the world. Buoys and tenders progressed in their construction and usefulness far beyond what the original Light House Board believed possible. The dedication and thoroughness of men like Henry and Bache coupled with the military and governmental background of Shubrick, Jenkins, and others, set the United States light house organization on a path that challenged its heirs to emulate. Holland later, and more correctly, noted that Congress

⁷²*The Laws and Regulations Relating to the Light House Establishment of the United States* (Washington: Government Printing Office, 1904) documents this change of departmental jurisdiction. Whereas the secretary of the Treasury had jurisdiction over the Light House Board, the new regulations required that "The Secretary of Commerce and Labor shall be ex officio president of the Light House Board. (Sec. 4654 Rev. Stat.)," 7. It is interesting to note that this compendium of regulations includes one directed specifically at masters of tenders. Approved in an act dated June 16, 1880, this regulation required that "Masters of light house tenders shall have police powers in matters pertaining to Government property and smuggling. (*Act approved June 16, 1880, vol. 21, U.S. Stat., p. 263*)," 38. Other laws and regulations pertaining to buoyage and the specifics of numbering and color, shape and size, and uses of anti-fouling paints (e.g. zinc) or coal tar remained consistent with regulations provided when the board was under the jurisdiction of the secretary of the Treasury.

⁷³Holland, *America's Lighthouses*, 37.

wished to do away with the military's role in aids to navigation to "eliminate this paramountcy of the military and create a civilian aura around this primarily civilian service."⁷⁴ The head of the new Bureau of Light Houses was George R. Putnam, an individual exquisitely non-military and not constrained by purely bureaucratic tendencies. He had a reputation as a cartographer and explorer, as well as ties he maintained with the Coast and Geodetic Survey.⁷⁵ Putnam would prove to be an individual capable of sustaining and driving the Bureau of Light Houses by the sheer force of his will alone.

⁷⁴Ibid., 37.

⁷⁵George R. Putnam, *Sentinel of the Coasts: The Log of a Lighthouse Engineer* (New York: W.W. Norton and Co., Inc., 1937), various references.

Chapter III

The Age of Putnam: Early Administration and the Consequences of War

1910-1922

President William H. Taft, with the stroke of a pen on June 17, 1910, mandated the Congressionally-supported reorganization of the quasi-military Light House Board that had faithfully served the cause of American aids to navigation for over seventy years. The new Light House Bureau faced a future of decentralization with the "consolidation of the general work in each lighthouse district under a single officer, the lighthouse inspector."¹ The new act of Congress also provided for the gradual appointment of civilian inspectors.² This was a complete reversal of the 1840 revolution that sought to place aids to navigation and their maintenance under a quasi-military organization. As stated earlier, Ross Holland believed that this administrative change was due to the unwieldy nature of the nine-member Light House Board. John S. Conway, who served as Deputy Commissioner of Lighthouses under George R. Putnam, noted that the trend toward decentralization was the driving force behind the reorganization. Conway praised the decision to decentralize the service, and wrote in 1923 that the reorganization was a

¹*The Lighthouse Service Bulletin*, No. 1 (January, 1912), 1.

²According to the August 1912 issue of *The Lighthouse Service Bulletin*, this program of selecting civilians for what were military positions was deemed necessary for the "success of the plan of reorganization adopted by Congress. These positions are under the classified civil service, and therefore it is essential that they be filled in accordance with civil service rules," 29.

complete success in that "as a result [of the reorganization] it [the Light House Bureau] has the smallest proportion of personnel in Washington, only forty persons in all being stationed there out of the 6,000 in the Lighthouse [sic] Service."³

The head of this new bureau was George R. Putnam, who moved from a post with the U.S. Coast and Geodetic Survey to the position of Commissioner of Lighthouses in 1910. Putnam was no stranger to the workings of government; when he accepted the appointment to the top post of the Light House Bureau, he was already celebrating twenty years of government service. On July 1, 1890, Putnam entered the Coast and Geodetic Survey as a recorder. During his tenure with that service, he conducted numerous experiments and was accorded many honors and promotions; he assumed responsibility for a project that documented a series of transcontinental gravity measurements; these measurements confirmed the hypothesized isostatic condition of the earth's crust. The Coast Survey appointed Putnam as the first director of coast surveys in the Philippine Islands, 1900 to 1906, and in this capacity, he organized the Coast Survey work there.⁴ Putnam had the scientific expertise and organizational experience and skills necessary to

³John S. Conway, *The United States Lighthouse Service 1923* (Washington: Government Printing Office, 1923), ii.

⁴*The Lighthouse Service Bulletin*, Vol. IV, No. 66 (June 1935), 207. This information is taken from an article that appeared in *The Lighthouse Service Bulletin* describing Putnam's career on the occasion of his retirement from the Light House Bureau after forty-five continuous years of government service.

bring American aids to navigation to the forefront and make the service an internationally recognized entity.

Putnam continued the Light House Board's commitment to the testing and adoption of new and improved designs of buoys and fuels for lighted buoys. He also recognized and sought to capitalize on design advances in other countries—specifically from Great Britain. As early as the second issue of *The Lighthouse Service Bulletin* in February 1912, the bureau mentioned experiments conducted by Trinity House involving a clock-like device for switching lighted buoys and beacons on and off.⁵ The very institution of *The Lighthouse Service Bulletin* is a credit to the decentralization of the new bureau, in that the *Bulletin* provided the major source of information to the diffuse staff of tender captains, crews, keepers, and others in the field.⁶

The Light House Bureau continued using improved lighted buoy designs by Pintsch, as described in Chapter 2. The Pintsch buoys of 1910 were more advanced than

⁵*The Lighthouse Service Bulletin* described this new device as consisting of "a clock mechanism for use in gas buoys and beacons. This clock opens and shuts off the supply of gas, so that the light will burn from about an hour before sunset to an hour after sunrise automatically changing with the season of the year. The clock itself is wound by the gas, which after is burned in the light," 5.

⁶*The Lighthouse Service Bulletin* contained information of scientific interest, anecdotes of wayward buoys, stories of lamplighters who performed their duties under extraordinary circumstances, and practical information such as *Instructions for Water-Pressure Test of Pintsch Gas Buoys and Tanks* (reprinted from Circular 78 in Vol. I, No. 2), and *Instructions for Handling Willson Acetylene Gas Buoys*, August 1912, No. 8. These two illustrate another component of the Light House Bureau that was rarely admitted to by the Light House Board: safety concerns and the safe handling of potentially explosive aids to navigation, namely lighted buoys.

those tested under Professor Henry with the Light House Board. Pintsch gas buoys were available to the Light House Bureau in 1910 through the Safety Car Heating and Lighting Company of New York City. The company, in a 1913 booklet directed to "Lighthouse and Marine Authorities," described the new development of a high pressure Pintsch system. This system allowed the compression of Pintsch gas

into small steel cylinders at 100 atmospheres pressure with a gain of 30 per cent effective capacity [that] has made the Gas [sic] particularly adaptable for use on Shore Beacons, Lightships, and Unwatched Lighthouses [sic]. This system is also recommended for transport and buoy charging, for through equalization of pressure from these cylinders, a buoy may be charged to its full capacity without the aid of a compressor.⁷

While these advances in fuel storage technology allowed tenders to visit buoys less frequently, they also contributed to a phenomenon heretofore unknown to the Light House Service—the appearance of buoys as explosive hazards to crews and engineers of lighthouse tenders.⁸ In light of the tragic first death associated with pressure testing a

⁷The Safety Car Heating and Lighting Company, *Aids to Navigation Lighting Apparatus for Coasts, Harbors, and Rivers* (New York: n.p., 1913), i.

⁸The premier issue of *The Lighthouse Service Bulletin* described an incident on board the lighthouse tender *Amaranth* in connection with a Pintsch gas buoy. According to the documentation: "On the morning of the 18th of December [1910], at the Detroit lighthouse depot, eleventh district, during a pressure test of the B III type Pintsch gas buoy [see Fig. 20], the buoy blew up, and John A. Dunbar, machinist attached to the tender *Amaranth*, was killed. The test was made with Pintsch gas at a pressure of 18 atmospheres (approx. 270 pounds), and the buoy exploded as Mr. Dunbar closed the valve, the compressor having been shut down about five minutes before the accident. The top of the buoy separated from the barrel portion of the buoy at or near the weld, taking the cage work with it. The cage carried away the mainmast of the *Amaranth* and fell to the dock. The cone landed on and broke through the roof of the lamp shop some distance away. The barrel portion of the buoy and counterweight went through the dock.

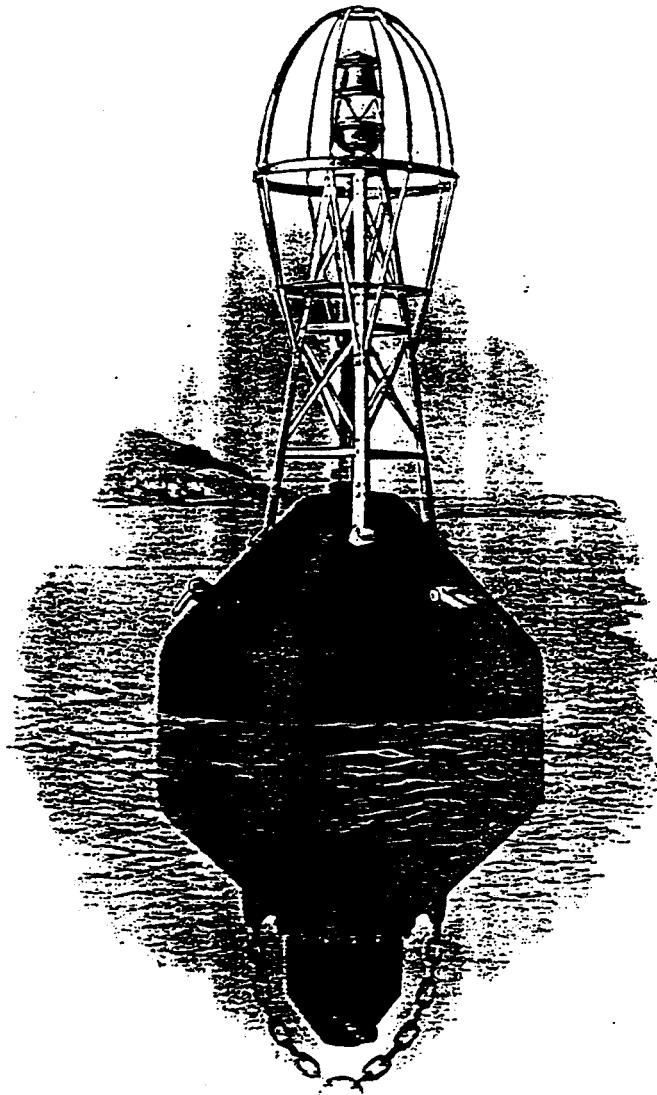


Figure 20. A B III Type Pintsch Gas Buoy. From The Safety Car Heating and Lighting Company, *Aids to Navigation Lighting Apparatus for Coasts, Harbors, and Rivers*, 1913.

buoy, the Light House Bureau reprinted Circular 78, *Instructions for Water-Pressure Test of Pintsch Gas Buoys and Tanks*, in the subsequent *Lighthouse Service Bulletin* for the information of all bureau employees.⁹ Despite instructions and warnings of pressure testing of these buoys, negligence and unfamiliarity with the proven dangers of the procedure persisted, though not in the numbers of incidents that might have been expected.¹⁰

In 1904, a pilot steered the steamer *Ancon* through the newly-completed Panama Canal. This journey through American-built locks in a foreign land opened a new chapter in the history of aids to navigation for the United States—not in the canal itself, but in the consequences of the marking of the new route across the isthmus. When President

Paragraph: 'Test of gas buoys and tanks,' page 34 of the Regulations of the United States Lighthouse Service [sic], provides for the test of buoys by hydrostatic pressure and not by gas or air. The bureau regrets the loss in the line of duty of an efficient and conscientious employee. This is the first buoy accident of this character in the United States Lighthouse Service," 3.

⁹In addition to this information, the Light House Bureau published detailed instructions for handling and lighting Pintsch gas buoys in its No. 14, February 1913 edition of *The Lighthouse Service Bulletin*.

¹⁰The April 1919 issue of *The Lighthouse Service Bulletin* relates the incident of a buoy bursting during test: "On March 11, while under test at a lighthouse depot, a gas buoy burst, injuring two employees who were assisting in the test, one of whom subsequently died as a result of these injuries. From the report and photographs of the damaged buoy received, it appears probably that the hydrostatic pressure was applied too quickly, thereby causing a dynamic force which imparted a hammer-like blow, the force of which can hardly be estimated, causing the buoy to burst. Hydrostatic pressure should be applied slowly and all of the air expelled from the buoy. Observance of these simple precautions would have prevented this accident," 70.

Theodore Roosevelt realized the completion of the engineering marvel that was the Panama Canal, it seemed natural that the marking of the route would fall to the Light House Board of the United States. Instead, responsibility for the design and maintenance of aids to navigation fell to the U.S. Commission of Fine Arts.¹¹ The commission did not award the contract for navigational aids to an American company, but looked abroad. The contract was let to and successfully completed by a Swedish firm: Svenska Aktiebolaget Gas Accumulator of Stockholm.¹²

The original Svenska Aktiebolaget Gas Accumulator American concern was located in Philadelphia and was founded in 1909. The Elizabeth Division of the Elastic Stop Nut Corporation of America is the most recent incarnation of the Svenska AGA, which in 1916, moved a plant to Elizabeth, New Jersey. The company's chroniclers credit the completion of the Panama Canal contract for Svenska AGA's expansion into the American market. By 1916, with the Elizabeth, New Jersey, plant established, the company began manufacturing operations. Soon after the establishment of a plant, American managers replaced the resident Swedish managers. American investors

¹¹This choice is never fully explained in any of the texts, manuscripts, and governmental documents consulted for this study.

¹²In the company's commissioned history *This is ESNA*, the company's historians maintain that AGA was the original holder of patents for acetylene powered marine beacons. This contention is open to debate, although ESNA may have held a Swedish patent for the acetylene powered beacon; the name does not appear on U.S. patents.

recognized the investment potential and bought the company's stock.¹³ It is significant that the primary American investor was the Du Pont family—an interest that continues to dominate the manufacture of marine aids to navigation today.

The Light House Bureau adopted and deployed American Gas Accumulator (AGA) buoys by 1913 when detailed handling instructions appeared in *The Lighthouse Service Bulletin*. These buoys operated through a process by which “acetylene gas is absorbed in acetone, which has the capacity of taking up several times its volume of gas, and is given out continuously.”¹⁴ These buoys were also prone to explosion when handled inappropriately, as demonstrated by the accident at Portsmouth, Virginia, depot on September 24, 1915:

The buoy had been relieved by the tender on Sept. 18, and on the 22d [sic] the tank pocket covers were removed and the gas tank connections disconnected. On the 24th, the day of the accident, the gas tanks were removed from the pockets and about one hour afterwards the blacksmith applied a flame from a kerosene blow torch to the drop bolts for the tank pocket covers, to burn off old paint and

¹³*This is ESNA*, n.p., n.d., 1. This manuscript dates from ca. 1970. It exists in photocopy form at the National Aids to Navigation School in Yorktown, Virginia, and in the author's files. It appears that this document was produced as part of an orientation packet for new members of the ESNA team or for individuals considering the possibility of using ESNA for their supply needs.

¹⁴U.S. House of Representative, House Appropriations Committee. *Congressional Hearings Relating to the U.S. Lighthouse Service* (Washington: Government Printing Office, 1925), 1347. Secretary of Commerce and Labor William Redfield appeared before the House Appropriations Committee in 1915 to answer questions relating to the *Sundry Civil Appropriations Bill of 1915*, and offered this explanation of the workings of the AGA buoys to the committee.

rust on the threads and make the nuts work freely. The torch had been in operation about 10 minutes when the explosion occurred, burning the two men who were working on the buoy. The condition of the buoy indicates that the explosion took place in the buoy body, and was probably caused by the accumulation of gas through one or more joints in the connection between the tank pockets and the body.¹⁵

While the Pintsch and AGA buoys continued to be the most popular and numerous lighted buoys in the Light House Bureau arsenal for the early years of the twentieth century, a new type of buoy using a very different type of fuel began to gain favor with lighthouse inspectors. Patented in May 1905 by its inventor Thomas Leopold Willson, the Willson Automatic Gas Buoy, patent number 791,119 (Fig. 21), was marketed to the Light House Bureau as an alternative fuel buoy for use in areas where it was uneconomical to bring in Pintsch gas. The fuel for the Willson buoy consisted of calcium carbide and its reaction with water to form gas for lighting the buoy's lamp. The March 1913 edition of *The Lighthouse Service Bulletin* contained exceedingly detailed instructions for handling this most explosive of buoys. Paramount in all instructions is the handling of the calcium carbide for charging the buoys to ensure the safety of the crews. According to the instructions:

4. Calcium carbide will not generate gas when wet with kerosene oil and the danger of explosion will be greatly lessened if carbide and sides of chamber are wet with same before carbide is placed in chamber. A small quantity of kerosene dumped into chamber during or after filling will remain on top of water in tube when buoy is placed in water, and to an extent will prevent after generation. Too much kerosene may cause burners to clog and the lens to be smoked.
5. Do not change buoy in wet weather. Do not permit any lights or allow anyone

¹⁵*The Lighthouse Service Bulletin*, No. 48 (December 1915), 192.

*to smoke in the immediate vicinity of the buoy. Do not permit anyone doing the work to place his face over the carbide door.*¹⁶

These buoys were subject to the same accidents as plagued the Pintsch and AGA buoys. The most serious transpired on board the tender *Hibiscus* in December 1913. The incident involved a 9 ½ Willson gas and whistling buoy off the coast of Maine. The explosion injured the tender's first officer. According to documentation "It is reported that the sea was calm, with very little wind, and that work of filling the new buoy with carbide was about half completed."¹⁷ The crew testified that they had taken all precautions advised by the Light House Bureau for charging that type of buoy. The Light House Service investigators concluded that the cause of the explosion could not be determined, but "it was possibly caused by a spark resulting from a lump of carbide striking against the shell of the buoy."¹⁸

By 1915, the Willson Company was slowly fading from the scene. Secretary of Commerce and Labor William Redfield, testifying before the House Appropriations Committee during hearings concerning the *Sundry Civil Appropriations Bill of 1915* stated:

The Willson concern, making another type of acetylene buoy, has practically gone out of business. It sold its plant and moved it away and is doing almost no business now. We regard those buoys as dangerous. We lost the life of a good

¹⁶*The Lighthouse Service Bulletin*, No. 15 (March 1913), 60.

¹⁷*The Lighthouse Service Bulletin*, No. 25 (January 1914), 99.

¹⁸*Ibid.*

officer this summer—a man personally known to me—by the explosion of one of them indirectly. He was injured by the explosion, soon after contracted pneumonia, and died. Others have exploded.¹⁹

Until 1916, the Light House Bureau relied on 375mm cut-glass lenses for lighted buoys in the United States. Experiments at the Tompkinsville, New York, lighthouse depot with pressed-glass lenses changed the perception of the bureau and reversed its policy on pressed glass. According to the inspector of the third district “pressed glass lenses, which from practical tests both with the naked eye and with the photometer have proven of equal efficiency to the cut-glass lenses, can be made for about \$150 each—a savings of \$250 over the cost of the cut-glass lenses.”²⁰ Appealing to the frugality that had always governed aids to navigation in the United States, the administration took the recommendations to heart and mandated that all 375-mm lenses purchased after 1916 would be of the pressed-glass variety.

The United States was not the only country experimenting with different types of fuel for buoys. Due to George Putnam’s influence, the International Congress of Navigation met in Philadelphia in May 1912.²¹ Delegates from every major maritime

¹⁹U.S. House of Representatives, House Appropriations Committee. *Congressional Hearings Relating to the U.S. Lighthouse Service* (Washington: Government Printing Office, 1925), 1347. Secretary of Commerce and Labor William Redfield testifying before the House Appropriations Committee about the Sundry Civil Appropriations Bill of 1915.

²⁰*The Lighthouse Service Bulletin*, No. 59 (November 1916), 244.

²¹An earlier conference was held in Washington, D.C., in 1889. The International Marine Congress was attended by delegates from 28 maritime nations. This conference

nation in Europe attended, and fuel for lighted buoys provided a topic for much debate. The chief engineer of the Central Service Lighthouses and Beacons of France, Monsieur de Joly, reported that the French service relied heavily on oil-gas buoys, and tended to discourage the use of buoys powered by electricity or mineral oil. In addition, de Joly reported the conducting of experiments with coal-gas buoys and Blau gas; the results, however, were not favorable enough to persuade the French to abandon oil-gas. "Acetylene has not been adopted for buoys in France, but it is used for some beacons, with mantles to give an incandescent light."²² Regierungsbaumeister Braun of Berlin reported on the lighting of the coast of Prussia, revealing that his service preferred the light produced by Blau gas over oil gas. Herr Braun, like Monsieur de Joly, spoke hesitantly about electrically lit buoys, and those dependent upon petroleum for fuel.²³

Lighted buoys did not stand alone as subjects for experimentation. Sound-producing buoys also fell under close scrutiny as early as 1911. The first of the bell buoys, the Brown's Bell Buoy, was extensively described in chapter two. The early-twentieth-century equivalent was built on this simple design, but did not change greatly as evidenced by John Conway's description of a bell buoy in 1923:

sought to establish guidelines for the marking of channels. It confirmed the use of the lateral system world-wide. A later conference held in St. Petersburg, Russia, in March 1912 sought to reverse the earlier ruling on the lateral system, but was largely ignored by maritime nations as the safety of the system in place had already been demonstrated.

²²*The Lighthouse Service Bulletin*, No. 6 (June 1912), 20.

²³*Ibid.*

Bell buoys have a hemispherical-shaped hull, built of steel plates, with a flat deck, and carry a structural-steel superstructure which supports a bronze bell and usually four iron clappers. The motion of the buoy in the sea causes these clappers to strike the bell, so that the action is entirely automatic...This type of buoys is especially efficient in harbors or inside waters for marking points where a sound signal is desired. Bell buoys weigh about 6,900 pounds each, complete, and are moored by means of a bridle or chain attached to lugs on the opposite sides of the hull near the water line, the main mooring being shackled to the middle and lowermost part of the bridle and extending in the customary scope of chain with a swivel to a heavy cast-iron sinker on the bottom. A large-sized ballast ball is shackled to a mooring eye at the bottom of the buoy, and the whole effect of this arrangement is to assist in the pendular motion necessary for ringing the bell.²⁴

Ice presented the greatest danger to this type of buoy (besides collisions with passing vessels), since the ballast ball as described above exhibited the tendency in heavy ice of striking the hull of the buoy, sometimes rupturing and sinking it. Conway prescribed the remedy for this condition by the attachment "of a fixed hollow counterweight of cast iron poured with lead, bolted fast to the lower end of the buoy."²⁵

October 26, 1911, marked the establishment of the first submarine bell buoy, which was placed on Barnegat Shoal, New Jersey.²⁶ It was a prototype buoy, and the

²⁴John S. Conway, *The United States Lighthouse Service 1923* (Washington: Government Printing Office, 1923), 57.

²⁵Ibid.

²⁶A submarine bell is a submerged bell that marks a shoal or other danger to navigation. It is sounded automatically in the water and had a superior range to an audible signal sounded in air. Vessels equipped with specialized direction finding apparatus were able to record the signal from a submarine bell at ranges from ten to thirty miles away. Specialized equipment on board magnified the tone (each bell equipped with a distinctive tone), and navigators were able to plot a course relative to the aid. Signals recorded on the

bureau tracked its progress carefully. The bell ringing mechanism for this buoy was an innovation. The size of the swell in which the buoy rode determined the regularity of the bell's sounding. The movement of the swells stretched a spring, which, when it reached a predetermined point, retracted and allowed the clapper to strike the bell. Light House Bureau engineers found no objection to the variations of the interval at which the bell was struck since this peculiarity "distinguish[ed] the buoy from any submarine bell on shore or light vessel which may be established in the vicinity, and which is rung at regular intervals, but only during thick and foggy weather."²⁷

Whistle buoys constructed after the John M. Courtenay design continued to be the whistle buoy of choice among lighthouse inspectors.²⁸ The hardiness of the design is

beam were superior to signals recorded on the bow or aft of the vessel. Submarine bell signals also allowed navigators to triangulate their positions when two submarine bells could be identified. Further information about submarine bells and their applications is available from Austin M. Knight, *Knight's Modern Seamanship*, 8th Ed. (New York: Van Nostrand and Reinhold Co., Inc., 1945), various citations.

²⁷*The Lighthouse Service Bulletin*, No. 5, May 1912, 18. Preliminary reports from mariners to the bureau proved encouraging: "The steamer *Almirante* reported that the bell was heard on February 14 at a distance of 17 miles, moderate sea; and it has been reported repeatedly as having been heard for distances of from 10 to 15 [sic] miles."

²⁸John S. Conway described these buoys in *The United States Lighthouse Service 1923* as being "built of steel plates, and consist[ing] of a pear-shaped body with the smaller end uppermost, with a long open tube on the lower end. This tube extends through the length of the buoy, and is closed at the upper end by a headplate on which is mounted a check valve and a whistle on the superstructure of the buoy. The sound is produced by the air in the upper portion of the tube being compressed by the falling of the buoy in the waves, its means of escape being through the whistle. Like the bell buoy, the sound is automatic, depending solely on the motion of the waves, and therefore the whistle may be silent when the sea is very smooth. [It] is employed for important points

evidenced by the epic journey of the whistle buoy that marked the station of the Nantucket Shoals Light Vessel off Massachusetts. This buoy broke its mooring on January 20, 1915, and embarked on a cruise that covered at least 3,300 nautical miles in a span of nineteen months. Vessels sighted the buoy repeatedly during its journey, but efforts by lighthouse tenders to locate and recover the buoy were fruitless, although "its characteristic shape and conspicuous red painting, with the regulation marks LV/N, together with the fact that the whistle continued to operate as usual, made the buoy readily distinguishable."²⁹ When a passing vessel captured the buoy and towed it to port in August 1916, the district lighthouse inspector noted that bits of the mooring chain were still attached, and that, in spite of its lengthy cruise, the buoy was in good condition.

The more numerous and dangerous buoys employed by the Light House Bureau demanded newer, more advanced tenders. In 1914, the wreck of the tender *Armeria* off the coast of Alaska served as the impetus for an ambitious new tender construction program.³⁰ Citing the recent losses of commercial shipping off the coast of Alaska as

with a single chain of the proper scope and a heavy iron sinker. The weight of the buoy is about 6,500 pounds. For great depths, where the necessary quantity of chain impedes the floatation of the ordinary size of this buoy, a special and larger size is in use similar to the regular size in design and operation but weighing about 11,000 pounds. Occasionally an additional buoy is shackled to the bight of the mooring chain when the water is unusually deep," 56.

²⁹*The Lighthouse Service Bulletin*, No. 59, November 1916, 237.

³⁰In a letter to the Hon. James R. Mann of the House of Representatives, Secretary Redfield acknowledge that the bureau was supporting aids to navigation in Alaska with the *Columbine*, but that the tender was not equipped to discharge her duties effectively.

well as the loss of thirty-two lives, Secretary Redfield and Commissioner Putnam pressed their request for funds for a new tender before the House of Representatives during 1915 hearings on the subject. Putnam described the intended vessel as being 200 feet long overall with a 37-foot beam. Fully-loaded, she displaced 2,000 tons and boasted a carrying capacity of 800 tons.³¹ Redfield was quick to add that, until a suitable vessel could be built, the Light House Bureau personnel were reliant solely on the Revenue Cutter Service for transportation.³²

Congress approved the 1915 appropriation for \$325,000 to construct a tender for use in Alaskan waters. The *Cedar* was the largest lighthouse tender of her time. Along with the dimensions described above, the *Cedar* boasted all-steel construction, a double-bottomed hull, and a single screw propelled by a triple-expansion steam engine. Two 3-

Redfield pressed his suit for a larger tender to support Alaska in that "the coast of Alaska is at once the most dangerous we have and the most difficult to protect. It is subject to much stormy weathy [sic] and its waters are very turbulent. A small though seaworthy vessel can not operate in them continuously, by which I mean that however safe she may be she can not do the work in the open sea which the nature of the service requires. Again, the distances are very great. From Ketchikan to Unalaska along the cost [sic] is 1,400 miles. To Bristol Bay and the Yukon district is still farther. A vessel is needed of sufficient size not only to keep the sea in rough weather and do her work, but also to have a coal supply sufficient to avoid making duplicate trips back and forth, and also to enable her to carry supplies sufficient for the entire coast when it shall be fully lighted without having to return and take a second cargo for lack of carrying capacity." *Congressional Hearings*, 1336-7, Letter from Secretary William C. Redfield to the Honorable James R. Mann, M.C. dated April 17, 1914.

³¹*Congressional Hearings*, 1337.

³²*Ibid.*

furnace Scotch type boilers burned oil as fuel and provided the steam, while a schooner rig on the *Cedar*'s twin masts supplied auxiliary power.³³

The Light House Bureau commissioned two more tenders in 1915: the *Laurel*, for service in the fifth district, and the *Fern*, built to serve the needs of the interior waters around the Alaskan coast. The *Laurel* measured 104 feet six inches in length overall with a 22-foot molded beam and a displacement of 190 tons. The *Laurel* was "a single-decked vessel, constructed of wood with steel watertight bulkheads surmounted by a wooden house on top of which the pilot house and deck officers' quarters [were] located."³⁴ The *Laurel* was also outfitted with a single pole mast "with boom, derrick rigged, and operated by a steam-driven, three-drum hoisting engine located in the forward cargo hold and operated by levers on the main deck."³⁵ The *Fern* also boasted all-wood construction, but whereas the *Laurel* was equipped with steel watertight bulkheads, the *Fern*'s bulkheads were made of wood. The *Fern* was larger than the *Laurel*, measuring 112 feet overall with a 22-foot molded beam. She displaced 236 tons and had a mean

³³*The Lighthouse Service Bulletin*, No. 43 (July 1915), 169. According to *The Record Book* and *The United States Lighthouse Service 1923*, two sailing tenders were still in service as late as 1882. The *Mignonette* was lost in a hurricane off the coast of Texas in 1887. *Pharos*, the surviving sailing tender, continued to discharge her duties until 1908 when the Light House Bureau condemned and sold her.

³⁴*The Lighthouse Service Bulletin*, No. 43 (July 1915), 169.

³⁵*Ibid.*

draft of seven feet in salt water.³⁶ Another difference between the two vessels was the type of fuel used by each: the *Laurel*'s boilers relied on coal, while the more modern boilers of the *Fern* used oil.³⁷

When the United States began preparations for entry into World War I, the mechanism for turning the Light House Bureau over to the War Department and Navy had already been established. The traditional naval aspect of the Light House Board administration defined in 1852 almost assured that personnel and equipment necessary were ready to assist the Navy in times of conflict. The Union Navy realized this necessity during the Civil War when it called upon the resources of the Light House Board for assistance in fighting against the Confederate States' forces.³⁸ World War I

³⁶"Tenders and Light Vessels" (n.p., n.d.), Coast Guard Historian's Office, n.p. These dimensions are also noted in *The Lighthouse Service Bulletin* issue No. 43 as above.

³⁷*The Lighthouse Service Bulletin*, No. 61, January 1917 related a report of the voyage of the *Fern* from Ketchikan, Alaska to Seattle, Washington between November 7-10, 1916. During the voyage, which took seventy-one hours, *Fern* consumed seventy-five barrels of oil in order to maintain an average speed of 9.76 knots. Her engineer calculated her consumption at 0.11 barrels of oil per mile. The engineer noted that: "More than half of the distance was run before a NW gale [sic]. Engines were not stopped from Ketchikan to Seattle, and ran at an average of 150 revolutions per hour for the entire voyage," 249.

³⁸The roles of the Union and Confederate Light House Boards were only briefly touched upon in chapter two. Space here is not sufficient for a complete and detailed rendering of the conflict as viewed through the opposing boards. Individuals manning tenders in areas of conflict were not exempt from the perils of capture. The tender *Martha* offered the best documentation of an ill-fated voyage. Confederate troops descended on the *Martha* in July 1863 as she conducted lighthouse work in Chandeleur Sound, and burned her after capturing her crew. The vessel's master escaped and reached the Union forces at New Orleans. Other vessels were seized at Charleston and Mobile, and the

was no different; all that the Light House Bureau needed was the approval of the president, and vessels and personnel required for naval operations were ready to enter the Navy's command. The naval appropriation act of August 1916 reinforced the fact that such a transfer was possible in times of emergency and by order of the president.

Commissioner Putnam received the call when an executive order crossed his desk on April 1, 1917. The order transferred thirty tenders to the War Department, and an additional fifteen tenders, twenty-one light stations, and four light vessels came under Navy control along with the 1,120 people associated with them.³⁹

Confederacy successfully severed the supply line tended by the schooner *Guthrie* in Galveston, Texas. This information is detailed best in John S. Conway, *The United States Lighthouse Service 1923* (Washington: Government Printing Office, 1923).

³⁹According to Conway and George Putnam's *Sentinels of the Coast*, the transfer was complete on January 31, 1918, when "another lighthouse tender was transferred making 1,132 persons and 50 vessels transferred." John S. Conway, *The United States Lighthouse Service 1923* (Washington, D.C.: Government Printing Office, 1923), 7. When involved in hearings before Congress in 1923, Putnam clarified that the vessels originally transferred to the War Department were quickly turned over to the Navy for service. No mention was made of why the War Department was a considered recipient of vessels and manpower from the Light House Service except Putnam's statement: "we have another relation to these two branches [Army and Navy] of the military service [the question posed requested information about the assignment of Army and Navy officers to the Light House Service]. Congress passed a law in 1916 authorizing the transfer of the Light House Service, or any part of it to either the War or Navy Departments in time of military necessity [this was the Naval Appropriation Act of August 29, 1916]. It authorized the President, in his discretion, to do this, and in 1917, when we entered the war in Europe, the President did transfer a part of the force temporarily to the War Department, and finally about one quarter of the whole service to the Navy Department for duty under the Navy Department in connection with military operations. This part of the service, however, still conducted the lighthouse work and still worked under our bureau organization here, but at the same time was subject to orders that might be given by the naval officers of various districts." Putnam's testimony before the House

The Navy took full advantage of the transferred vessels during the war.

Commissioner Putnam, testifying before Congress in 1920, stressed the lengths to which the Light House Bureau went during the war, and reminded the legislature of how the Navy used tenders to "plant mines, to place and remove defensive nets, [and how they were] employed on patrol duties and were required to place buoys and aids for military uses."⁴⁰ The Navy required that Light House Service personnel assigned to various light stations report on submarine movements within sight of their stations as well as the movements of surface vessels on a continuing basis. The Light House Bureau suffered a loss with the sinking of the Diamond Shoals light vessel by a German submarine; before she was lost, her radio operator managed to warn other vessels in the vicinity of the danger. Light vessels were not the only ships in danger of attack. Putnam reminded Congress that the Light House Service vessels working in the coastal waters were almost certainly in real and constant danger, and "on several occasions, immediately after vessels were torpedoed, they [tenders] were sent out to locate these vessels and buoy them."⁴¹ When the Navy deployed the tender *Cypress* out of South Carolina on May 5, 1918, to

Appropriations Committee for the Commerce and Labor Appropriations Bill of 1923 in *Congressional Hearings*, 1923, 539.

⁴⁰U.S. House of Representatives, House Appropriations Committee. *Congressional Hearings Relating to the Lighthouse Service* (Washington: Government Printing Office, 1923), Putnam's Statement on Aids to Navigation and Pay in the Lighthouse Service, 1920, 35.

⁴¹*Ibid.*

search for a German submarine reported 180 miles off the coast, Putnam realized the danger of destruction to his tender fleet and the loss of life that threatened the crews.⁴²

In an opinion dated September 1, 1917, the solicitor of the Department of Commerce stated that the Light House Service tenders "are actively employed for war purposes and may therefore be properly classed as war vessels."⁴³ This statement proved vital to Putnam when he went before Congress in 1920 to fight for Light House Bureau personnel who served the country well as part of the Navy. The Navy Department retransferred all Light House Service vessels and personnel to the Department of Commerce in July 1919.⁴⁴ The end of the Great War marked the beginning of Putnam's fight for the rights and benefits of his people and his service.

⁴²The Light House Bureau lost no buoy tenders during World War I. Earlier citations about the *Martha* during the Civil War illustrate the danger to tenders during war time. The Coast Guard, in World War II, lost a tender to submarine attack. On March 15, 1942, the CGC *Acacia*, a buoy tender assigned to service aids to navigation in the British West Indies fell victim to a German submarine. The *U-161* pressed her attack against the tender and, according to witnesses, the U-boat surfaced after three unsuccessful torpedo attacks and tore at the tender with tracer fire. One shot ruptured an acetylene buoy lashed to the deck. The tender's crew, safe in lifeboats, watched as the *U-161* remained on the surface after the attack, watching *Acacia* go under. The captain of the tender believed that German naval officers on the deck of the U-boat attempted to make out the name of the vessel they had sunk, and tried to determine the *type* of vessel she was. The buoy, released by tracer fire, provided a safe mooring for lifeboats from the tender as the crew waited for rescue. Amy K. Marshall, *A History of Buoys and Tenders* in *The Commandant's Bulletin* (November 1995), 15.

⁴³U.S. House of Representatives, House Appropriations Committee. *Congressional Hearings*, 1923, Statement of George Putnam, Aids to Navigation and Pay in The Light House Service, 35.

⁴⁴Conway, 7.

When Putnam received the authorization for new tenders and light vessel construction in 1920, there was no appropriation attached. Undaunted by the lack of funds for financial year 1921, Putnam proposed a construction plan to Congress for financial year 1922 totaling \$5,000,000. When Putnam, his Deputy Commissioner John Conway, and Chief of Naval Construction Edward C. Gillette appeared before the House Appropriations Committee, Putnam arrived armed with condition reports on various tenders, and a detailed plan for thwarting the Congressional move to push inappropriate ex-Shipping Board vessels and ex-Navy minelayers on the Light House Service. The war had taken its toll on the aging fleet. Putnam relied heavily on the fact that the war had stopped vessel construction for the service, and that six existing vessels had been lost or condemned during the war.⁴⁵ It took some time for Putnam and his allies to explain thoroughly to the committee the importance of a specific type of vessel to tend lighthouses and buoys. Even so, after exhaustive testimony replete with illustrations (mentioned throughout the text), the committee still pressed the question: "Have you inquired of the Shipping Board whether they have any vessels suitable for your purposes?"⁴⁶ Putnam politely replied that the inquiry had indeed been made, but the

⁴⁵U.S. House of Representatives, House Appropriations Committee. *Congressional Hearings Relating to the Lighthouse Service* (Washington: Government Printing Office, 1925), Putnam's Statement before the House Appropriations Committee, Sundry Civil Appropriations Bill, 1922, 1243.

⁴⁶*Ibid.*, 1253.

answer received in September 1920 was negative.⁴⁷

Combined with Congressional insistence on the incorporation of ex-Shipping Board vessels into the Light House Bureau fleet was the push for the acceptance of ex-Navy mine-layers for use as tenders. In an attempt to reduce the \$5,000,000 construction request, Congress reasoned that the decommissioned minelayers would be suitable for buoy tending since buoy tenders had been employed as minelayers during the war. Both Putnam and Gillette fought the transfer of the minelayers - arguing that the ships would still be insufficiently prepared to discharge the duties of a tender. Deputy Commissioner Conway, writing in 1923, described the most essential attributes of a lighthouse tender and how the design differed from vessels of comparative size:

[the vessel has a] low forward deck and the buoy-handling gear, whereby the foremast is rigged as a derrick, with a boom and falls for reaching over the side. The construction of the hull, the framing of the deck and all parts of the superstructure, also all mechanical appliances, are designed with a large reserve of strength, and are made as simple and sturdy as possible. As these vessels are frequently required to take and keep the sea even in the face of the most violent storms, a high degree of seaworthiness is essential, and as the nature of their duty requires them to be handled around shoals, rocks, and other obstructions in the placing and relief of buoys, their economic maximum draft is proportionally

⁴⁷Ibid. When Gillette spoke before the Committee on Interstate and Foreign Commerce on the subject of Aids to Navigation and Pay in the Lighthouse Service later in 1920, the question of the use of Shipping Board vessels for use as light vessels appeared again. After briefly explaining the stresses to which a light vessel is routinely subjected, Gillette concluded, "these Shipping Board vessels are not built for that work; they are not strong enough in the bows to handle the moorings that would be necessary to hold them on stations. I have looked at this subject from all sides, and as a naval architect, I would not recommend putting them out as light ships, considering the safety of the people aboard; I would not go out there on one myself." Edward C. Gillette in *Congressional Hearings*, 1923, 85.

limited, and unusually strong hulls are required to prevent damage from accidental grounding which such work frequently entails.⁴⁸

Putnam and Gillette lost the battle with Congress and, in January 1923, published a notice of acceptance of six mine planters in *The Lighthouse Service Bulletin*. The less-than-enthusiastic notice asserted that: "The needs of the Lighthouse Service for the larger types of seagoing tenders have been met for the next two or three years by the transfer of six mine planters from the War Department."⁴⁹ The acceptance and implementation of the vessels and the prominent publications of a notice to that effect must have placated Congress, but the news raised eye-brows throughout the service since inspectors, keepers, masters, and crew knew, as Deputy Commissioner Conway would later write, that the average life of a tender was approximately twenty-five years. In the end, Congress could claim only a hollow victory.

The transfer of the Light House Service to the Navy directly affected 1,284 employees.⁵⁰ That tender and light vessel masters and their crews were placed in considerable danger of enemy attack and that they performed duties vital to the war effort is not debatable. What was the subject of debate during meetings of the Committee on Interstate and Foreign Commerce in 1921 was the ambiguous status of Light House

⁴⁸Conway, 73.

⁴⁹*The Lighthouse Service Bulletin*, No. 61, January 1923, 263.

⁵⁰152 employees joined the Army and Navy outright.

Service personnel in the military.⁵¹ Putnam produced a letter dated June 2, 1917, that provided unequivocal evidence of the inferior treatment of Light House Service personnel as being civilians caught up among so much military:

As a single instance of the unjust and humiliating conditions existing at present I may cite a report which came to me not long since. The tenders *Orchid* and *Juniper* were working in Hampton Roads in conjunction with a motor yacht owned and operated by a patriotic landsman who had turned the vessel over to the Naval Reserves. This gentleman was commissioned an ensign in the Naval Reserves, and so outranked the captain of the *Orchid*, with whose experience, capability, and value there could be no fair comparison.⁵²

What upset Putnam most was that his personnel received no credit for military service during World War I, and

they have no standing as veterans. There is a great deal of discrepancy in the actions of the various departments. They were allowed the benefits of the war risk insurance; they are to be allowed Victory medals; but they did not receive the

⁵¹Putnam, speaking before this committee, stated: "I think there is considerable doubt as to what the standing [of Light House Bureau personnel] is, and in a moment I will show you some opinions and decisions we have upon that subject. The officers and crews of Lighthouse Service vessels, keepers of lighthouses, and other employees were called upon for duty of a military character, and were subjected to risks of war without having their military standing clearly defined, and they were required to act with naval vessels and military and naval personnel without any relative military status. This law does not give them any military standing, and it does not say whether they are civilian or military." Putnam's testimony before the House Appropriations Committee in reference to the Commerce and Labor Appropriations Bill for 1923 in *Congressional Hearings*, 1923, 36.

⁵²*Ibid.*, 37. This letter came to Putnam from the superintendent of the fifth lighthouse district.

war bonus; they are not mentioned in the military records as having performed any service. They are not in the class of war veterans, although many of them took far more risks than a great many who now have the status of war veterans.⁵³

Putnam produced correspondence to support the measure, H.R. 136: S. 211, and respectfully reminded the committee of the not-so-distant past when aids to navigation relied on a quasi-military organization for placement and maintenance. In September 1921, Secretary of Commerce Herbert Hoover dispatched a letter via Putnam to the chairman of the Congressional Joint Committee on Pay and Allowances of the Army and Other Services. Hoover stated that he believed the omission of Light House Bureau personnel was not intentional on the part of Congress, "but was due to the matter not then coming to notice under the circumstances under which this legislation was enacted."⁵⁴

Putnam's victory in winning veterans' rights for Light House Bureau personnel who fought in World War I inspired him to lobby for more sweeping changes concerning pay and allowances. The most significant of these were his fight to win disability compensation for personnel injured in the line of duty, and compensation for those

⁵³Ibid., 37.

⁵⁴U.S. House of Representatives, House Appropriations Committee. *Congressional Hearings*, 1923, 469. Putnam reinforced this with the drafting of a statement for the consideration of the committee in which he quoted a letter from the secretary of the navy dated April 14, 1916 stating: "The War Department, in 'Rules and Regulations' for execution of the selective service law, May 18, 1917 (p.27), states that the words 'persons of the military and naval service of the United States,' shall be construed as including among others, the transferred personnel of the Lighthouse Service. 2. [sic] The Lighthouse Service has a relation to the Navy Department similar to other nautical services, and should have similar status,' " 470.

retiring from the bureau.

While Putnam and other high-ranking officials were before Congress debating tenders and compensation, technological changes in the post-war years accelerated until the most important contribution to world-wide aids to navigation burst onto the scene. It was not an innovation from a major European maritime power—not from Trinity House, nor the French Bureau des Phares—that changed aids to navigation, it was an innovation from the United States. With the development and testing of the first radio beacon in 1921, sea lanes and America's coasts would never look the same.

Chapter IV

The Age of Putnam: The U.S. Lighthouse Service Comes of Age

1921 - 1939

Putnam and his senior administrators won equitable treatment for Light House Bureau personnel in light of their military service and successfully argued for a new tender construction program. The face of the service was about to change drastically with the improvement to aids to navigation, that would stand as an unmatched monument to the progressiveness and ingenuity of the Light House Bureau. Lighthouse engineers continued experiments with an invention that would change the course of aids to navigation world-wide. This invention, tested in 1921 and quickly adopted for use with lighthouses and on light ships, was the radio beacon. Radio beacon technology allowed major aids to navigation to be used in thick weather and from greater distances. Using an on-board receiver, a vessel could use a radio signal emitted from a station on a lighthouse or light vessel to take a bearing and determine an exact position relative to the aid.¹ Radio

¹Superintendent of the Third Lighthouse District John T. Yates reported how a demonstration of a radio beacon on-board the tender *Tulip* in September 1920 included the suggestion that the radio beacon would be useful in the avoidance of collisions at sea for "if in thick weather arrangements were made for ships to send a low-powered signal every few minutes, their bearings could be taken by other ships in the vicinity and collisions thus could be prevented." *The Lighthouse Service Bulletin*, No. 50 (February 1934), 170. It is interesting to note that Mr. Yates's comments on the use of radio beacon signals for collision avoidance were published just over three months before the tragedy involving Nantucket lightship No. 117 and the S.S. *Olympic*.

signals emitted from specific aids could be identified miles out to sea, thus making the approaches to America's shores less perilous for deep draught vessels.²

Radio beacons on board light ships did not always render them visible to large vessels approaching them. The May 1934 edition of *The Lighthouse Service Bulletin* warned of the dangers brought on by the accuracy of radio beacons emitted from light ships. According to reports, the Nantucket *Lightship No. 117* was involved in a scrape with an unnamed Atlantic liner that "found the radio bearing so accurate that the steamer scraped the side of the lightship and carried away the antenna yards; the other signals of the lightship were not heard in time to permit the course to be changed to pass clear; also the crew of the lightship did not hear the steamer's fog warning whistle in time to give any special counter warning."³ Fourteen days later, the greatest tragedy of Putnam's administration came to pass when, on May 15, 1934, the Nantucket *Lightship No. 117* keeping her station in a heavy fog, beamed her radio signal to the unsuspecting S.S. *Olympic*. The sister ship of the *Titanic* took a bearing on Nantucket's signal and set a relative course. According to all accounts, the radio beacon continued to function and the signal was accurate. Somehow, in the dense fog, the *Olympic* began to run toward the lightship. In a suddenness that shocked the crew of the liner, Nantucket lightship appeared before the bow of the *Olympic*, and was sliced in half and driven to the bottom.

²Ibid.

³Ibid., 175.

All hands on board the Nantucket lightship drowned, while the *Olympic* sustained damage that did not put her in peril of sinking. A tablet commemorating the five crewmen of Nantucket was dedicated in Seamen's Bethel, New Bedford, Massachusetts, in May 1935.

So successful was this new technology, coupled with the efficient maintenance of unlighted and lighted buoys, that Lloyd's of London published favorable results concerning the United States in a fifteen-year study of maritime nations:

Lloyd's Register of Shipping, which takes a quite impartial view of such matters, reports that in the 15 years from 1920 to 1935, the United States advanced from sixth place to second place in sea safety. Only Holland outranked this country in 1935 in low percentage of ships lost in maritime accident [sic], and the United States stands first among the major shipping countries. We have 17.16 percent of world ship tonnage, against Holland's 4.59 percent.⁴

The fifteen-year period covered in the Lloyd's report reflects a time of progressive change in the Light House Bureau and supports the bureau's faith and reliance on the application and aggressive deployment of radio beacon technology and lighted buoys. Radio beacons were not tested on buoys until 1939. These experiments clustered around the time Congress transferred the Light House Service to the U.S. Coast Guard.

Throughout the 1920's and early 1930's, the Light House Bureau continued to rely on unlighted nuns, cans, and spar buoys for marking rivers and less important channels.

⁴*Rockford Illinois Star* as reprinted in the *Washington Star*, as reprinted in *The Lighthouse Service Bulletin*, No. 13 (January 1937), 48.

In June 1922, the Light House Bureau had a total of 7,524 unlighted buoys in service.⁵

Unlighted Buoys in Service: June 30, 1922	
Type of Buoy	Number in Service
Wooden Spar	5,061
Iron Spars, Cans, and Nuns	2,143
Bell Buoys	246
Whistling Buoys	74

Table 1. Unlighted Buoys in the Light House Service as of June 30, 1922.

That is not to say that the Light House Bureau had abandoned its tradition of experimentation with different designs and materials. Wooden spar buoys, for instance, were the victims of relentless attacks by *teredo navalis*. This situation caused much concern among lighthouse district inspectors and was responsible for the frequent deployment of tenders for relief. In 1916, the inspector of the second lighthouse district deployed two spruce spar buoys in Vineyard Sound, Massachusetts, at Half-Moon Shoal and Tarpaulin Cove where cedar spars previously marked the hazards. At the close of the first year of navigation, the inspector reported that "these buoys do not appear to be water-soaked more than cedar buoys, give no indication of being worm-eaten, and so far have given good results."⁶ By 1919, the third lighthouse district submitted reports on steel plate spar buoys. Primarily constructed for use in shoal waters, these buoys were

⁵This table was created using information from John Conway's *The Lighthouse Service in 1923* (Washington: Government Printing Office, 1923), 58.

⁶*The Lighthouse Service Bulletin*, No. 71 (November 1917), 289.

three-sixteenths inch steel plate "cylindrical in shape at the middle body with conical ends."⁷ These buoys measured seven feet three inches in length with a two feet diameter.

The Lighthouse Service Bulletin reported that

From observation it appears that this type of buoy is more conspicuous than the spar buoys and of a neater appearance. In comparing the range of visibility of this buoy with the [wooden] spar buoy, it was found that it could be seen as far again as the [wooden] spar buoy.⁸

By January 1927, the application of the spar buoy in its traditional function as a shoal marker began to decline. The bureau finally addressed the concerns voiced for years by mariners regarding the inadequacies of the wooden spar buoy design and construction. Among the complaints were the pilots' inability to spot spar buoys from great distances, and the fact that the "color of the buoy which designates the hand on which the buoy is to be passed cannot be distinguished at night or when the buoy is in the sun's glare, and only with difficulty in thick weather."⁹ To combat these problems, the Light House Bureau experimented with iron buoys to replace the spars. These buoys, which came to be known as special-class cans and nuns, were divided into three classes: the first class measured 19 feet, 2 inches length with a 27 inch diameter; the second class

⁷Ibid., No. 17 (May 1919), 73.

⁸Ibid.

⁹Ibid., No. 37 (January 1927), 147. *The Lighthouse Service Bulletin* reported some experiments with special can and nun-type buoys used to replace the wooden spars as early as 1924. Early reports were favorable, but it required three years of further testing with these special buoys in different sizes and capacities before the Light House Bureau would adopt them fully.

was 11 feet, 7 inches in length and 24 inches in diameter; and the third class was 7 feet, 11 inches long with a 24 inch diameter. The Light House Bureau tested the third class buoy extensively in icy conditions.¹⁰ All classes of this type were constructed using the electric or acetylene welding processes, and, while the cost for an individual iron buoy was far greater than that of its wooden counterpart, the greater visibility this navigational aid provided mariners and its longer service life expectancy outweighed the initial investment.

Spar buoys were not the only unlighted buoy to undergo transformation. The Light House Bureau eliminated the wooden spar buoy in deference to new and improved designs of the nuns and cans that continued to be deployed by the Coast Guard into the 1940's. Prior to 1920, the familiar nuns and cans were virtually unchanged in their 1850 riveted design. In 1920, the Third Lighthouse District announced the deployment of a tall-type cone buoy. Like the experimental steel spar buoy, this cone boasted three-

¹⁰Ibid., No. 37 (January, 1927), 147. The lighthouse engineers described the problems encountered by wooden spars in icy conditions and the advantages of the new iron buoys in that the wooden spars "are unsatisfactory from the point of maintenance as they are quickly destroyed by worms and cut by ice. In several instances the entire set of spar buoys in Hudson River has been cut down by ice so that only a pencil point of the buoy showed at low water, which made them entirely useless for further use. Also, practically all the paint is cut off the spars in winter so that they show no color. This is always the case where channels are kept open by boats during winter, and this leaves the buoys without a designating color until they can be relieved in the spring; also the spars are frequently run into and broken or cut off just below water, and the stump remaining is hard to locate and recover and remains a dangerous obstruction to navigation." Lighthouse engineers maintained that the new type of iron buoys were not subject to the problems faced by the wooden spars as described in their paper.

sixteenths inch steel plate construction with electrically welded joints. The Third Lighthouse District deployed six experimental buoys of this type in the Bronx River, New York. After six months on station, they reported that the buoys were satisfactory in that they demonstrated an ability to hold their positions while subjected to extreme icing conditions of the winter of 1920. The lighthouse engineers commented that the buoys had a neater appearance than the traditional spars, and mariners reported that they were visible from greater distances and were overall better than the fourth-class spar buoys previously used in the river.¹¹

Results of a number of experiments conducted on the effects of sea water on cast iron demonstrated the superiority of steel construction for all types of buoys and resulted in the bureau's abandonment of cast iron. According to the report, the depth of corrosion and effects of galvanic coupling from the proximity of diverse metals in a sea-water environment could not be arrested by the application of traditional preservatives such as anti-fouling paints and tar. The results of these experiments included the reliance on steel plate buoys and the understanding and improving of maintenance of lighted aids which were more subject to the deterioration processes aggravated by the galvanic coupling of their iron and copper fittings.

The Light House Bureau continued to rely on whistle buoys based on the Courtenay design (Fig. 22). Newly designed audible buoys of the 1920's expanded on the

¹¹Ibid., No. 28 (April 1920), 122.

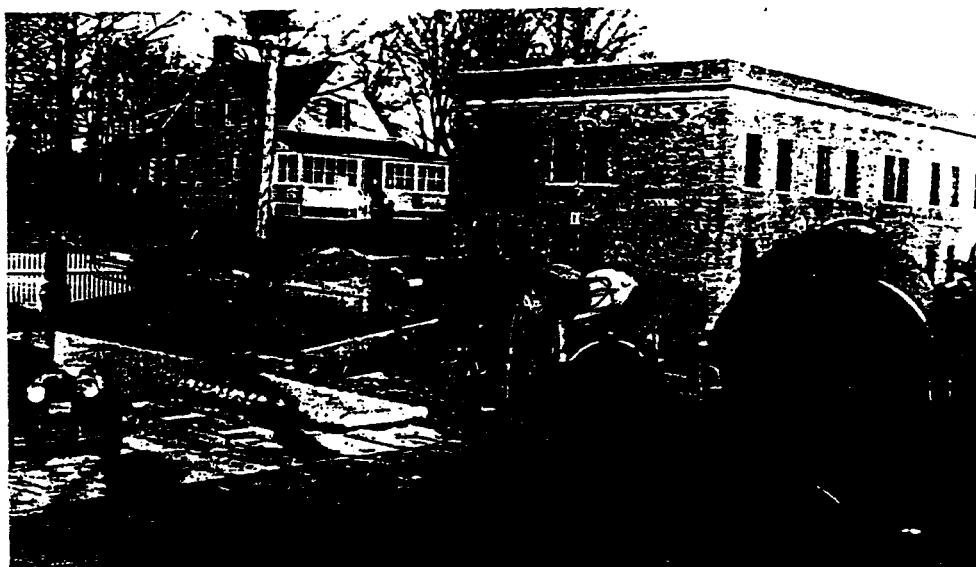


Figure 22. An unidentified buoy wharf ca. 1927 showing whistle buoys after the Courtenay design still in use by the Light House Service. Courtesy of the Coast Guard Historian's Office.

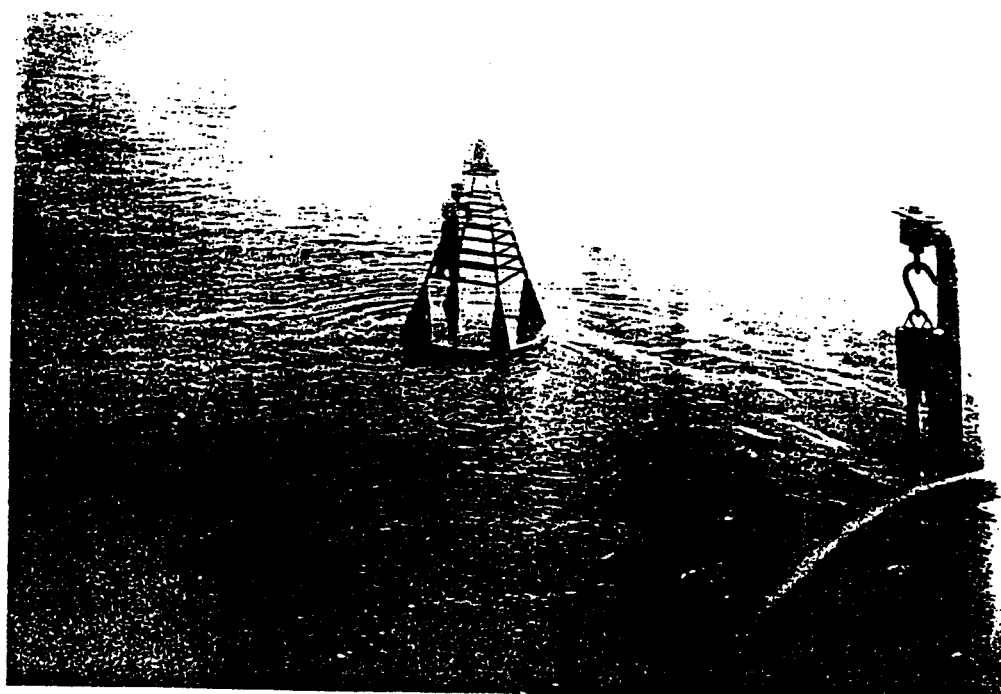


Figure 23. A crewman from an unidentified tender stands on the superstructure of a bell buoy similar in design to the Brown's Bell Buoy of the mid-nineteenth century. Courtesy of the Coast Guard Historian's Office.

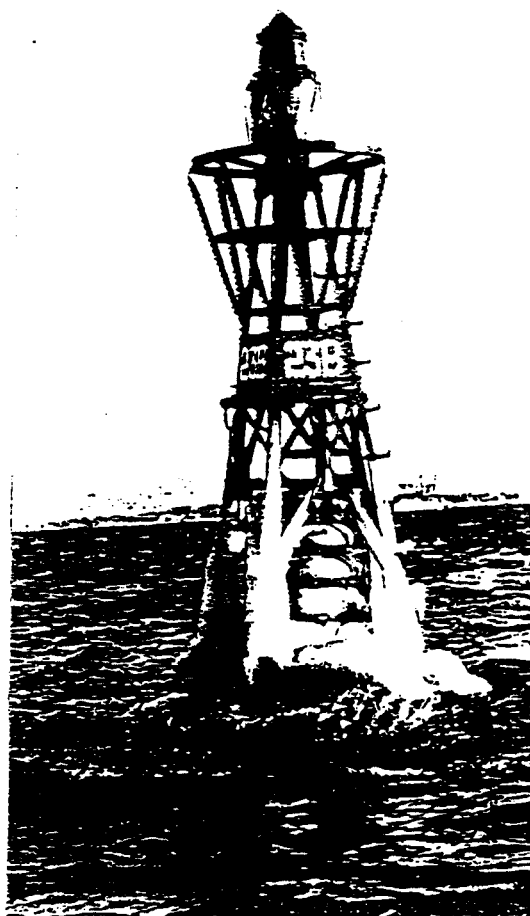


Figure 24. Alternately called a "chime" or "gong" buoy, this innovative buoy type was tested in 1922 and found to be successful. This chime buoy is beset but unsunk by ice near the close of navigation in a busy harbor. Note the serrated edges of the buoy's superstructure. This is a later development (ca. 1927) to allow the buoy the ability to cut free from mis-thrown lines or other obstructions that might capsize it. Courtesy of the Coast Guard Historian's Office.

design of the Brown's Bell Buoy (Fig. 23). In 1922, the Light House Bureau tested a variation on the Brown's Bell Buoy off St. George, Staten Island. The bureau designated this new type of audible buoy a "chime buoy (Fig. 24)." The bureau described this aid as looking "much the same as the ordinary bell buoys which mark the various channels, but its warning or signal is unique."¹² Mariners had long noted the bell buoys' limited use in thick weather; pilots could not distinguish one buoy from another based on tonal qualities alone. Lighthouse engineers created the chime buoy with four bells of varying sizes, ensuring that each would create a different tone. John T. Yates, Superintendent of the Third Lighthouse District, who designed the chime buoy, described its benefits:

There is no sequence or rhythm to the notes thus rung out across the water, although the effect is not unmusical. But the combination of notes is distinctive and readily recognized. The lookout on a vessel approaching the chime buoy in a fog will have no difficulty in recognizing its characteristic music among the scores of ordinary fog bells, and will thus receive definite information as to his position. Any passenger on the Staten Island ferryboats can readily observe this for himself. The new chime buoy rides at present just north of the channel used by the boats on turning toward the slip at Staten Island.¹³

Another important advance in audible signal buoys was tested in the mid-1920's and proved its success in the early 1930's. The automatic bell striker used carbon dioxide gas under pressure to cause a clapper to strike a bell. The early automatic strikers used technology that paralleled the use of pressurized air pioneered in the Courtenay's buoy.

¹²Ibid., No. 57 (September, 1922), 242.

¹³Ibid. This same buoy was labeled a "gong buoy" in the October 1922 edition of *The Lighthouse Service Bulletin*, which described the aid's success on station at Robbins Reef in New York harbor.

The automatic bell strikers were extremely successful in a variety of conditions. In fact, the Third District reported that one such striker functioned even though the buoy on which it rode was completely submerged in ice. According to reports, the Bartlett Reef Lighted Bell Buoy off the coast of Long Island, New York, was beset by severe ice for three weeks in the winter of 1934, and

during this time the bell and striker were submerged on many occasions by running ice, but at no time did the bell striker cease to operate. On several occasions lighthouse tenders went alongside the buoy, finding it submerged, yet were able to hear the bell sounding under the ice. On at least three occasions the entire buoy, including the bell and lantern, were submerged.¹⁴

The Light House Bureau continued to rely on acetylene power for lighted buoys. Like unlighted aids, these buoys were subject to environmental stresses. *Teredo navalis* did not threaten metal buoys as it did their wooden counterparts, but, the effects of sea water and salt deposition on lanterns were a major concern. As mentioned earlier, the Light House Bureau turned to pressed glass for 375-mm buoy lanterns after extensive testing in 1916. The Bureau of Standards at the Department of Commerce conducted tests on the effects of sea water on glass and how such deterioration affected the visibility of an aid to navigation. The Bureau of Standards concluded in January 1924 that the most serious problems stemmed from the evaporation of salt water spray on buoy lanterns and the deposition of salt on the lenses. This process of evaporation eventually etched the glass used in the lenses. The investigators concluded that of the three types of glass

¹⁴Ibid., No. 52 (April, 1934), 173.

tested, boro-silicate, lead, and soda-lime, the lead glass proved most inferior, while the other two types did not show significant damage due to salt deposition.¹⁵

Despite numerous improvements in handling techniques, acetylene buoys continued to be dangerous. As late as 1929, the bureau reported the explosion of an acetylene buoy that resulted in the deaths and serious injuries to several members of an unnamed lighthouse tender crew.¹⁶ Undaunted by accidents involving acetylene gas buoys, the Light House Bureau required the conversion of the B III type Pintsch gas buoys to the acetylene type. This change was partly precipitated by the railroads' abandonment of Pintsch gas for lighting; the drop in overall demand created procurement problems for the Light House Service and their supply needs.¹⁷ The acetylene buoys proved so successful that they continued in service through two decades of Coast Guard

¹⁵Ibid., No. 1 (January 1924), 5.

¹⁶*The Lighthouse Service Bulletin*, No. 71 (November 1929), 312-313. The bureau reported that: "The effect of the explosion was to completely sever the flat top of the buoy and the cage work secured to it from the main buoy body. The tanks were not moved from their positions in the buoy, and the fusible plugs in the tank valves were not melted. The valves were found to be closed and the connection openings in the side of the valve plugged tightly."

¹⁷*The Lighthouse Service Bulletin* for January 1932, describes the process of converting the Pintsch gas buoys into acetylene and maintains that the greatest advantage for the conversion of the buoys was the relative ease with which acetylene buoys could be serviced since the bureau could now discontinue the use of gas compressors and storage tanks necessary for servicing Pintsch gas buoys. The conversion was completed by "the installation of two pipe tank pockets in the body of the buoy, to accommodate two A-50 accumulators, with all piping, etc., outside the buoy. Lanterns have also been remodeled with standard acetylene flashers and burners." 101-102.

maintenance of navigational aids. The Coast Guard brought the age of acetylene buoy deployment to an end with the October 14, 1963, removal of the last of this type in service from the James River in Virginia in the Fifth Coast Guard District.¹⁸

Francis Collins provided an excellent glimpse into how tenders relieved acetylene buoys. The *Larkspur*, the tender on board which Collins took his notes and photographs, was built in 1900. The *Larkspur* was 169 feet two inches in length overall with a 30-foot molded beam. She displaced 703.36 tons, and was equipped with a fore-and-aft compound steam engine.¹⁹ His book, published in 1922, provides a detailed description of a buoy tender's effort to relieve an acetylene buoy. Collins was on board the *Larkspur* as she made her trip from Newport, Rhode Island, to Cape May, New Jersey. Like Mary Crowninshield nearly forty years earlier, Collins left a detailed account of the servicing of a lighted bell buoy marking Ambrose Channel:

The first call of the inspection trip was made upon a monster buoy which rang a bell to the swash of the waves, and flashed a red light with clock-like regularity. It seemed a mere red speck in the distance, but, as the *Larkspur* came alongside, the light atop the red frame actually towered above the forward deck. The visit was made to find if the buoy needed more pressure to keep its light burning, and, in case it did, to supply it.

To come alongside the great buoy in such a sea required delicate navigation. The *Larkspur* was skilfully manoevered [sic] alongside, while half a dozen trained men stood at their stations forward. The towering steel structure of

¹⁸U.S. Coast Guard Historian's Office, Aids to Navigation file, News Release 5CGD-63-4-51: "Passing of an Era - Last Acetylene Buoy Removed from Fifth Coast Guard District Waters," n.p., October 17, 1963.

¹⁹"Tenders and Light Vessels" (n.p., n.d.) Coast Guard Historian's Office, Washington, D.C., n.p.

the buoy bumped alongside and drifted swiftly past with surprising speed. The instant the buoy touched the vessel's side experienced hands lassoed it. This may not be the correct nautical phrase, but it describes the action. Ropes were thrown about it, which were quickly caught by long boat-hooks and drawn in. Heavy hawsers had been attached to the lines, which in turn were drawn about the buoy, which was thus held rigidly to the vessel's side despite the motion of the sea.

With the agility of a cat a sailor sprang from the deck to the cage-like frame at the top of the buoy, and holding to the ribs, which swung violently from side to side, opened the lamp and inserted a complicated instrument. It would be difficult to picture a more unusual position for making a scientific observation. A moment later he turned to the ship and shouted a single word, "Four." The signal had nothing to do with the game of golf.

The captain shouted an order in return, and then explained that 'four' meant that the tank of the buoy still contained a pressure of four atmospheres. This would be sufficient to keep the light burning for two months or more, but would nevertheless be renewed to twelve atmospheres.

A flexible hose had meanwhile been carried to the buoy and attached. In the choppy sea the *Larkspur* and the buoy bobbed about outrageously; but the supply of compressed air was carried across the open water, and in a few minutes the tank was filled and the pipe drawn in. The sailor on the buoy rose to his feet and made a flying leap across three or four feet which separated him from the deck of the *Larkspur*, landing in safety. A moment later the rope had been drawn in and the buoy quickly floated away with sufficient air pressure to last her for six months.²⁰

In 1922, Putnam appeared before the House Appropriations Committee to answer questions and clarify parts of the 1923 Commerce and Labor Appropriations Bill in which he requested \$75,000 for the establishment of buoys. Putnam described the bureau's intention of establishing lighted buoys on stations previously guarded by unlighted buoys.²¹ The Committee requested information and locations of the buoys

²⁰Francis A. Collins, *Sentinels Along Our Coast* (New York: The Century Company, 1922), 159-161.

²¹Commerce and Labor Appropriations Bill, 1923 in *Congressional Hearings Relative to the Lighthouse Service* (Washington: Government Printing Office, 1925), 551.

proposed to be covered under the appropriations. Putnam replied that:

Our records would show many places where buoys are needed, but I have no record here which would show those particular localities. This was not gotten up with the idea of putting buoys at any particular place, but there is a very constant demand for improvements in our buoy system and the amount has been running about the same for a number of years.²²

The committee pressed for information detailing buoy establishment over the previous fiscal year, 1921, which Putnam supplied. Putnam's success in obtaining this appropriation from Congress enabled him to further the mission of the bureau, and led to an unprecedented growth in the application of lighted buoys.

The 1888 Gedney's Channel experiment marked the first time the Light House Board attempted to use electricity to power lighted buoys. The series of spars connected to a generator on shore at Sandy Hook by cables remained in place until 1903, when the Committee on Experiments reported that difficulties with deep-draught vessels severing the cable and mechanical problems doomed the series to failure. The failure of the Gedney's Channel series did not completely thwart engineers' effort to apply electric power to floating aids to navigation. Lighthouse engineers worked to create a different electrically-lit buoy; they deployed it for testing early in the winter of 1934. The Fifth Lighthouse District fitted a second-class tall type buoy with an electric light unit; this unit had a 90-mm closed top lens, and the motor-driven battery operated flasher connected to a battery of twelve no. 6 dry cells. This assembly was sealed in a water-tight container

²²Ibid., 552.

and bolted to the top by a flange.²³ The engineers equipped the buoy with a cage around the light so it could resist damage from ice. They deployed the buoy during the winter when traditional lighted buoys had to be removed because of the threat of running ice. According to the Fifth District's report "the unit operated without difficulty or damage during this period, and was the subject of much favorable comment by mariners because of its functioning under severe conditions."²⁴

The electrically-powered buoy proved its worth in conditions of running ice. On January 25, 1935, lighthouse engineers began a test of this buoy type at the mouth of the Columbia River in Oregon. The heavy seas and gale force winds towed the buoy under and its light failed. Engineers countered by installing "a waterproof electric lantern and special cartridge type dry battery packs in the tank pockets."²⁵ The 14-volt 200-mm lamp operated effectively on 12 volts. A tender visited the buoy six months after she placed the aid on station, and the master noted how the buoy had endured heavy weather and continued to operate.²⁶

²³*The Lighthouse Service Bulletin*, No. 67 (July 1935), 209.

²⁴*Ibid.*

²⁵*Ibid.*

²⁶The lighthouse engineers responsible for the test of the electrically lighted buoy in the Columbia River concluded in their report published in the July 1935 issue of *The Lighthouse Service Bulletin* that "the performance of the buoy has been carefully observed by lighthouse tender officers, as well as members of the Columbia River Bar Pilots Association, and has been the subject of much favorable comment from all sources. This is the first large lighted buoy in the Service to be so equipped." 209.

Tenders also underwent changes in the 1920's. Naval architects, realizing the necessity for strong-hulled, maneuverable vessels for lighthouse work continued to experiment with designs with great success. John J. Floherty, writing in his 1942 book *Sentries of the Sea*, related his experiences as a guest on board the *Tulip*. As a testament to the construction of vessels like the *Tulip*, Floherty detailed the story of the fate of the tender during a hurricane in 1938. The wind and water swept *Tulip* from her moorings and cast her up on shore. She landed on the tracks of the New York, New Haven, and Hartford Railroad; her stern rested on a stone pier. A full seventy-five feet of her keel hung unsupported, but her construction was so strong that engineers were able to refloat her without damage to her machinery or hull.²⁷

By 1925, the bureau boasted fifty-eight tenders ranging in size from the *Cedar*, which displaced 1,245 tons, to the *Poinsettia* of 27 tons.²⁸ In addition to the traditional tenders, the bureau experimented with large launches for tending small gas buoys. These launches measured thirty-five feet in length overall with a ten foot beam and a four foot draft. Lighthouse engineers fitted each of these wooden vessels with an "A" frame "derrick mast and boom for handling buoys."²⁹ These smaller gas buoys were tested

²⁷John J. Floherty, *Sentries of the Sea* (New York: J.B. Lippincott Company, 1942), 210-211.

²⁸A list of these tenders, tonnages, and complements can be found in Appendix B.

²⁹*The Lighthouse Service Bulletin*, No. 46, October 1927, 211. The *Bulletin* described the hoisting system of these smaller boats by stating that the "derrick is hinged so as to lower down on deck, and the boom swings aft. The buoy boat is equipped with a

exclusively in the Navesink and Shrewbury rivers in the Third Lighthouse District. The following year, 1928, the bureau began to test a new type of power boat constructed for use in conjunction with larger tenders. These boats were successful in the relief of spar buoys.³⁰

Lighthouse tenders were not solely used for lighthouse supply and buoy tending. In 1936, the captain and crew of the *Rose* received a commendation for heroism displayed at the Bandon, Oregon, fire. As fire threatened the town on the Coquille River where the *Rose* was tied up, the master of the vessel aided in fighting the fire. When it became evident that the fire could not be contained, he used the *Rose* as a ferry to evacuate the residents across the Coquille River. According to the commendation:

For 48 hours a considerable number of people were sheltered on the tender, many of these being old persons or those who were ill. During the entire time the stewards and cooks did all possible to supply food to those in need. Both officers and crew turned over their quarters to the needy, they remaining on duty constantly for the full time. Until other agencies took over the work, the lighthouse tender did everything possible to shelter and feed the most distressed, and patrols from the ship searched the ruins for people who might have been

gasoline engine for propulsion, and the derrick gear is operated by a winch driven by a small gasoline engine. This boat will carry four of these small gas buoys with sinkers and moorings complete, and it is now in successful use."

³⁰*The Lighthouse Service Bulletin*. No. 55 (July 1928), 249-250. Figure shows one of these new buoy boats in use as its crew relieves a tall-can type buoy - the type of buoy that would slowly come to replace spar buoys. The *Bulletin* gives the dimensions of this new buoy boat as being thirty-seven feet six inches in length overall with an eleven foot beam and a four foot seven inch draft. "It is constructed of oak, with cedar planking, and is fitted with a folding "A" frame derrick and gear and propelled by a 4-cylinder, 4-cycle gasoline engine, directly connected to a shaft driving a 3-blade, right-hand propeller, 22 inches in diameter, with a pitch of 12 inches."

injured.³¹

The best records of buoy tender construction in the early twentieth century exist in the specifications of the *Oak*, built in 1918, the *Hollyhock* of 1936, and the *Zinnia* of 1938. These three tenders illustrate the changes in propulsion and tending capacities of tenders in a crucial twenty-year period of development of the Light House Bureau. The fact that the *Zinnia* was laid down before the transfer of the bureau to the Coast Guard is significant because she provides a blueprint for a direction which the Coast Guard pursued.

The earliest of these tenders, the *Oak*, was a single-screw steel, steam-propelled tender built in 1918. She was 160 feet in overall length with a 30-foot molded beam and an approximate displacement of 875 tons.³² The fuel for the *Oak*'s Scotch-type boilers was bituminous coal, and she was equipped with wing coal bunkers with a total capacity of eighty tons. Lighthouse engineers provided the *Oak* with a derrick mast capable of safely hoisting twenty tons. According to the specifications, "the derrick, boom, and the blocks for same shown on the plans will be furnished and installed by the Government."³³ The

³¹*The Lighthouse Service Bulletin*, No. 11 (November 1936), 39.

³²Department of Commerce/ Lighthouse Service, *Specifications for the Single-Screw, Steel, Steam-Propelled Lighthouse Tender OAK* (Washington: Government Printing Office, 1918), 3.

³³*Ibid.*, 36-7. The government also planned for the provision and installation of the four drum hoisting engine, as well as distant control levers and connecting gear. The government also agreed to provide "all boats with covers and outfits, two 75-fathom 1-1/4 inch stud link chain cables, two floodlight-projector searchlights for the top of the

Oak served the Light House Bureau faithfully until she was decommissioned and sold. Her engine and radio rooms remain intact as a permanent display in the Museum of American History at the Smithsonian Institution.

As the *Oak* entered her eighteenth year of service, the Light House Bureau, now under the direction of Commissioner Harold D. King after the retirement of George Putnam in 1935, drew up plans for a new twin-screw steel, steam-propelled lighthouse tender to be christened the *Hollyhock*. The *Hollyhock*'s overall length measured 174 feet 10 ½ inches with a 32-foot molded beam. Her displacement in salt water was approximately 825 tons, and she was powered by two triple-expansion steam engines. The steam-generating apparatus consisted of two water-tube boilers equipped with furnaces arranged for fuel-oil. Specifications for the *Hollyhock*'s buoy ports required a clear opening of sixteen feet "fitted with shutters [to be] worked in the bulwarks on the buoy deck."³⁴ The specifications for the *Hollyhock* include detailed instructions for the

pilot house, two U.S. Navy standard binnacles and compasses, oil lamps for staterooms and crew's quarters and hand lanterns, all floor covering, mats, rugs, etc., except those specified, wooden tables, desks, chairs, and stools, except as otherwise specified, beds and springs, excepting those built in steel, and other berths in quarters, all mirrors, mattresses, bedding, bed covering, bed and table linen, all plated silverware, cutlery, china, crockery, galley utensils, and glassware, engineers' and carpenters' tools, except as otherwise specified, two 24-inch lighthouse bow ornaments, fire extinguishers, and two Lighthouse Service pennants, two ensigns, and a complete set of International Code signal flags." Ibid., 98.

³⁴Department of Commerce/ Lighthouse Service, *Specifications for the Twin-Screw, Steel, Steam-Propelled Lighthouse Tender HOLLYHOCK* (Washington: Government Printing Office, 1936), 29. The comparable figures between *Hollyhock* and *Oak* indicate a need for larger buoy ports; *Oak*'s specifications called for ports measuring

construction of the tender's derrick and boom; the Light House Service engineers required her builders to rig her with a "steel derrick mast and steel boom having a safe lifting capacity of 20 tons."³⁵ Unlike the individuals involved in letting the contract for the *Oak*, contracting officers in charge of the *Hollyhock*'s construction required the builder to provide the derrick and boom system for the tender under the strictest specifications.³⁶ Like the *Oak*, the *Hollyhock* required articles furnished by the government. Changes in articles furnished to each tender illustrate the progress of the bureau in the eighteen years that elapsed between construction:

All boats with outfits

- Two 90-fathom 1 1/4 inch stud link chain cables
- Two searchlights for the top of the pilot house
- All portable floor covering, mats, rugs, etc. except as otherwise specified
- All mattresses, bedding, bed covering, bed and table linens
- All plated silverware, cutlery, china, crockery, galley utensils, and glassware

14 feet 6 inches and operated similarly to those on *Hollyhock*. See also Department of Commerce/Lighthouse Service, *Specifications for the Single-Screw, Steel, Steam-Propelled Lighthouse Tender OAK* (Washington: Government Printing Office, 1918), 26.

³⁵Ibid., 40.

³⁶Specifications required that "the mast shall be built up of steel plates and shapes. There shall be two seams, one port, and one starboard. Plating shall be flush on the outside with treble-riveted butt and single-riveted seam straps on the inside. All riveting shall be countersunk and flush on the outside. The mast shall be firmly stepped on the center keelson as specified under 'Foundations.' The height of the step to the cap shall be 81 feet 6 inches [sic]." Further specifications are too lengthy to include here, but the dimensions of the boom, to be built up in the same manner and with the same types of materials as the derrick mast, were "50 feet long, not less than 16 by 16 inches square in the middle, and tapered to 10 by 10 inches at ends. Angles to be 4 by 4 inches by 12.8 pounds, plates not to be less than 15 pounds per square foot," 40-41.

Engineers' and carpenters' tools, except as otherwise specified
 Two 24-inch lighthouse bow ornaments
 Electric fans
 Line throwing gun
 Bronze plate, outlining steering orders
 All flags, consisting of two ensigns, two Lighthouse Service pennants, and a full set of international code signals, 4 by 4 feet
 Storage battery 110-volt 240-ampere-hour capacity
 Gyro compass³⁷

The *Zinnia*, laid down in 1937, demonstrated the departure from steam-propelled tenders in the Light House Service. This tender, described in the specifications as a twin-screw, steel, diesel-propelled tender with an overall extreme length of 122 feet three inches, a molded beam of 27-feet, and a displacement in salt water of approximately 342 tons, ushered in a new type of propulsion for the service. The *Zinnia*'s diesel engines provided 400 horsepower and propelled her at a top speed of ten knots. Lighthouse naval constructors required the *Zinnia*'s builders to ensure the tender's long service in a salt water environment by providing protection against the dangers of corrosion and electrolysis.³⁸ With this tender, the bureau also established strict guidelines for the castings of alloys for incorporation into the construction.³⁹ The *Zinnia* was a significantly smaller vessel than the *Oak* and the *Hollyhock*. The *Zinnia*'s buoy ports provided ten feet

³⁷Ibid., 107-108.

³⁸Department of Commerce/ Lighthouse Service, *Specifications for the Twin-Screw, Steel, Diesel-Propelled Lighthouse Tenders ZINNIA and Class* (Washington: Government Printing Office, 1937), 1.

³⁹Table information taken from *Specifications for the Twin-Screw, Steel, Diesel-Propelled Lighthouse Tenders ZINNIA and Class*, 5.

of clear opening and were fitted with portable rails. This size of buoy port represents 8.1 per cent of the *Zinnia*'s total length, as compared with the *Oak*'s buoy ports representing 9.0 per cent, and the *Hollyhock*'s 9.1 per cent. The *Zinnia*'s designers built her to handle smaller buoys more effectively; additionally, the *Zinnia*'s derrick mast and boom configuration provided a safe hoisting capacity of only ten tons. As with the *Hollyhock* before her, the *Zinnia*'s derrick mast and boom were subject to strict specifications and were to be supplied by the contractor.⁴⁰ The list of articles furnished by the Light House Bureau for this vessel includes navigational instruments, boat compasses, bow ornaments, all hawser and towing lines, as well as all accouterments necessary for the creature comforts of captain and crew residing on board the tender.⁴¹

Even in light of the new construction and experimentation with new designs, the Light House Bureau continued to cultivate its image, rightly deserved, as a frugal

⁴⁰Specifications for the mast dictated that it should be "about 55 feet long and made of seamless drawn steel tubing 14 inches diameter by ½ inch thick. It shall be in one piece from heel to hounds. The upper part shall be 5/16 inch thick and tapered from full size at the hounds to 4 inches at the truck, forming a topmast. It shall step on a steel plate foundation on the center keelson. Where it passes through the deck the plating shall be well reinforced with plate doublers, and the opening closed by means of a 3 by 3 inches by 7.2 pound staple angle riveted to the deck and mast and calked [sic] watertight. The top end shall be covered with steel cap casting forming a neat finish and having lugs for the halliards and socket for lightening rod. The boom shall be 38 feet long. It shall consist of a steel H column 9 by 9 inches by 38 pounds similar to Carnegie section CB-93 in one piece. [It] shall work freely without fouling any of the ropes or parts from beam to beam across the forward deck, and at any height the boom can be topped up to." from *Specifications*, 30.

⁴¹*Ibid.*, 78.

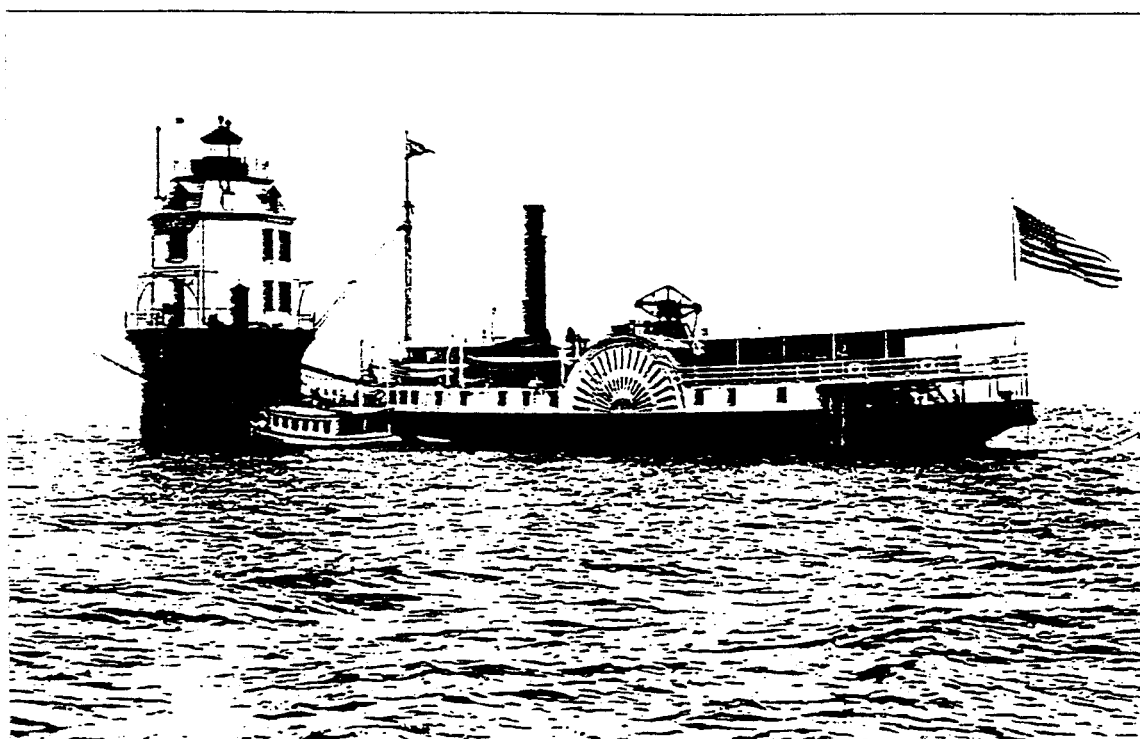


Figure 25. The side-wheel steam tender *Holly* as she worked in relief of a lighthouse. The *Holly* has the distinction of being the last side-wheel steam tender in coastal service. Courtesy of the Coast Guard Historian's Office.

government entity. The tenders described herein were necessary for the completion of the bureau's mission. The bureau, however, did not discard tenders until all working ability was wrung from them. On December 4, 1931, the Fifth Lighthouse District sold the last side-wheel steam tender in coastal service—the *Holly*.⁴² She was built in Baltimore by Malster and Reaney in 1881 at an original cost of \$41,911. The *Holly* measured 176 feet in length with a 24-foot beam and a loaded draft of 8 feet 6 inches (Fig. 25). The tender enjoyed a varied career over her fifty years of service—from tending aids and supplying lighthouses in the Fifth District, to standing ready as a relief lightship in the 1890's, to her use by President Grover Cleveland on Chesapeake Bay. Yet, while screw-propelled vessels had proven more maneuverable and better equipped to safely handle coastal buoys, the Light House Bureau was never an entity to discard a resource capable of service. This propensity for frugality served the bureau and its personnel well when it was transferred to the equally frugal Coast Guard in 1939.

In 1935, after twenty-five years as Commissioner of Lighthouses, and a full forty-five years of government service, George Putnam retired. In a glowing editorial, *The New York Times* lamented the loss of the Light House Bureau's commander in chief:

Until his seventieth birthday a fortnight ago, GEORGE reigned over the 50,000 miles of coastline and river channels along which his bells toll and his lights blink

⁴²The description of the *Holly* as the last *coastal* side-wheeler is significant because the bureau still relied on side-wheelers on the western rivers and on the Mississippi River.

at night for the protection of all those who go down to the sea in ships... But back of the lighthouse and lightship and buoy, as MR. PUTNAM notes in his book [*Sentinels of the Coasts: The Log of a Lighthouse Engineer*], "there must be a great engineering and business machine, with its endless contracts, plans, specifications, appointments, routine." Of those plans and that routine, GEORGE PUTNAM was ever a master. He was one of those quiet, capable, hard-working chiefs of the permanent government service of whom the general public hears little, but to whom it owes much. When you think of men of his character and devotion the word "bureaucracy" loses its sting.⁴³

Those familiar with the inside workings of government can truly appreciate the creation of Putnam's will that became the Light House Bureau. Secretary of Commerce Daniel Roper congratulated Putnam on the sheer numbers of aids to navigation that placed America as number two in the world after Holland as having the safest and most approachable coasts. Mere numbers do not relate the entire story of Putnam's achievement, nor is there space here to relate the many times Putnam appeared before Congressional Committees on behalf of his people in the field—arguing for better wages and retirement benefits, and also the benefits of Light House Bureau personnel who were truly veterans of World War I. He left his creation in the capable hands of the new Commissioner Harold D. King. The service survived an additional four years until its transfer to the Coast Guard under a reorganization in 1939.

The January 1939 edition of *The Lighthouse Service Bulletin* celebrated the establishment's 150th anniversary (see Fig.26) by reprinting the original act of Congress that created the service as well as a number of contracts for new construction of

⁴³*The New York Times* "Putnam of the Lights," Editorial Page, June 9, 1935.



Figure 26. The Lighthouse Service/Coast Guard logo celebrating 150 years of aids to navigation service in the United States. Courtesy of the Coast Guard Historian's Office.

lighthouses for the early Light House Service. In June 1939, *The Bulletin* published its final edition with the banner headline: "In Union There is Strength." The tone of the article that followed was somber but resigned. The provision in the President's Reorganization Order No. 11 was a fait accompli, and the bureau was obliged to comply.

There will inevitably be experienced no little heartfelt regret and a measure of concern at the passing of the name of the Lighthouse Service, reflecting as it does, so much of the symbolism which traditionally surrounds the lighthouse and the lighthouse keeper. But it is in the function and not the form that the essence of this symbolism lies and from which derive the characteristics of reliability and stability and of unselfish service which reflect time-hallowed honor upon the keepers of the lights, in all lands and times, and under whatever form of administration whether of the priesthood, or traders and merchants, or governmental.⁴⁴

This somber yet hopeful reflection best expressed the feelings of the bureau about the passing of its organization. The Light House Service had experienced a number of rebirths, but the name, in some form, had always remained. Now, it was destined to join the ranks of an organization composed of two services that joined forces in 1915: the Revenue Cutter Service and Life Saving Service. To the bureau's credit, it provided the Coast Guard with a solid legacy on which to build, and provided evidence of its achievements in the lighting of America's coasts:

⁴⁴*The Lighthouse Service Bulletin*, No. 42 (June 1939), 183.

Buoy Type	1910	1920	1930	July 1, 1939 est.
Unlighted Buoys without Sound Signals	6,000	7,195	8,067	13,432
Unlighted Sound Buoys (bell, whistle, gong, trumpet)	278	321	339	369
Lighted Buoys without Sound Signals	224	381	621	1,196
Lighted Sound Buoys (bell, whistle, gong, trumpet)	36	201	396	678
TOTAL:	6,628	8,098	9,423	15,675

Table 2. Types of Buoys Deployed during the Light House Service of the 20th Century.

The Lighthouse Service Bulletin, the chronicler of the last twenty-nine years of the service, chose as its final article Polonius's speech from Act I Scene III of *Hamlet* in which he counsels his son Laertes against all the "seeming" in the world:

Polonius: Yet here, Laertes! aboard, aboard, for shame!
The wind sits in the shoulder of your sail,
And you are stay'd for. There; my blessing with thee!
And these few precepts in they memory
Look thou character. Give thy thoughts no tongue,
Nor an unproportion'd thought his act.
Be thou familiar, but by no means vulgar.

Those friends thou hast, and their adoption tried,
 Grapple them to thy soul with hoops of steel....
 Beware of entrance to a quarrel, but being in,
 Bear't that the oppose may beware of thee.
 Give every man thy ear, but few thy voice:
 Take each man's censure, but reserve thy judgment.
 Costly thy habit as thy pursue can buy,
 But not express'd in fancy; rich not gaudy;
 For the apparel oft proclaims the man,
 And they in France of the best rank and station
 Are of a most select and generous chief in that.
 Neither a borrower nor a lender be;
 For loan oft loses both itself and friend.
 This above all: to thine own self be true,
 And it must follow, as night the day,
 Thou canst not then be false to any man.
 Farewell: my blessing season this in thee!⁴⁵

Thus, it was not without trepidation that the Light House Bureau conveyed its mission to the U.S. Coast Guard. The newly-formed union, however, proved beneficial to all services involved, and the cause of aids to navigation continued to progress even through the present day.

⁴⁵Ibid., 192.

Conclusion

For 150 years, the Light House Service existed as a separate entity dedicated to the preservation of lives and property in the waters of the United States. From its beginnings in 1789, when buoyage in America's waters consisted only of a few spar and wooden, metal-hooped bound cask buoys, through its growing pains in the 1840's precipitated by the advent of steam navigation, to its final incarnation under Putnam in 1910, the mission of the service remained constant: the effective marking and maintenance of safe approaches to the shores of the United States, and the efficient marking and lighting of rivers and channels. Few governmental organizations can boast of retaining their primary mission when confronted with as many reorganizations as the Light House Service endured. Yet every time the service met with reorganization, it evolved into a better institution—more committed to its mission, more willing to experiment with new ideas, but tied to a past of frugality that, while never endangering the cause of aids to navigation, persisted in the continued use of out-dated vessels to tend buoys. Where the service continually tested new buoy designs, its imagination for tenders appears startlingly limited. The persistence of sailing tenders into the twentieth century is evidence of this.

John Maginn, president of the New York Pilots Association, and others who complained so vehemently of Stephen Pleasanton's administration of the lights and buoys

in the 1840's would hardly have believed the legacy left even by the time of the dissolution of the Light House Board in 1910. The Light House Service of the 1840's turned to the charter and institution of Great Britain's Trinity House for a model from which to build its new Light House Board and administration. The United States was a navigational backwater in the 1840's as it related to buoyage, and the Board was quick to realize that this situation had to be remedied. The adoption of audible signal buoys in the 1870's and lighted buoys soon after, coupled with the fifteen-year long experiment of the electrically-lit spar series in Gedney's Channel in New York harbor pushed the service forward in its drive to become a maritime institution unparalleled in the world.

America was a maritime nation and relied heavily on trade. That Congress recognized this fact and acted upon it in light of the consequences of lost lives and property is significant. The application of the scientific method and the willingness to experiment with designs deemed beneficial to the mariner were the hallmarks of the Light House Board. Only under this organization, which counted two of the nation's most respected scientists among its members, could such a tradition of experimentation be founded.

The appointment of George Putnam as Commissioner of Lighthouses in 1910 was also a move calculated to continue the scientific advancement of the service. Putnam's tenure in the Coast and Geodetic Survey had given him a thorough understanding of the needs of mariners as they approached America's coasts. His willingness to try new ideas

and advance safety issues gave greater strength to the service as a whole. Under Putnam, the service continued to build on the foundation of excellence of service and ingenuity laid under the administration of the Light House Board in the late nineteenth century.

That the Light House Bureau would emerge as one of the premier organizations of its kind in the world is a testimony to the ideals and momentum that drove it.

Recognition of the service came under George Putnam. The significance of the Lloyd's Register of Shipping report of 1930, which rated the United States as number two in the world for navigational aids establishment and maintenance cannot be ignored; nor can the reflection of this achievement in the low casualty rate among arriving and clearing vessels. While some could argue, with some validity, that Putnam stood upon the shoulders of giants before him, it cannot be denied that his background and personality were responsible for many of the strides taken by his Light House Bureau in the years of his direction. He openly encouraged experimentation with new designs and fostered the creativity of his personnel. Under Putnam's management, the Light House Bureau implemented the radio beacon technology, which later had world-wide implications; other maritime nations quickly recognized its advantages and sought to adopt it. He recognized the benefits of a decentralized staff—of the placement of people in the field and the ability of his district inspectors and superintendents to recognize their areas' needs and communicate those needs to a sparsely-staffed head office in

Washington, D.C. The publication of *The Lighthouse Service Bulletin* informed service personnel of news in their agency nationwide. It also served as a forum to provoke thought and to spark ideas on how to make the service better.

The Light House Board and, later, the Light House Bureau encouraged creativity in the American citizenry as demonstrated by the number of patents obtained for buoy designs. The organization capitalized on the most successful designs and ensured the fulfillment of its mission. *The Journal of the Light House Board* recounts numerous instances of thanks tendered to would-be inventors who submitted their designs to the board's Committee on Experiments. Such rapport with scientists and inventors could only help the cause of aids to navigation.

The Light House Bureau that merged with the Coast Guard was a very different entity than the one that shrugged off the administration of the Light House Board. For twenty-nine years, the service existed as a civilian agency (except for a period in World War I when it was transferred to the Navy). Once again, the bureau found itself part of a quasi-military agency, but this time the bureau's mission was teamed with duties as diverse as fisheries management and customs' work. It was only natural for the personnel of the Light House Bureau to feel a sense of loss as the Coast Guard took over operations. The somber tone of the final edition of *The Lighthouse Service Bulletin* suggests that the Light House Bureau veterans believed that the diverse nature of the Coast Guard's mission would preclude any true commitment to aids to navigation—that

the mission that had so focused the Light House Service for 150 years would be relegated to a second-class status. Admiral Russel Waesche, Commandant of the Coast Guard, in an open letter to Light House Bureau personnel assured them of the Coast Guard's commitment to aids to navigation. True to Admiral Waesche's word, the Coast Guard remains committed to the efficient establishment and maintenance of aids to navigation in the United States to the present day.

SELECT BIBLIOGRAPHY

Manuscript Collections

Coast Guard Historian's Office, Washington, D.C.

Aids to Navigation Subject File

Tenders and Light Vessels, a bound collection of information and specifications of vessels used by the Light House Service during the mid-19th century through the 1920's.

Cutter File

Mariners' Museum, Newport News, Virginia

Miscellaneous Collections including some papers and correspondence from Stephen Pleasonton

National Aids to Navigation School, Yorktown, Virginia

Miscellaneous document collection

National Archives, Washington, D.C.

Record Group 26, Records of the United States Coast Guard

Entry 1, Journal of the Light House Board, Volumes I, II, and III.

Entry 16, Title Papers of Vessels Owned by the Light House Board 1853 - 1895.

Entry 17, Correspondence: 1785 - 1852.

Entry 18, Letters Sent Regarding the Light House Service 1792 - 1852.

Entry 45, Miscellaneous Materials Received by the Fifth Auditor.

Record Group 45, Naval Records Collection of the Office of Naval Records and Library

Subject File of the Confederate States Navy, 1861 - 1865.

Nautical Technology and Science

KL. Lighthouses and other navigational aids, microfilm (M1091).

Patent Record Office, Crystal City, Virginia

Optics Patent Subject File

Smithsonian Archives, Washington, D.C.

Alexander Dallas Bache Papers 1821 - 1869. Smithsonian Record Unit 7053

Joseph Henry Papers. Smithsonian Record Unit 7053

Southern Historical Collection, University of North Carolina, Chapel Hill, North Carolina
Joseph Ramsey Papers 1860 - 1865

Published Sources

Bachand, Robert G. *Northeast Lights: Lighthouses and Lightships: Rhode Island to Cape May, New Jersey*. Norwalk, Connecticut: Sea Sports Publications, 1989.

Baltimore Sun. Announcement of Acceptance of Bids for Buoy Construction and Tending. 2 September, 1842.

Canney, Donald L. *U.S. Coast Guard and Revenue Cutters 1790 - 1935*. Annapolis: Naval Institute Press, 1995.

Chadwick, F.E. "Aids to Navigation" in *Naval Institute Proceedings*, Volume VII, No. 17, 1881.

Cipra, David L. "The Confederate States Light House Bureau: A Portrait in Blue and Gray" in *The Keeper's Log*, Volume VIII, No. 2, Winter, 1992.

Collins, Francis A. *Sentinels Along Our Coast*. New York: the Century Company, 1922.

Conway, John S. *The United States Lighthouse Service 1923*. Washington: Government Printing Office, 1923.

Crowninshield, Mary Bradford. *All Among the Lighthouses or the Cruise of the Goldenrod*. Boston: D. Lothrop Co., 1886.

The Elastic Stop Nut Corporation of America. *This is ESNA*. Elizabeth, New Jersey: n.p. 1970.

- Holland, Francis Ross, Jr. *America's Lighthouses: Their Illustrated History Since 1716*. Brattleboro, Vermont: The Stephen Greene Press, 1972.
- Johnson, Arnold Burges. *The Modern Light House Service*. Washington: Government Printing Office, 1890.
- Knight, Austin M. *Knight's Modern Seamanship*, Eighth Edition. New York: Van Nostrand Reinhold, Co., Inc., 1945.
- Marshall, Amy K. "A History of Buoys and Tenders" in *The Commandant's Bulletin*, Washington: U.S. Coast Guard, November 1995.
- Naish, John. *Seamarks: Their History and Development*. London: Stanford Maritime Limited, 1985.
- The New York Times*, "Putnam of the Lights." New York: Editorial Page, 9 June 1935.
- Putnam, George R. *Sentinel of the Coasts: The Log of a Lighthouse Engineer*. New York: W.W. Norton and Co., Inc., 1937.
- Rush, Richard et al., eds. *Official Records of the Union and Confederate Navies in the War of the Rebellion*. 31 vols. Washington, D.C.: Government Printing Office, 1894 - 1927.
- The Safety Car Heating and Lighting Company. *Aids to Navigation Lighting Apparatus for Coasts, Harbors, and Rivers*. New York: n.p., 1913.
- U.S. House of Representatives, House Appropriations Committee. *Congressional Hearings Relating to the U.S. Lighthouse Service*. Washington, D.C.: Government Printing Office, 1923.
- . *Congressional Hearings Relating to the U.S. Lighthouse Service*. Washington, D.C.: Government Printing Office, 1925.
- U.S. Light House Board. *Laws of the United States Relating to the Establishment, Support, and Management of the Light-Houses, Light-Vessels, Monuments, Beacons, Spindels, Buoys, and Public Piers of the United States from August 7, 1789 - March 3, 1855*. Washington, D.C.: A.O. Nicholson Public Printer, 1855.
- . *The Laws and Regulations Relating to the Light House Establishment of the United States*. Washington, D.C.: Government Printing Office, 1904.

"The United States Lighthouse Establishment" in *Appleton's Annual Cyclopaedia* 1880.
New York: D. Appleton and Co., 1881.

- U.S. Lighthouse Service. *Annual Report of the Lighthouse Service*, 1826. Washington, D.C.: Government Printing Office, 1827.
- . *Acts and Laws Relative to the Light House Service 1789 - 1852*. Washington, D.C.: Government Printing Office, 1853.
- . *Compilation of Public Documents and Extracts Relating to Light-Houses, Light-Vessels, and Illuminating Apparatus, and to Beacons, Buoys, and Fog Signals, 1789 - 1871*. Washington, D.C.: Government Printing Office, 1871.
- . *Annual Report of the Light House Board*, 1878. Washington, D.C.: Government Printing Office, 1878.
- . *Annual Report of the Light House Board*, 1888. Washington, D.C.: Government Printing Office, 1888.
- . *The Lighthouse Service Bulletin*, 1912 - 1939, a quarterly publication of the U.S. Lighthouse Service, various issues.
- . *Specifications for the Single-Screw, Steel, Steam-Propelled Lighthouse Tender OAK*. Washington, D.C.: Government Printing office, 1918.
- . *Specifications for the Twin-Screw, Steel, Steam-Propelled Lighthouse Tender HOLLYHOCK*. Washington, D.C.: Government Printing Office, 1936.
- . *Specifications for the Twin-Screw, Steel, Diesel-Propelled Lighthouse Tenders ZINNIA and Class*. Washington, D.C.: Government Printing Office, 1937.

White, Richard D., Jr. "Saga of the Side-Wheel Steamer *Shubrick*: Pioneer Light House Tender of the Pacific Coast" in *American Neptune*, Vol. XXXVI, No. 1, 1976.